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Essays on Bargaining and Coordination Games: The Role of Social Preferences and Focal Points

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Abstract

This thesis presents three chapters that investigate the role of social preferences, focal points and loss aversion in bargaining situations. The first chapter contributes to existing research by examining the effects of loss aversion on players' ability to coordinate their claims in a simultaneous two-player battle of the sexes game. In this game, two objects worth a different monetary value are placed on a symmetrical spatial grid, eliciting spatial proximity as a potential payoff-irrelevant focal point. A failure to claim separate objects leads to a net loss for both players. Results show that the introduction of potential losses creates a preference to choose the less profitable option in order to avoid a loss. The second chapter adds to recent research by investigating how Asian vs. Western cultural backgrounds and corresponding levels of self-interest influence bargaining results in intercultural bargaining games. Results show that self-interest is a reliable predictor of offer levels. Further, self-interest seems to be a more prominent predictor of offer levels in Eastern than in Western cultures. The third chapter tests the impact of spatial proximity as a potential focal point on relationship-specific investments and bargaining behaviour. Players first made investments, followed by claiming bought objects on a spatial grid. Different configurations of the objects elicited spatial proximity as a potential focal point. Results revealed that players did not seem to use the focal point in their choice behaviour. Furthermore, players seemed mostly concerned with the notion of proportional equity in line with equity theory. In some cases fairness concerns lead to inefficiencies. The research in this dissertation has provided further evidence on how (social) preferences can adversely affect efficient solutions. Future bargaining interactions should incorporate players' social preferences and need for safety in a more holistic approach.

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Introduction

Searching for an agreement regarding the exchange or division of a good, also known as bargaining, is one of the “most basic activities in economic life” (Camerer, 2003). In order to reach agreement, often people have to make best-guess assumptions about other people’s preferences and valuations of goods (forming beliefs) as no other information is available. The uncertainty about the other party’s future actions in a bargaining situation often prevents people from choosing optimal strategies to reach desired outcomes. However, the individual valuations of a good are private until shared in some form of interaction including bargaining. Valuations are determined by people’s circumstances, beliefs and preferences as well as “human interaction in the context of scarcity”, a central theme to Economics (Heyne et al., 2006).

The exchange of information can be direct via communication and indirect via showing one’s preferences through behaviour. Bargaining serves as an example of an indirect way to determine people’s individual preferences. In some cases a bargaining interaction can have a cooperative setting in which people work together in order to maximize a mutual gain, and in other cases it can have a competitive setting, in which people try to maximize their own gain at the expense of another person. Cooperative and competitive approaches to bargaining often depend on how scarce a resource is as well as on agents’ intentions. Some bargaining scenarios require both cooperative and competitive behaviour, but at different stages. In any bargaining situation the information available regarding people’s preferences and valuations of goods often decides about making a profit or making a loss or whether a good can be split efficiently.

People attempt to compensate for their lack of information by utilizing any observed information, stereotypes, situational cues or past experiences to infer about another person’s possible course of action. Characteristics of the other person, such as ethnicity, gender and social group or past observed behaviour let people infer about general behaviour. In particular, preferences emerging in connection with the society we live in – social preferences (e.g., a preference for treating each other fairly, altruistic behaviour, self-interest, reciprocating another person’s behaviour, aversion against unnecessary inequality) – have inspired a vast body of research in economics. Still, many questions are unanswered regarding how people formulate optimal strategies. Among a plethora of unanswered questions, a currently relevant question in research is whether and how players can utilize payoff-irrelevant information to find optimal strategies when facing potential losses. It is also unclear whether post-investment exploitation can be remedied by payoff-irrelevant focal points. Additionally, the question remains whether optimal strategies are subject to a particular preferable set of culturally determined preferences.

Contributing to existing research, this dissertation investigates two-sided bargaining situations in which economic agents, henceforth players, are faced with the task of finding optimal, payoff-maximizing strategies congruent with their own social preferences and their best guess about the other player's behaviour. The experiments in this dissertation investigate three key scenarios in which players have to align their preferences and beliefs in order to achieve a successful outcome. In the first experiment, players are expected to make strategy choices in terms of coordinating the split of a sum while facing a potential loss in case of coordination failure. In the second experiment, players are expected to split a monetary amount in intercultural and intracultural settings. In the third experiment, players are asked to coordinate their strategies in a two stage hold-up scenario (including investment in the first stage), when being presented with additional payoff-irrelevant information. Next I present the concepts, research questions, as well as definitions and necessary backgrounds for the experiments.

Bargaining, coordination and social preferences

The key research questions, key concepts to investigate bargaining behaviour in the different chapters, as well as key results are briefly summarized and defined below. Chapter 1 focuses on the concepts of loss aversion, focal points and coordination. Chapter 2 focuses on the concept of culture and cultural dimensions, as well as self-interest in the context of bargaining (ultimatum games and alternating offer bargaining games). Finally, Chapter 3 deals with hold-up scenarios, fairness concerns as well as focal points.

Chapter 1

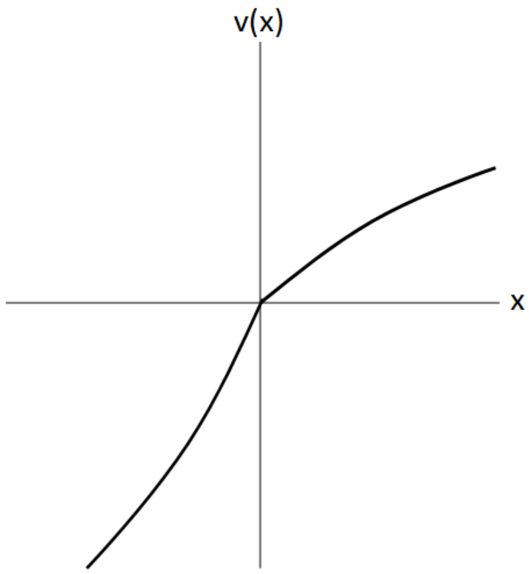
In Chapter 1, I investigate bargaining and coordination behaviour with potential losses. Players are asked to split an amount of money by simultaneously claiming one of two particular objects worth a certain monetary value. Players are not able to communicate with each other and in case they accidentally claim the same object, the objects remain on the table and both players incur a loss. Coordinating claims without possible communication are risky, as both players have a 50% chance to get it right. In order to facilitate coordination for the two players, strategy labels are introduced as payoff-irrelevant information to serve as potential focal points. Previous research has focused on coordination problems involving focal points under payoff symmetry (Schelling, 1960; Mehta et al., 1994a,b) and payoff asymmetry (Crawford et al., 2008; Isoni et al., 2013, 2104). General results from this research suggest that payoff-irrelevant information serves as a label-salient focal point in situations in which the payoff for both players is the same. If payoffs become asymmetric, payoff-irrelevant information becomes less important. Adding to existing research, I investigate whether payoff-irrelevant information becomes a salient decision criterion when players are punished for not coordinating by incurring losses.

Coordination tasks including losses can easily be extended to the real world. A good example is Wal Mart and its successful and rapid growth in the United States since 1962. As described in Walton (1992), Wal Mart’s successful expansionary strategy was based on the strategic placement of distribution centres. In rural areas more than one distribution centre could not be sustained if markets had to compete for customers, which would lead to a price war and subsequent losses. As a result, the retail chains had to “coordinate” placing their stores and distribution centres.

Experiment, concepts and results

In order to investigate the choice behaviour of players, I designed a laboratory experiment in which subjects were asked to select one out of two objects worth a certain monetary value presented to them in a symmetric spatial grid, henceforth bargaining table. The objects were located in close proximity to rectangles representing the two players on that spatial grid. The spatial proximity of the objects to the players' bases served as payoff-irrelevant focal point. The "rule of closeness" (Mehta et al., 1994a,b) suggests players coordinate by picking the object nearest to their base. In my experiment picking the same object is considered a coordination failure and players are punished by losing money from their endowment. In different scenarios the monetary value of the two objects as well as the possible loss for coordination failure was varied, allowing me to investigate people's choice behaviour associated with these different payoffs.

In order to understand the effect that potential losses have on people's behaviour, some concepts of loss aversion and loss avoidance are critical. Loss aversion, as employed in prospect theory (Kahneman & Tversky,1979) is the notion that "losses loom larger than gains". This very basic notion describes the finding that the pain of losing a specific amount weighs more than the pleasure of gaining the same amount. For example, a person that loses 1£ experiences a dissatisfaction that is larger than the satisfaction would be of receiving 1£. Loss aversion is relative, meaning that losses as well as gains are always perceived in relation to a reference point. In the simple example above, the reference point would be 0£. Kahneman and Tversky (1979) explain this phenomenon with an "s-shaped" function, which is concave for gains and convex for losses.



Example of an S-shaped utility curve in a typical Cartesian coordinate system showing players value v(x) in relation to an outcome x - (Kahneman and Tversky, 1979).

In the above figure, x depicts the outcome and V(x) depicts the subjective value associated with the outcome. Preferences change as the outcome becomes negative. Interestingly, little evidence of loss aversion in coordination scenarios exists. Research investigating losses interactive bargaining situations showed that players avoid strategies leading to a sure loss In favour of strategies leading to a possible gain, one aspect of loss avoidance theory (Feltovich et al., 2012). The prediction in my experiment was that according to Nash equilibrium theory losses improve coordination. Focal point theory suggested that players utilize the rule of closeness and coordinate better than randomizing their choices with ½. Due to looming losses, players have stronger incentive to coordinate and use the "rule of closeness".

The most relevant finding of this experiment is that potential losses do not improve coordination rates. Players show signs of loss aversion and make their choices according to payoff relevant cues. In case of payoff asymmetry, players both tend to choose the low payoff, leading to coordination failure. Subjects show a willingness to allocate the higher payoff to the other player as they perceive this as the safer strategy. This result implies a similar payoff bias found in experiments regarding coordination under payoff asymmetry by Crawford et al. (2008). Players assume that the other player would choose the high payoff and choose the low payoff. Focal points lose prominence if they are in contrast to more salient efficiency criteria, such as payoffs and losses.

Chapter 2

The next chapter investigates whether cultural background (i.e., nationality) as well as the degree of self-interest has an impact on offer and acceptance levels in bargaining scenarios in which two players divide up a pie. The basic idea is that players from a certain nationality behave in a particular way in bargaining situations in terms of making offers and also accepting offers. Often it is found that the different bargaining behaviour based on culturally based preferences leads to inefficiencies (i.e., suboptimal bargaining outcomes). To this date, research found overwhelming evidence that players are sensitive to who they bargain with, particularly sensitive to cues based on cultural background (Ferraro & Cummings, 2007; Brett & Okumura, 1998). Experimental results have shown that players in intercultural bargaining situations often realize less profit than they would have in intracultural bargaining situations (Brett & Okumura, 1998). So far, research has not answered the question sufficiently whether a particular cultural background provides players with a systematic advantage (i.e., a set of preferences that lets them gain more than someone from a different culture on average). Furthermore, research has not yet sufficiently answered the question which particular culturally-related preferences cause the inefficiencies in bargaining outcomes. Adding to existing research, in this chapter I focus on outcomes with regard to the proposed level of individualism associated with a particular cultural group as well as on whether a corresponding level of self-interest exists. I then measure whether the level of individualism as well as the level of self-interest predicts bargaining behaviour.

Research regarding bargaining in intercultural situations has been given more prominence as a result of increasing globalization. The international trade deficit in recent years in the United Kingdom was nearly reaching 4 billion £ in July 2014 due to increased demand of consumer goods and lowered productivity. At the very heart of that number is a series of intercultural negotiation scenarios involving governments, firms or individuals. Suppose two trading partners from Asia and from Europe bargain over the distribution of a surplus. The person from Asia values equality and a mutual gain for both trading partners. The person from Europe values personal gain. Now if the person from Asia makes an offer that splits the surplus almost equally, this proposal then is rejected by the person from Europe as it does not provide sufficient personal gain. Similar breakdowns of negotiations have been reported in previous experiments (Brett & Okumura, 1998; Adler & Graham, 1989; Adair et al., 2001).

Experiment, concepts and results

To address the research questions of this chapter, a laboratory experiment was designed in which subjects from different cultural groups (i.e., subjects with Asian nationalities and subjects with Western nationalities) were bargaining with each other about the distribution of a sum of money. Subjects were not able to communicate and did not have any information about the other player, as they were anonymously matched. The subject pool comprises of players with Eastern nationalities, predominantly from China, as well as Western Nationalities, predominantly from the United Kingdom. My experiment had three treatments, one in which only Eastern subjects bargained with each other, one with only Western subjects and one with mixed subjects. In my experiment I used simple alternating offer and ultimatum games. In each of the treatment subjects were not informed which nationality the bargaining partner had. Offer levels and acceptance rates as well as agreement levels were measured. Also, prior to the experiment players had to complete 24 distributional tasks in which they were asked to decide between two sets of payoffs for themselves and the co-participant. These distributional games were used in order to determine players' level of self-interest by measuring their Social Value Orientation (SVO-Score).

Social Value Orientation measures preferences of people regarding the distribution of resources. According to the theory based on Griesinger & Livingston (1973) and Van Lange (1999) people can be pro-self (i.e., like for them favourable outcomes) or pro-social (i.e., like favourable for the next person) to different degrees. The choice behaviour in the distributional games is measured and transferred to a score. The score can be grouped into certain categories. People who are grouped as individualists mainly are concerned with their own benefit without regarding the other person's outcome. Competitive players maximize their own outcome and minimize the outcome of the other person. Cooperative players maximize their own outcome and the outcome of the other player. Lastly, altruists are only concerned with the outcome for the other player. Overall the SVO-measure, next to surveys seemed to be the most logical way to determine players' orientation.

One interesting question is what exactly constitutes "culture". While there are several scientific explanations for this term, in this experiment I focus on the level of individualism as one attribute in the model of Hofstede (2001) describing the level of interdependence of people in a particular group. Other attributes in this model that were not considered are power distance (i.e., degree of preference for achievements), masculinity (i.e., degree of preference for achievements), uncertainty avoidance (i.e., anxiety regarding the unknown) and long term orientation (i.e., future oriented perspective). Out of these "cultural dimensions" individualism has been researched most and was attributed as a possible cause for the breakdown of bilateral bargaining agreements (Brett & Okumura, 1998). According to Hofstede (2001), people in Asian nations and people in Western nations show a significant difference in terms of individualism. Of course individualism should not be confused with self-interest. Someone that is individualistic is oriented mostly to himself in terms of his thinking and actions, but can still be an altruistic person.

The main findings in my experiment are showing that the level of self-interest predicts offer levels in both cultures. Further, the level of self-interest is not predicted by a particular level of individualism as defined by Hofstede (2001). Also offer levels were not predicted by nationality (cultural background). However, some cultural effects were found. Self-interest predicts offer levels better for Eastern subjects than for Western subjects. Hence, Eastern subjects are more sensitive to self-interest levels. Some signs of discrimination were observed, such as players making higher offer levels in the mixed frame. Overall the study did not find that players with a particular cultural background have a systematic advantage in bargaining as a result of their culturally based preferences.

Chapter 3

The last chapter of this dissertation investigates the influence of spatial proximity on players' investment and bargaining behaviour in a hold-up scenario. Prior to a two-player bargaining situation, players simultaneously decide how much of their endowment they will invest. In principle, once the investment is made, costs are sunk, and players do not have a guarantee that they recover any investment made in the following bargaining stage. As a result, it is often observed that there is no investment, as the investor does not want to be exploited. Often players cannot communicate prior to investing and do not have any knowledge regarding the other player's choices. Past research focused on mitigating underinvestment and found that direct, pre-investment communication remedies the problem partially (Ellingsen & Johannesson, 2004a,b), as well as pre-investment allocation of ownership rights (Fehr et al., 2008). However, underinvestment could not be mitigated fully and some room for coordination failure in the bargaining stage remains. A partial reason for coordination failure is the type of bargaining situation presented to players in past research. Players often were confronted with simultaneous, one-round games, in which a failed coordination of claims and demands leads to a payoff of zero. Also, if players made agreements regarding any split before investing, they did not act as it was agreed. Past experiments almost unanimously found that choice behaviour could be explained by different degrees of fairness concerns (e.g., Ellingsen & Johannesson, 2004a,b). So far, research has not yet solved the problem of underinvestment and coordination failure entirely. While there are some approaches that somewhat mitigate the underinvestment problem with direct communication, little research has been conducted regarding the effect of spatial proximity (as defined in Chapter 1) on players' choice behaviour in the bargaining and the investment stage. While it has been shown that pre-investment determination of ownership rights has a positive effect on remedying underinvestment, it has not been determined whether players are able to use spatial proximity as a focal point in order to coordinate their strategies. The question is that if investment profits were displayed on a bargaining table while clearly displaying the contribution of each player, whether players would use these spatial cues in order to divide the surplus from investment. If players as a result anticipated a fair split, they would invest. Further, it is unclear how players' exhibit fairness concerns exactly. Adding to existing research I introduce focal points in terms of spatial proximity to the hold-up problem, and I shed further light on the influence of fairness on players' choice behaviour by comparing two different fairness concepts.

Experiment, concepts and results

I experimentally tested whether players substitute ownership with spatial proximity and are able to coordinate their investment and bargaining behaviour. In each experiment players were anonymously paired up and presented with the task to make an investment, followed by a bargaining stage in order to divide the surplus. Half of the players in each session received a small or no endowment and half of the players received a larger endowment. In each two-player bargaining situation, a player with a low endowment was paired with a player with a large endowment. Players were unable to communicate prior to or during the game. They could make an investment by purchasing several circular objects worth a certain monetary value. After investment, the objects were placed on a bargaining table. In order to investigate the effect of spatial proximity in some games objects were placed vertically on the bargaining table at equidistance to the two players bases and in other games the objects were placed next to the base of the player that purchased them. Players then were engaging in a free-form bargaining game lasting 90 seconds in order to reach an agreement. An agreement is reached if both players agree on an allocation of the objects and the total number of objects claimed is equal or smaller than the number of objects on the bargaining table. If no agreement is reached, both players receive a payoff of zero. In theory players should split the objects as suggested by spatial proximity. As fairness concerns were a predominant decision rule in past research, particular emphasis was laid on inferring players fairness concerns as suggested by their choice behaviour.

I investigate two main concepts of fairness. Fairness concerns in terms of inequity aversion as defined by Fehr & Schmidt (1999) suggest that players incur a loss of utility if their payoff is either higher (superiority aversion) or lower (inferiority aversion) in comparison with the other player. Depending on players' preferences, the highest utility is reached if both players gain the same amount of net surplus from the pie. According to the model of Fehr & Schmidt, different clusters of population exist, each willing to accept a different share of the pie. In my experiment inequity aversion was measured by investigating to which degree the player with the lower starting endowment was compensated for this asymmetry by the player with the larger endowment. Also, it was investigated whether players looked for equal splits of the surplus and to which degree players looked for equal splits of the total amount in the game. A further concept introduced into that game is proportion as defined by equity theory (Adams, 1965). Equity theory would assume that players find a division of the pie that reflects the level of their contribution to the overall amount to be split. Players then would find it fair if both players receive exactly the same ratio out of investment and share of the pie.

The main findings of my experiment can be summarized as follows. Players did not incorporate spatial proximity into their decision making process. However, results show that players were concerned with proportionality when dividing up the pie. In addition, some signs of inequity aversion could be observed as players did compensate for lower initial endowment levels in their decisions. It was further found that players with a higher endowment invested predominantly on the level of the maximum endowment of the player with the lower endowment. This is considered as a "safe" strategy next to not investing at all. Players then often proceeded to split the pie equally. In this case both players did forgo higher payoffs in order to equate their risk to be exploited. In this case, fairness concerns cause inefficiencies. In summary, spatial proximity does not seem to mitigate underinvestment fully. However, players in my design invested more than in comparable games in the experiments of Ellingsen & Johannesson, (2004a). A visual representation of payoffs can aid players to some extent, and players are more confident about not being exploited as a result of the possibility of cheap talk in the bargaining session. Players were most concerned on how to reach a proportional outcome and to minimize the risk of exploitation.

Conclusion

The experimental results in this dissertation provide further insight into players' choice behaviour in bargaining situations, reflecting their personal preferences regarding losses, self-interest and culture and fairness. In addition, the salience of payoff-irrelevant cues is investigated. Looking at bargaining interactions from three different angles helped to elucidate people's motivations when interacting in bargaining.

The fact that people tend to sacrifice gains in order to avoid losses in coordination games does have some implications real world problems. In the example of Wal Mart opening superstores in remote locations that can only sustain one particular superstore, the strategy would have been clear. In case of possible conflict, ceteris paribus, Wal Mart would pay less attention to the store being in close proximity to its distribution centres and would focus on finding a location that is somewhat less attractive in comparison with others. In that way, losses could potentially be minimized. This of course excludes all other factors necessary for a decision, such as price competition policy, predatory competition policies, price changes in transportation costs and other strategic considerations. Wal Marts strategy focused on being in a particular location first, and then attempting to prevent entry. Nevertheless, the general application of the finding is relevant and highlights people's strategies of loss prevention. Further research could elucidate this finding by extending the strategy choices of players with regard to incurring higher losses. Since players are affected in their decision making process by the height of the possible loss, it can be conjectured that, as losses increase, players will at some point switch their decision making to include spatial proximity. Also it could be the case that the salience of a payoff-irrelevant focal point needs to be established as a convention in the market first.

Furthermore, this dissertation gives support for the notion that players are influenced in their decision making by self-interest and indirectly by culture. While offer levels and self-interest levels were not predicted by cultural background, some culturally related effects could be found. While cultural background does not predict self-interest, for Eastern subjects offer levels are predicted better by their social preferences. Belonging to a certain cultural group did not provide players with a systematic bargaining advantage.

Applied to the real world, this result suggests that when players from different cultures interact in a bargaining scenario, it would be wise to know the individual level of self-interest of this person. Also, when bargaining with someone from an Eastern culture it is good to know that self-interest levels matter more than when bargaining with someone from Western cultures. Future studies should incorporate more cultural variables next to individualism. Also, further studies should select subjects from different countries that do not have any other affiliation to any particular group.

Lastly, players are sensitive to the possibility of exploitation as theory predicts. However, in contrast to theoretical predictions, players seek to mitigate that risk by reciprocating the level of investment of the player with the lower endowment. In order to achieve that, they forgo larger gains. In that regard, fairness concerns are the cause of underinvestment. Also, it appears that people are concerned with relational equity meaning a proportional distribution with regards to their own level of contribution. As spatial proximity is not a sufficiently salient focal point, players cannot use the suggested distribution by the focal point to achieve higher investment rates.

I conjecture that underinvestment in a hold-up situation is sensitive to the form of bargaining as well as the presentation of the surplus. Indirectly this would mean that payoff-irrelevant information does to some degree influence players. Also, the possibility of a risk equilibrium might be essential. While players are concerned with relational equity, they do prefer to play it safe. However, the higher investment rates (when compared with Ellingsen & Johannesson, 2004a,b, under the no-communication premise) suggest that future research should put more emphasis on factors such as risk involved and presentation of the bargaining scenario.

In conclusion, I find that players are seeking a safe strategy that minimizes risk whenever possible. Players are concerned with payoff, degree of self-interest as well as proportional equity. The reason that payoff-irrelevant cues are not so prominent could be caused by the growing money bias in modern society. Culturally-related behaviour is also influenced by values that are reinforced by the war for resources and wealth, where globalization makes value systems continuously more homogenous. The research in this dissertation has provided further evidence on how (social) preferences can adversely affect efficient solutions. Future bargaining interactions should incorporate players' social preferences and need for safety in a more holistic approach.

Chapter 1
Losses in Coordination Games with Payoff Asymmetry - a Bargaining Representation

1. Introduction

1.1 Introduction to loss aversion and bargaining

Successful coordination in a simultaneous move game, without cues regarding other people's courses of action and the possibility of communication, is often difficult to achieve. A known example of this is the battle of the sexes game. This describes a coordination problem for two decision makers who "win" if they manage to make a choice that matches the choice of the other person, and who receive considerably less if they fail to do so. The absence of any information forces people to make best guesses based on beliefs about the other person's course of action. In this situation, non-payoff-related strategy labels (i.e. focal points) could provide helpful cues for the decision-makers. Researchers have investigated the effects of non-payoff-related cues as potential focal points in an attempt to improve coordination (e.g., Schelling, 1960; Mehta et al. 1994a,b; Bacharach, 1997). Other information (such as possible payoffs) could be influencing a decision-maker's choice in a coordination scenario, besides the non-payoff-related strategy labels (such as focal points). Indeed, recent research has shown that the level of available profits in such a strategic interaction can influence the decision-maker's choice, especially if payoffs are asymmetric (Crawford et al. 2008). In such a scenario, payoff-irrelevant focal points lose their influence on decision-makers. However it is unclear, whether this generalises to scenarios in which payoffs can be negative and whether coordination failure would result in losses.

Contributing to existing research, this chapter explores the effects of different asymmetric payoff-levels and potential losses upon a decision-maker's choice in coordination games. In particular, I examined the effects of losses upon interactions between two decision-makers in coordination games. For my research the concepts of loss aversion (Kahneman & Tversky, 1979; Kahneman, Knetsch & Thaler, 1990) as well as loss avoidance (Feltovich et al., 2012) were of particular importance. In my study I used a spatial grid as a visual representation of a simple battle of the sexes game as shown in Figure 1.1, which makes strategy choices more obvious and more natural to the decision-maker. The bargaining table in Figure 1.1 represents an extension of the experiments conducted by Mehta et al. (1994a) (experiments 11 – 16). An important feature of the bargaining table is the complete spatial symmetry in which two rectangular bases are placed on the right and on the left of the grid; each representing one of the players. The amount to be bargained over is then placed in the form of several circular objects (henceforth objects) in a particular spatial configuration on the spatial grid. The objects have different spatial proximities to the two rectangular bases. This design was chosen as players, ceteris paribus, naturally apply the "rule of closeness" in order to claim objects. The "rule of closeness" (Mehta et al., 1994a,b) describes the tendency of players to choose the object nearer to them when having the choice between two identical objects located at an unequal distance to them. In this type of design, spatial proximity acts as a non-payoff-related, label salient focal point. For example, using the "rule of closeness", players managed to achieve high coordination rates in payoff-symmetric games when instructed to coordinate (Mehta et al., 1994a,b). The application of asymmetric payoffs with the possibility of losses adds a new dimension to this type of coordination task.

The remaining chapter is structured as follows: after providing a basic overview of loss aversion in bargaining experiments in the remainder of Section 1, the theoretical framework of the model is introduced in Section 2. Sections 3 and 4 describe the experiment design and expected results. Section 5 presents the results of the experiment. Then, Section 6 concludes with a discussion of the results and implications for further research.

1.2 Focality

Contrary to traditional game theory, the early work of Schelling (1960) found that the salience of decision labels provides players with cues to successfully synchronise their behaviour. Schelling (1960) asked people to meet in New York City without previous communication. If two people were to coordinate by choosing the same location out of many possible locations, they would receive a reward. However, if they did not manage to coordinate, they would get a payoff of zero. In this very rudimentary setup, Schelling (1960) found high expected coordination rates and demonstrated for the first time that a decision label could be a "focal point", in this case the Grand Central Station. In another version of this game investigated by Schelling (1960), subjects were obliged to coordinate on calling either heads or tails of a coin. This experiment was formally repeated by Mehta et al. (1994a) in which they obtained similar outcomes. Schelling's (1960) informal experiments found above-average coordination rates on "heads", which he explained with the existence of a "focal point". Players predominantly focused on this decision label, as they clearly preferred "heads" rather than "tails".

The existence of focal points has been more formally investigated and documented in recent literature, which found that label-salient focal points are influenced by payoff-symmetry (Mehta, Starmer and Sugden, 1994a,b; Crawford et al., 2008; Bardsley et al., 2010; Isoni et al., 2013, 2014). In most of the conducted experiments, payoffs were symmetrical for participating players. Initially, it was assumed that the power of a focal point was sufficiently strong even if payoffs were not symmetrical (Sugden 1995, pg. 548). This assumption has been further investigated by Crawford et al. (2008), who contend that "when payoffs are even minutely asymmetric and the salience of labels conflicts with the salience of payoff differences, salient labels may lose much of their effectiveness and coordination rates may be very low" (p. 1456). Crawford et al. (2008) further found that coordination failure is connected to the asymmetry of payoffs.[1] One key experiment of Crawford et al. (2008) was the X-Y game, in which players chose simultaneously either the labels X or Y. If both players chose the same strategy, they successfully coordinated and received the designated payoff. In case of failure to coordinate, none of the two players would receive a payoff. With small payoff-differences, players chose in favour of the other participants' payoff (i.e. allocating the higher payoff to the other player). According to Level-K theory, as payoff differences increase, players attempt to maximize their own payoff. The results of Crawford et al. (2008) suggest a strong payoff-bias in players' decision-making in case of payoff-asymmetry, where players utilise label salient focal points much less.

[1] The work of Crawford et al. (2008) uses a Level-K model to explain why with increasing payoff-asymmetry, players became more payoff-biased in their choices, increasingly favouring their own payoffs, and disregarding the label salient strategy choice for coordination.

While according to Crawford et al. (2008) Level-K theory explains the pattern of coordination failure as payoff-differences increase, Nash equilibrium theory suggests that overall coordination decreases with increasing payoff-asymmetry (Appendix 1.1). Research in this field so far has omitted to include the effect of losses in such a coordination scenario. While Nash equilibrium theory suggests an improved coordination when losses are introduced, the question is whether the salience of a strategy label increases if players are punished for coordination failure by incurring losses. Particularly, the underlying psychological aspects of loss aversion (prospect theory) and loss avoidance are crucial to understanding players' choice behaviour when losses loom.

1.3 Loss aversion and loss avoidance

Choice behaviour in interactive bargaining situations with potential losses has been mainly explained by the concepts of loss aversion and loss avoidance. Loss aversion as part of prospect theory and subsequent research, (i.e. first to third generation prospect theory as in Kahneman & Tversky, 1979; Kahneman, Knetsch & Thaler, 1990; Luce & Fishburn, 1991; Tversky & Kahneman,1991, 1992; Schmidt et al., 2008; Erev et al., 2008) is based on the principle that the disutility of a loss outweighs the utility of an equivalent gain. In fact, "losses loom larger than gains", which is captured in an S-shaped value curve in prospect theory (Kahneman and Tversky, 1979, 1992). This S-shaped value curve possesses the property that it is steeper in the loss domain, having a convex shape and flatter in the gains domain, having a concave shape. According to prospect theory, this generally results in people's risk aversion in the gains domain and risk seeking behaviour in the loss domain. In the underlying expected payoff-function, decision weights are applied for the probabilities of obtaining a payoff as well as the payoff itself. A general phenomenon is that decision weights are applied so that small probabilities are over-weighed and larger possibilities are under-weighed, leading to the condition that decision weights applied are non-linear. These important observations were extended by a second generation prospect theory model for choice situations with unknown probabilities (Kahneman & Tversky, 1992). In a typical experiment, a larger number of decision-makers would take a certain outcome over the chance of receiving a higher outcome with 80% and receiving nothing with 20%. However, when faced with losses, decision-makers would choose the gamble over the certain loss. Some important underlying axioms of this theory are transitivity, dominance and invariance. Further, Tversky and Kahneman (1986) showed that the framing of the loss may result in a change of preferences of the decision-maker. This argument stems from the fact that losses (as well as gains) are always measured in relation to a reference point.

Loss aversion can be found also in strategic interactions, however it is more difficult to measure. While the effect of loss aversion has been thoroughly investigated (e.g., in Kahneman, Slovic, & Tversky, 1982), loss aversion in an interactive environment, such as in a bargaining situation, has not yet been explored to a greater extent. Kahneman, Knetsch and Thaler (1990) contend that concession aversion defines the actions of the decision-makers in a bargaining environment. Concessions made to the other decision-maker are treated as losses, while compensation received are treated as gains. In accordance with loss aversion, decision-makers overvalue what they give compared with what they get. Of particular importance for both players is their status quo, the starting point of the bargain. Such bargaining and cooperation scenarios are investigated with respect to international politics in Jervis (1978), Keohane (1984), Grieco (1990), Stein and Pauly (1992) and Richardson (1992). A similar concept to concession aversion is the status quo bias (Samuelson & Zechhauser, 1988; Levy 1996), which states that agents are willing to undergo some effort to protect the status quo if they believe a change to be leading to potential losses. Concession aversion as well as the status quo bias, are driven by players overvaluing losses, consistent with loss aversion. Players would only incur a risk making a change from the status quo is not acceptable to them.

Generally, only some research is available that investigates losses in a bargaining context, however, findings in the literature suggest that loss aversion in a bargaining prove to be disadvantageous for the more loss-averse player (Shalev, 2000). Additionally gender effects under this situation have been found (Schade et al., 2010), where female subjects use mixed strategies twice as often as male subjects, leading to potential coordination failure. Additionally, bargaining failure can be an equilibrium outcome when losses are present (Butler, 2007).

Further, a related concept to loss aversion is loss avoidance, which is defined as the tendency to avoid choices that yield negative payoffs with certainty in favour of choices that have a possibility of a positive outcome (Cachon and Camerer, 1996). The notion of loss avoidance has been tested by Rydval and Ortmann (2005), and Feltovich et al. (2012) using Stag-Hunt games (Rousseau, 1973) to test equilibrium selection with varying payoff-levels. Although strict loss frames are not tested, the experiments of Rydval and Ortmann (2005), as well as Feltovich et al. (2012) show that changes in payoff-levels have an effect on the equilibrium outcome. In another experiment, Feltovich (2011) investigates the effect of losses in a set of Hawk-Dove games (with high and low payoffs) and Stag-Hunt games. The low set of payoffs leads to a negative payoff for both players if the Hawk-strategy was mutually chosen. The games are strategically equivalent although payoffs vary. Feltovich (2011) puts forward the hypothesis that the Dove-strategy is chosen more often when losses are present. In both fixed and random matching, players did choose the Dove-strategy significantly more often in the low payoff game. The Dove-strategy represents the "safe" strategy for a player as he is content to get a lower payoff, rather than risking a negative payoff.

In particular, loss avoidance in a strategic interaction could be observed in the experiments of Feltovich et al. (2012). In the experiment, subjects are confronted with three different Stag-Hunt games with high, medium and low payoff-levels. The medium and low payoff-levels were designed to include potential and certain losses. During the experiment, the number of times the games were played, the matching procedure (random versus fixed matching), as well as the level of payoff information were varied. Players encountered each game only once including (1) full payoff-information, (2) one without full payoff-information, (3) a treatment in which players repeated each game with randomly matched players, also under full payoff-information and (4) one without full information. Results imply that over all treatments differences in choice behaviour were present due to loss avoidance. Similarly to the latest experiments of Feltovich (2011) and Feltovich et al. (2012), players were requested in my experiment to choose between a high and a low payoff, facing potential losses. The above concepts are considered starting points to predict players' behaviour in my experiment involving losses and potential losses. Some of the above mentioned key psychological underpinnings of loss aversion, status quo bias and loss avoidance theory are important for predicting the subjects' behaviour in my experiment. Particularly the overstatement of losses and the perceived reference point in the coordination game define players' choice behaviour. In a gain domain, a player will start with 0 and is able to get a certain amount of money if he coordinates. In the loss domain, a player will start with an initial endowment that he can lose if he fails to coordinate.

2. Theoretical framework

Consider a coordination game in which two players (P1, P2) have to each choose a circular object on the bargaining table as in Figure 1.1 in order to gain the respective payoffs (α, β). In the current framework, the obtainable payoffs are such that $\alpha \leq \beta$ (i.e., the payoff of β is strictly preferable). If both players choose the same object, they will receive a profit of 0. Both players make a simultaneous choice. The graphical representation of the scenario is depicted in Figure 1.1.

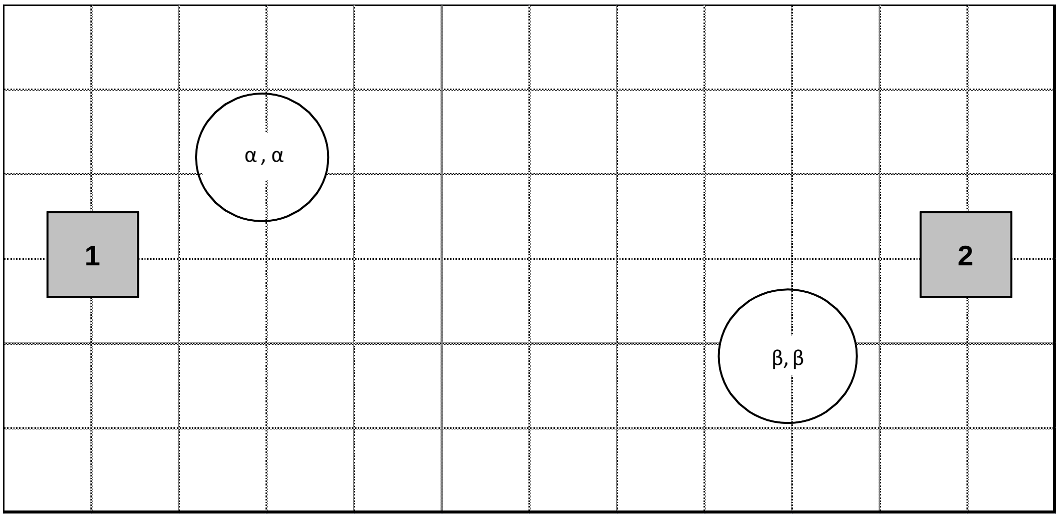


Figure 1.1: Bargaining Table

Both circular objects represent the two possible choices the two players can make. The players are located at the squares 1 and 2. The object on the left yields the payoff α and the object on the right yields the payoff β. The 2x2 matrix of this problem is depicted as

	PLAYER 2			
PLAYER 1	Near		Far	
Near	α	β	0	0
Far	0	0	β	α

Figure 1.2: Coordination game in normal form: 2x2 matrix of the game

Here, α and β represent payoffs associated with two different objects. If both players coordinate on choosing separate objects, they receive the payoffs α and β respectively. The game has two pure Nash equilibria (Near, Near) and (Far, Far) as well as a mixed strategy Nash equilibrium. The available choices of the players are limited to two, Near or Far, i.e. players do not have the option to choose not at all or to choose both objects at the same time. Not making a choice is a weakly dominated strategy, so I excluded this option from my design. If not choosing any object is weakly dominated, then also choosing both objects is weakly dominated. Hence, I eliminated this choice also in my design. The work of Isoni et al. (2013) found that if the option of not making a choice and choosing all objects at the same time was provided to subjects, only a small fraction of the subjects was actually choosing none or both options at the same time.

2.1 Costs

Consider two players having to choose one of the two objects (α, β) (Figure 1.1). In case of a coordination failure, both players incur a cost, c ≥ 0. If they coordinate, no costs apply. Assume the following modifications to the model in Figure 1.3: introducing a cost for not coordinating. The payoff matrix is:

		PLAYER 2			
		Near		Far	
PLAYER 1	Near	α	β	-c	-c
	Far	-c	-c	β	α

Figure 1.3: Coordination game in normal form with costs

As the representation in Figure 1.3 shows, the game has two pure Nash equilibria (Near, Near) and (Far, Far), as well as a mixed strategy Nash equilibrium. The mixed strategy Nash equilibrium is given by

$$\left(\frac{\alpha + c}{\alpha + \beta + 2c}, \frac{\beta + c}{\alpha + \beta + 2c}\right)$$

for player 1, and

$$\left(\frac{\beta + c}{\alpha + \beta + 2c}, \frac{\alpha + c}{\alpha + \beta + 2c}\right)$$

for player 2, where the first term denotes the probability of choosing the Near location and the second term denotes the probability of choosing the Far location.

Let us denote the probability for successfully coordination as P(S), that is player 1 and player 2 successfully coordinate by choosing (Near, Near) or (Far, Far). Looking at the effect of cost c on the overall probability of coordination P(S), we can now state our first result.

Proposition 1:

An implication of both players playing the mixed strategy Nash equilibrium is that the probability of successful coordination, P(S), is increasing in c.

Proof: Appendix 1.1.

The cost c is a positive real number, c ϵ {0, ….., ∞}, that denotes the expected payoff in case of coordination failure. If α, β are held constant the function lim c →∞ P(S) approaches ½ (ceiling effect). The function is strictly increasing.

2.2 A more general case of costs

For the general case, I introduce an external profit / loss variable Δ that influences all payoffs. Our basic model is not changed by the variable Δ; the game theoretic predictions remain the same, i.e. games stay theoretically equivalent to each other. The variable Δ represents different market phases that can lower or raise overall possible payoffs. Payoffs (α, β) are adjusted by the variable Δ, as well as the cost for coordination failure (c). In a bad market, profits (α, β) are generally lower due to other costs incurred by a firm. In our simple model this applies also to the extreme case of no coordination, in which a player has to bear the external costs related to a bad market environment.

Proposition 1 holds even in the more general version of the game. Introducing an external profit / loss variable (Δ) to the equation lets us regard the game in a more general version. Assume the game as in Figure 1.3, then the payoff matrix becomes:

		PLAYER 2			
		Near		Far	
PLAYER 1	Near	α+Δ	β+Δ	Δ-c	Δ-c
	Far	Δ-c	Δ-c	β+Δ	α+Δ

Figure 1.4: Coordination game in normal form with costs and factor Δ

where $\Delta = \{-\infty, \ldots., \infty)$. If markets go particularly well, we define this as a profitable scenario; the player will in any case receive a positive payoff. In a non-profitable scenario, in which $\Delta < -\beta$, the player will incur a loss with certainty, due to other non-performing markets, that are external to the above scenario. In all cases the game theoretic prediction remains the same (Appendix 1.1).

3. Experiment

3.1 Experiment design

Considering the game outlined in Figure 1, I define a set of parameters consisting of α, β, c, and Δ. Additionally, the parameter E depicts the endowment provided to the subjects and F depicts the show-up fee. The endowment E varied among the three treatments (E = 5, 10, 15). The show-up fee for all treatments was £2. Recall that α, β are the coordination payoffs. In my experiments, there are six separate parameter sets of α and β. The variable c is the payoff that both players receive in case of coordination failure. For each set of parameters of α and β, a cost of c is applied. The parameter Δ is a scale variable that is added to all the game's parameters. Choosing different values of delta allows consideration of the role of pure gain or loss framing effects. The scale variable that is applied lies within the range of $\Delta = \{0, -5, -10\}$. This experiment setup creates a 3x3 matrix for each set or parameters as shown in Figure 1.5. Overall, the experiment consisted of three treatments with 18 separate games each.

These parameters satisfy the following constraints in every case: $\beta \geq \alpha$ and $c \geq 0$. In the experiment, the final payoffs were the possible game payoffs of α, β and c plus the endowment and the show-up fee. For any given set of parameters of α, β, Δ and c, different levels of endowment E were provided. Since it was possible in some games to make losses by not successfully coordinating, a large enough combination of the endowment (E) and show-up fee (F) ensured that subjects did not incur a net loss, one of the important constraints of this experiment. Overall, the final payoff for the subjects can be expressed as $\Pi = E + F + P(S\ \alpha)\ \alpha + P(S\ \beta)\beta - (1-P(S))(c) + \Delta$ with the constraints of and $E \geq \Delta\text{-}c$ and $E + F > \Delta\text{-}c$. The above constraints ensured an overall minimum payoff M_w for each game, where $M_w(F, E) \geq 0$.

This experiment setup allowed me to test the hypotheses (presented in Section 4), looking primarily into the effect of different levels of c and Δ, while keeping α, β constant. This provided an indication of whether loss aversion has an impact on subjects' decision-making process. Comparing these effects over six different sets of parameters for α and β, it was possible to measure whether the effects of c and Δ were subject to the degree of payoffs achievable and the degree of payoff difference between α and β.

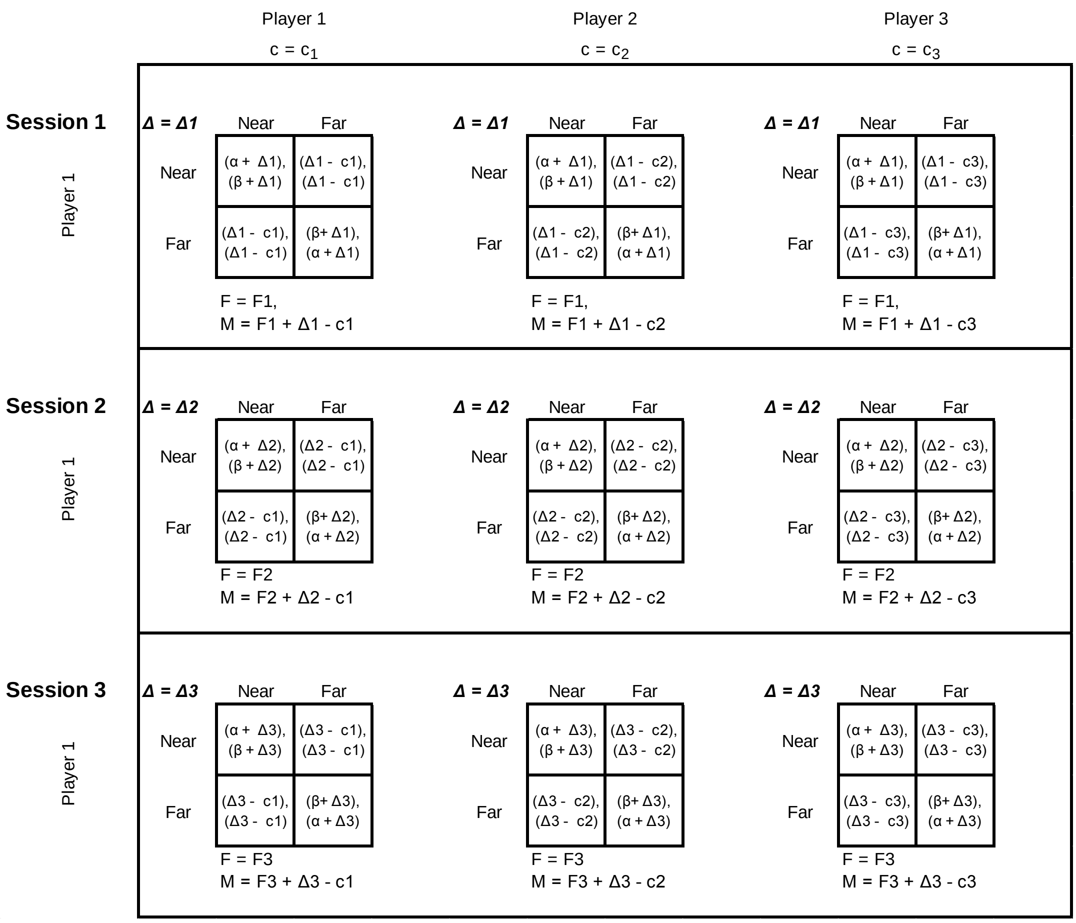


Figure 1.5: Experiment setup, 3x3 design (general)

3.2 Experiment Procedure

The sessions were held between 10^{th} of May and 26^{th} of June of 2011 and lasted between 30 minutes and 60 minutes. If there was more than one session on a particular day, the sessions were held one hour apart, such that subjects that completed the experiment did not have the immediate opportunity to pass on their experiences to new subjects.

The experiment was computer-based using the software Z-Tree (Fischbacher, 2007) and was set in the laboratory of the University of East Anglia. Due to laboratory constraints, only a maximum of 14 subjects could participate at a time. For each treatment, several sessions were conducted. Overall, I recruited 197 subjects from the student population of the University of East Anglia via the ORSEE-System (Greiner, 2004). Graduate students in the field of economics were excluded from recruitment. Beyond that, there were no further recruitment restrictions. Seventy-four subjects participated in treatment 1 in six sessions, 64 subjects participated in treatment 2 in five separate sessions, and 59 subjects participated in treatment 3 in 7 separate sessions. No single subject participated in more than one session.

For all games in one treatment, one value of the scale variable Δ was applied. This experiment setup made it possible to use one particular endowment E for each of the sessions. During each treatment, one set of parameters of α and β occurred three times with different values of c. An overview can be found in Figure 1.6.

	Treatment 1					Treatment 2					Treatment 3				
Game	α	β	c	Δ	E	α	β	c	Δ	E	α	β	c	Δ	E
1	5	5	0	0	5	5	5	0	-5	10	5	5	0	-10	15
2	5	5	1	0	5	5	5	1	-5	10	5	5	1	-10	15
3	5	5	5	0	5	5	5	5	-5	10	5	5	5	-10	15
4	5	6	0	0	5	5	6	0	-5	10	5	6	0	-10	15
5	5	6	1	0	5	5	6	1	-5	10	5	6	1	-10	15
6	5	6	5	0	5	5	6	5	-5	10	5	6	5	-10	15
7	3	8	0	0	5	3	8	0	-5	10	3	8	0	-10	15
8	3	8	1	0	5	3	8	1	-5	10	3	8	1	-10	15
9	3	8	5	0	5	3	8	5	-5	10	3	8	5	-10	15
10	1	10	0	0	5	1	10	0	-5	10	1	10	0	-10	15
11	1	10	1	0	5	1	10	1	-5	10	1	10	1	-10	15
12	1	10	5	0	5	1	10	5	-5	10	1	10	5	-10	15
13	10	12	0	0	5	10	12	0	-5	10	10	12	0	-10	15
14	10	12	1	0	5	10	12	1	-5	10	10	12	1	-10	15
15	10	12	5	0	5	10	12	5	-5	10	10	12	5	-10	15
16	5	10	0	0	5	5	10	0	-5	10	5	10	0	-10	15
17	5	10	1	0	5	5	10	1	-5	10	5	10	1	-10	15
18	5	10	5	0	5	5	10	5	-5	10	5	10	5	-10	15

Figure 1.6: Overview of the treatment parameters

Prior to each experiment session, subjects were registered in front of the computer laboratory. An even number of subjects was required for the experiment. If an uneven number of subjects showed up and if subjects showed up too late, they received a show-fee of F = £2 and were told to register in a later experiment. Prior to the experiment subjects were seated in the computer laboratory in random order. At the start of the experiment the experimenter read the instructions (see Appendix) aloud and students could follow them on their screen.

In each session the subjects were informed that they were to be presented with 18 separate games, what their task was, and that one of these 18 games was to be randomly selected to determine their final payoff. This provided an incentive for the subjects to treat each game as potentially payoff-relevant and thus as if it were determining their payoff. This mechanism was used for budget reasons. Further, the subjects were informed in advance what their show-up fee and their endowment would be. The subjects were informed that their total payoff had three components, the payoff from the payoff-relevant game (α, β and c), the endowment E and the show-up fee (F = £2). Also they were informed that they could not make a real loss in the experiment due to their endowment. The split of the show-up fee and the endowment was necessary in order to make losses as salient as possible. Subjects were informed that the entire amount of earnings was handed to them at the end of having encountered the 18 different scenarios. The subjects were also informed that they would be matched randomly with another player for each scenario and that they would not know whom the other player in the room would be. Overall subjects earned between £2 and £19 in the experiment.

After the explanation of the games, verbally and on screen, the subjects were tested on their understanding of the task by a set of questions prior to the experiment. The subjects were only allowed to participate once all questions were answered correctly. Subjects had the opportunity to read the instructions as often as necessary and they were allowed to ask questions to the experimenter. Communication between the subjects was not allowed. Once all subjects answered the questions correctly they encountered the 18 scenarios. The scenarios presented lasted only one round. The sequence of scenarios was chosen by the computer and was different for each subject. Subjects faced only one scenario each in one round. The task for each subject in these scenarios was to select one circular object on the spatial grid shown on the screen by clicking on it. A scenario was immediately completed when the subject selected one of the two circular objects. Subjects could not change their choice after the selection was made and were not informed whether they successfully coordinated or not after each round. The scenario would commence once all players finished making their selections.

After all subjects successfully completed 18 consecutive scenarios, the final payoff was shown on the computer screen, including the chosen payoff-relevant game, game parameters and whether there was a successful coordination. While waiting to be paid, subjects were asked to state the reason for their actions in a brief questionnaire. Before explaining their decisions, each subject knew the final payoff. Giving an explanation via the questionnaire was not mandatory. Once students were paid at their work station, they were asked to leave the computer laboratory.

4. Expected findings

4.1 General hypotheses

The Focal point theory (Schelling, 1960; Mehta et al., 1994a,b) suggests that subjects will use the "rule of closeness" in their decision-making process:

Hypothesis 1: *In case of payoff-symmetry ($\alpha = \beta$) as well as payoff-asymmetry ($\alpha \neq \beta$, where $\alpha \leq \beta$) , $c \geq 0$, and $\Delta \leq 0$, players will use the spatial properties of the bargaining table and apply the "rule of closeness" in their choice behaviour, thus choosing the label-salient focal point Near.*

The above hypothesis is based on Schelling's (1960) reasoning regarding the use of decision labels in order to achieve coordination in pure coordination games. Considering Level-K analysis as in Crawford et al. (2008) investigating the effect of payoff-asymmetries suggests that:

Hypothesis 2: *With increasing payoff-asymmetry ($\alpha \neq \beta$, where $\alpha \leq \beta$, $c \geq 0$, and $\Delta \leq 0$) players will choose the payoff salient option (i.e., the higher payoff) instead of the focal point (Near, Near).*

If players mix their strategies, the Nash equilibrium theory implies that increasing payoff-asymmetry lowers the possibility of coordination (Appendix 1.1)

Hypothesis 3: *With increasing payoff-asymmetry, where* $\alpha \leq \beta$*,* $c \geq 0$*, and* $\Delta \leq 0$*, players will be less successful at coordinating than under payoff-symmetry. As payoff-asymmetry increases, expected coordination rates decrease.*

4.2 Hypotheses regarding choice behaviour when losses are possible

Generally not much research has been conducted investigating choice behaviour in coordination games when losses are present. However, regarding the evidence presented in the literature my conjecture is that in my experiment the presence of losses lets players revert their attention from asymmetric payoffs back to the label salient focal point (Near / Near). My conjecture is based on the psychological underpinnings of several behavioural concepts, such status quo bias, loss aversion (prospect theory), relatedly loss avoidance theory and focal point theory. In my experiment, some of these psychological effects seem to be mutually reinforcing when determining choice behaviour of players. When losses loom, research shows that players undertake great efforts in order not to incur a loss, such as taking on the risk of even higher losses, or overly defending a certain status quo at a great expense (Levy, 1996). The presence of losses changes strategic and choice behaviour of players as the focus lies on avoiding a certain loss. This focus then leads to risk seeking in light of a certain loss, which mainly expresses the players' determination not to incur a loss in the first place.

In my experiment players are given a salient strategy choice in order to coordinate and limit potential negative payoffs, which is choosing the Near option. In a simultaneous move battle of the sexes game there are otherwise no other cues for players on how to coordinate successfully. The action of the co-participant in the experiment cannot be predicted with certainty and cannot be observed prior to decision making. Past research showed that when payoffs are positive and asymmetric, players mainly focussed on the asymmetry when choosing a strategy. However, doing so, does not lead necessarily to an improved coordination (Crawford et al., 2008).

Hence, asymmetric payoffs in the loss domain trigger two psychological responses. One is to focus on payoffs, due to asymmetry, and the other is to focus on losses, which ought to be avoided at all costs. However, losses cannot be avoided with certainty when keeping up the payoff bias, as coordination is uncertain. On the other hand, research has shown that spatial proximity serves as a strong coordination device in a pure coordination game (Metha et al. 1994a,b). Hence, I conjecture that the focus on asymmetric payoffs is offset by the focus of avoiding a loss, and players revert their attention back from payoff asymmetry to using the label salient focal point.

My conjecture is bolstered by research considering the status quo bias (Samuelson & Zeckhauser, 1988) and concession aversion (Kahneman et al., 1990). Both theories are subject to the psychological effect of losses being overweighed (Kahneman & Tversky, 1979; Slovic, Fischoff, and Lichtenstein, 1982; Kahneman, Knetsch & Thaler, 1990; and Tversky & Kahneman, 1991).The status quo bias suggests that players undergo some effort to keep their status quo if it is acceptable to them instead of risking a potential loss (Levy, 1996). Indeed governments tend to choose an acceptable status quo more likely than making a change in foreign policy that could end up on a possible loss (Levy, 1996).

In my experiment the status quo for both players is represented by the given endowment as well as the payoff that is closest each player as suggested by the "rule of closeness". If players consider the object located closely to them as belonging to them and as an acceptable status quo, they would want to preserve it, reverting their attention back from the payoff asymmetry to the label salient focal point and choosing the Near object, rather than incurring a potential loss.

Further, Loss avoidance suggest the same behaviour. Loss avoidance theory states that players would choose a strategy that avoids a certain loss in favour of a strategy that gives them a potential gain (Cachon & Camerer, 1996; Feltovich, 2011; Feltovich, 2012). If players consider the payoff from not coordinating as a loss, and the coordination payoff as a gain – even if all payoffs are in the loss domain – they would seek a strategy that gives them a potential relative gain, hence, a strategy that leads most likely to coordination. Among all strategies available the most probable strategy leading to coordination is to choose the label salient focal point.

Given the above psychological responses of players to possible losses, I now formulate Hypotheses 4 and 5:

Hypothesis 4: *Focal point theory in combination with loss aversion and loss avoidance suggest that as potential overall payoffs become increasingly negative, given $\alpha = \beta$ as well as $\alpha \neq \beta$, where $\alpha \leq \beta$, $c \geq 0$, and $\Delta \leq 0$, the overall coordination* *rate on the Nash equilibrium (Near, Near) will increase. Players will choose the label salient focal point (Near) more frequently.*

And:

Hypothesis 5: *Considering the bargaining table, $\alpha = \beta$ as well as $\alpha \neq \beta$, where $\alpha \leq \beta$, $c \geq 0$, and $\Delta \leq 0$, the expected coordination rate will improve as Δ becomes increasingly negative.*

A similar reasoning should extend to the possibility for subjects to incur a penalty for not coordinating. Moreover, Nash equilibrium theory suggests that by introducing potential penalties for not coordinating (cost $c \geq 0$) into the above-mentioned games, coordination results improve. Subjects are game theoretically more likely to coordinate according to the Nash equilibria (Near, Far) and (Far, Near). Thus, I expect that:

Hypothesis 6: *As c becomes larger, given $\alpha = \beta$ as well as $\alpha \neq \beta$, where $\alpha \leq \beta$, $c \geq 0$, and $\Delta \leq 0$, the coordination rate on the Nash equilibrium (Near, Near) will increase. Players will choose the label-salient focal point (Near) more frequently.*

And:

Hypothesis 7: *Given $\alpha = \beta$ as well as $\alpha \neq \beta$, where $\alpha \leq \beta$, $c \geq 0$, and $\Delta \leq 0$, the overall coordination rate will be higher as a result of an increase in c.*

5. Results

In each separate session, subjects made 18 consecutive choices in games that were presented in a random order. It might be contended that a learning effect was present by repeatedly playing the games for the experiment. Thus, I examined whether the subjects learned to choose the focal point (i.e. the Near choice) over the 18 different games with a repeated-measures logistic regression that controlled for clusters in observations (Rogers, 1993). To do this, choices for each player across all frames were considered. Results showed that the focal point play did not increase with increasing number of games played (odds ratio = 1.008, $z = 1.25$, $p = .212$). This suggests that the subjects' choices were not influenced by repeatedly playing the coordination games in this experiment.

5.1 The rule of closeness

5.1.1 Choice behaviour

Hypothesis 1. I first explore whether the choice behaviour of the decision-makers was influenced by "the rule of closeness" as a label-salient focal point (Mehta et al.,1994a, Isoni et al. 2013) as outlined in Hypothesis 1. The graphical representation of the bargaining game placed two objects into a spatial grid (i.e., the bargaining table in Figure 1.1). The objects provided a Left option and a Right option to the decision-maker and were located at the same spot on the spatial grid of the bargaining table in all games. Figure 1.7 provides relative frequencies with which Left and Right players choose the Left object on the bargaining table across all three frames. For example, choice frequencies of the game with the parameter set ($\alpha = 5$, $\beta = 5$ and $c = 0$ in the Gains frame, where $\Delta = 0$) were aggregated with the corresponding choice frequencies from the Mixed and the Loss frames ($\Delta = -5$, $\Delta = -10$, ceteris paribus). Overall, Left players chose the Left option in this particular game with a frequency of 75.3%, Right players chose the Left option with a frequency of 22.7%.

Across all 18 games in Figure 1.7, Left players chose the Left object with expected frequencies between 35.1% and 75.3% of the time. This large spread suggests that Left players were influenced by absolute payoff-levels as well as the difference between α and β. Left players chose the Left object with a frequency larger than 50.0% in 16 out of 18 games. Right players chose the Left object with a range of expected frequencies of 19% to 41% and chose the Right object with a frequency larger than 50%. Also, Right players seemed to be influenced in their choices by absolute payoff-levels and the difference between α and β. The observed frequency distributions in Figure 1.7 suggest that players overwhelmingly tend to choose the object on their own side of the table (i.e. the Near object).

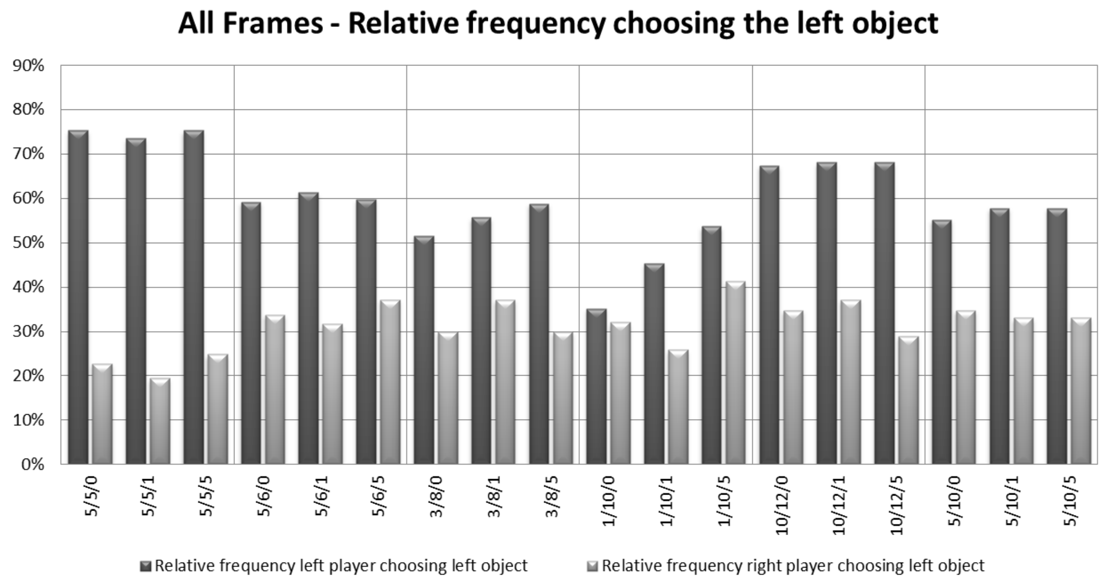


Figure 1.7: Comparison of average choice behaviour in all three frames – frequency of choosing the Left object

To conduct a statistical measure of this effect, I created a difference variable measuring the difference between the total number of times a particular player chooses the Left object and the total number of times a player chooses the Right object. This difference variable is created for each player, summed up over all games separate for the Left and the Right player and divided by the total number of the Left and Right players respectively. This measure has been successfully used by Isoni et al. (2013). The average in this experiment is $M_{\text{Left}} = 3.19$ for the 99 Left players and that for all 98 Right players is $M_{\text{Right}} = -6.75$. The difference is tested in a one–tailed Mann-Whitney-U test and shows a statistical significance at the level of $z = 6.13$, $p < .001$[2]. The result shows a systematic distribution of the choices of Left and Right players on an aggregate level.

In order to discern whether there were major differences between the different frames in terms of choice distribution between the Left and the Right player, I conducted the same test in each of the three frames. Similarly to Figure 1.7, Figures 1.8, 1.9 and 1.10 depict the Gains, Mixed and Loss frames, showing the frequency of the Left and the Right player choosing the object on the Left.

[2] The absolute magnitude of the average differences for Left and Right players depend on the total number of games measured as well as the choices made by the players.

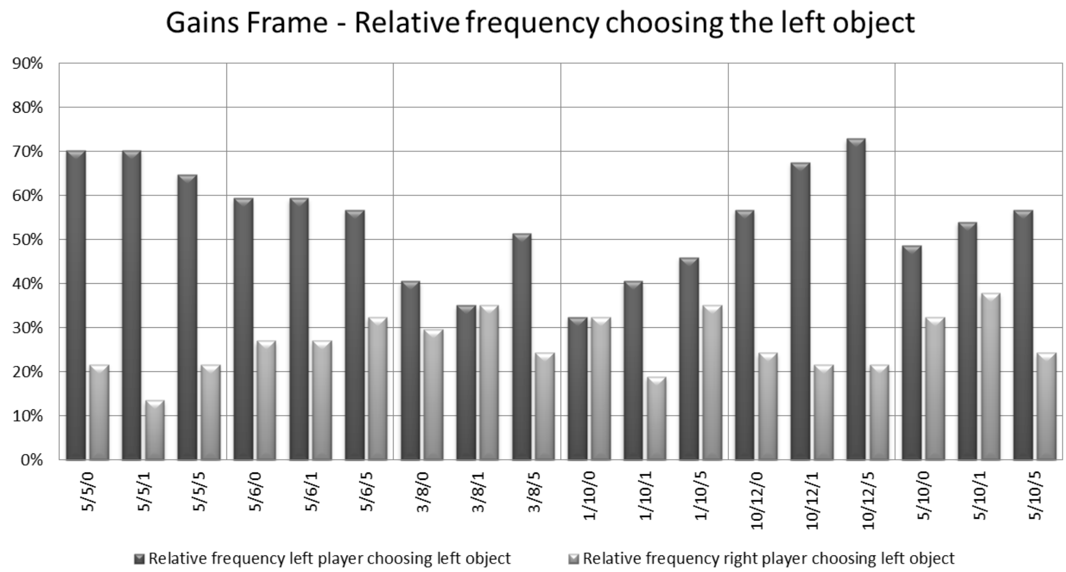


Figure 1.8: Comparison of choice behaviour in the Gains frame –frequency of choosing the Left object

Not surprisingly, Left players (average difference score of $M_{\text{Left}} = 1.68$) chose the Left object more frequently than Right players (average difference score of $M_{\text{Right}} = -8.38$), Mann-Whitney-U z = 16.41, p < .001. In the Mixed frame, the average difference score for Left players ($M_{\text{Left}} = 3.5$) and that for Right players ($M_{\text{Right}} = -6.25$) was significantly different as well, Mann-Whitney-U $z = 16.41$, $p < .001$. Finally, in the loss frame Left players on average chose the Left object over the Right object with a difference score of $M_{\text{Left}} = 5.05$ and Right players chose the Right object over the Left object with an average difference score of $M_{\text{Right}} = -5.17$. The difference between these choices is also statistically significant, $z = 15.63$, $p < .001$ (Mann-Whitney-U test).

5.1.2 Summary

Looking at the observed frequency ranges of all three frames as well as on the aggregate level (Figures 1.7, 1.8 – 1.10), it can be stated that players tend to overwhelmingly choose the object on their own side of the bargaining table. This effect seems to be relatively robust. In absence of "the rule of closeness", the most effective choice for players would be to choose each disc with a probability of 50.0% (Isoni et al., 2013). Thus, Hypothesis 1, which states that players use the spatial distribution of the bargaining table and apply the "rule of closeness" in their decisions, can be confirmed (i.e., the focal point is salient). The data further suggests that the level of asymmetry and the framing influence the choice behaviour. This is investigated in the following sections.

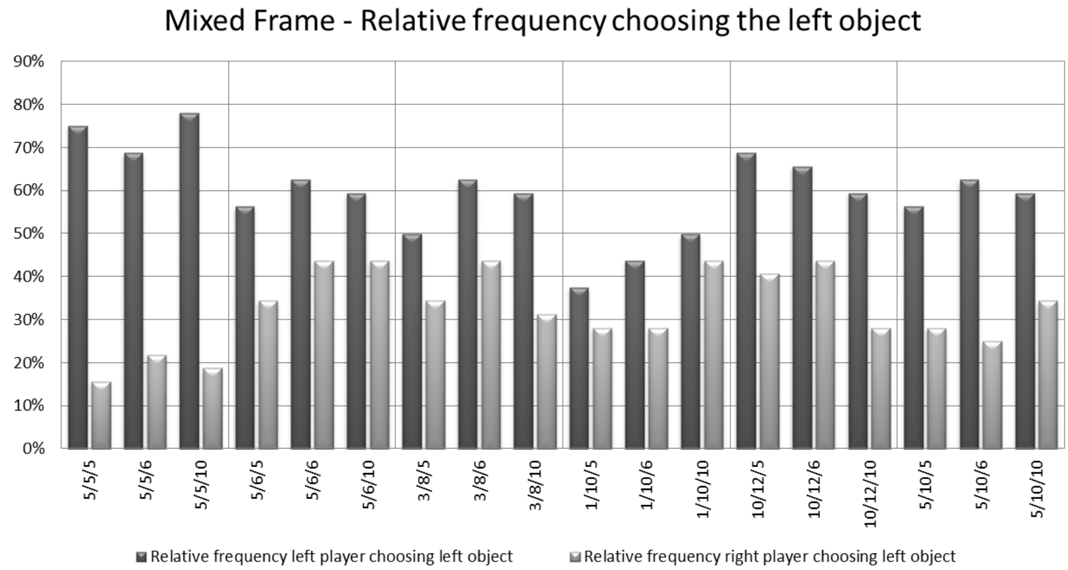


Figure 1.9: Comparison of choice behaviour in the Mixed frame – frequency of choosing the Left object

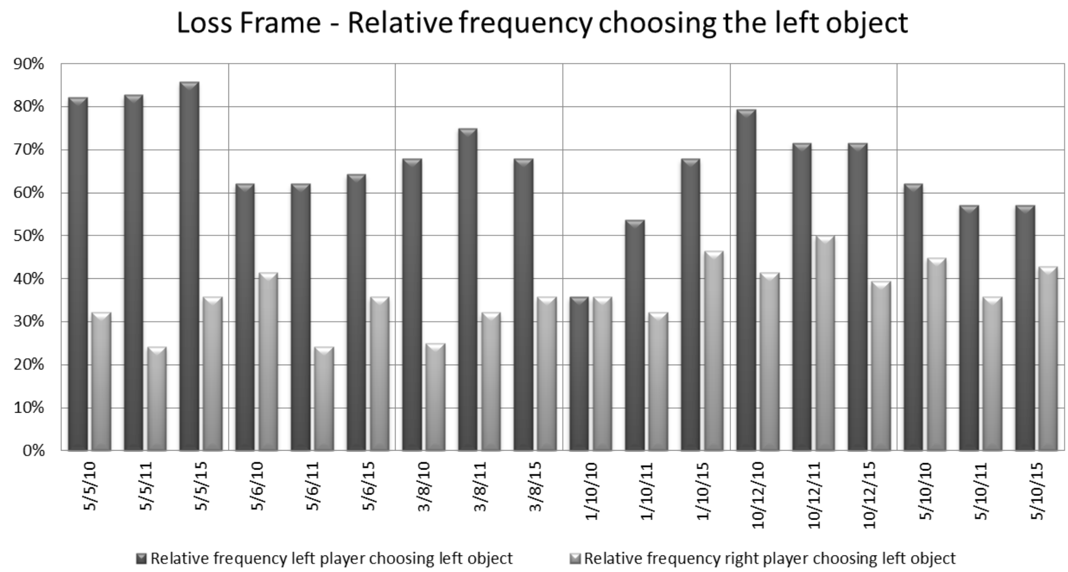


Figure 1.10: Comparison of choice behaviour in the Loss frame – frequency of choosing the Left object

5.2 The effect of asymmetry (α ≠ β, where α ≤ β)

In my experiment setup, I used different parameters for α and β creating payoff-asymmetries. In this section, I test the impact of asymmetries on the choice behaviour of the players and expected coordination rates.

5.2.1 Choice behaviour

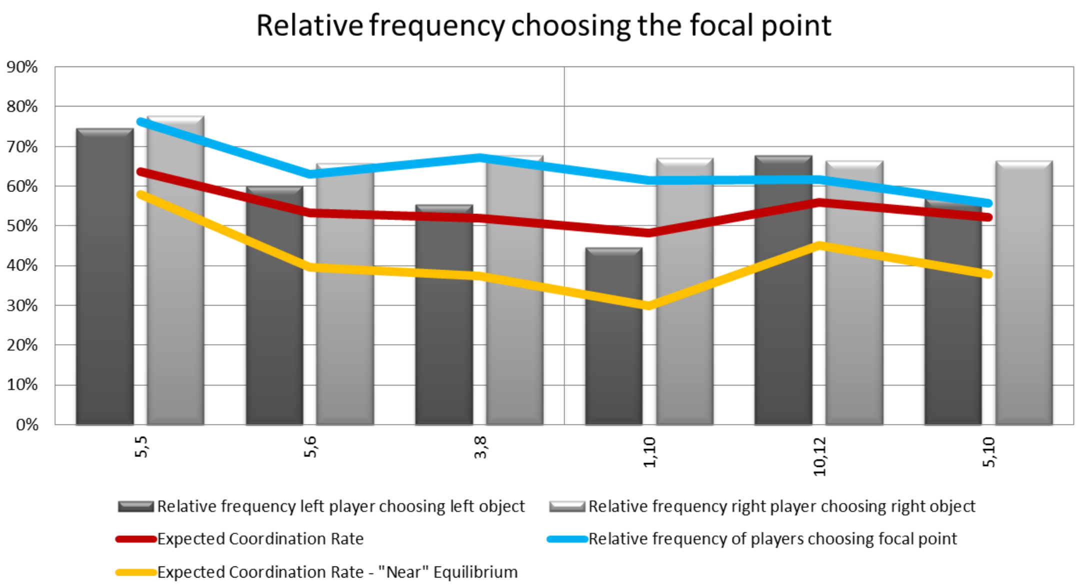


Figure 1.11: Choice behaviour: frequency of the Left and the Right players to choose the focal point

Hypothesis 2. First I investigate the effect of payoff asymmetry on choice behaviour. Figure 1.11 depicts the relative frequency for players to choose the focal point by game (x-axis depicts value combinations for α and β). For example, the (5, 5) data point includes the choice behaviour from the games α = 5, β = 5 and c = 0, 1, 5 across all frames. For this particular data point, the relative frequency for the The frequency for both players to choose the focal point is thus 76.2% depicted by the blue line. The red line depicts the expected coordination rate, in this case 63.7% and the yellow line depicts the expected coordination rate on the Near equilibrium (58.0%). Figure 1.11 shows an effect of asymmetries on choice behaviour. As the level of asymmetry increases, the power of the relative frequency of focal point play decreases.

Grouping the games according to the absolute difference between α and β, which can assume the values 0, 1, 2, 5 and 9, the choice behaviour of the Left and Right players choosing the focal point can be compared with a binomial test. Testing the proportions of focal point play for each of the difference levels between α and β against the proportion from the symmetric game (76.2%), the differences are statistically significant (*p*s < .01). Thus, introducing asymmetry clearly reduces focal point play at all levels of asymmetry.

Further, Figure 1.11 shows that spatial proximity has a different effect on Left and Right players under asymmetry. For the Left player, the frequency of choosing the focal point lies between 44.7% and 67.8% in the asymmetric games, while the higher the asymmetry, the lower the observed frequency. For the Right player, the range is between 65.9% and 67.7%. This suggests that the power of the focal point decreases for the Left player as asymmetry increases, while the Right player's choice is unaffected. However, Figure 1.11 does not reveal whether the choice behaviour of the Right player is influenced by the focal point (Near) or a payoff bias. To further investigate the choice behaviour, I test players' choices against the theoretically predicted Nash equilibrium probabilities with a binomial test. The differences to the observed frequency of choosing the focal point for the Left player was significant (*p*s < .001). However, the same test for the Right player is only significant for the $\alpha = 5$, $\beta = 5{,}6$ as well as the $\alpha = 3$, $\beta = 8$ game (*p*s < .01). Given that the Nash equilibrium probabilities are calculated without the concept of focality, the power of the focal point cannot be demonstrated for the Right players' choice in half of the games (i.e., it cannot be determined whether the Right player's choice has a label bias).

Lastly, in this section I analysed the effects of increasing payoff-asymmetry and player type (Left vs. Right) on focal point play (i.e., *Near* choices) with a repeated-measures logistic regression that controlled for clusters in observations. This analysis revealed that increases in payoff-asymmetries significantly reduced choices of the Near equilibrium, odds ratio = .810, $z = -5.21$, $p < .001$. The effect of player type was not significantly predictive of focal point play (p = .871), however a significant interaction between asymmetry and player type supported the notion that the increasing asymmetry influenced the Left and Right players differently, odds ratio = 1.10, $z = 3.61$, $p < .001$. Specifically, whereas choosing the focal point was not influenced by payoff-asymmetry for Right players, Left players chose the focal point less often as payoff-asymmetries increased. Overall the results in this section partially support Hypothesis 2 and show a payoff bias in players' decision making in most games.

5.2.2 Coordination

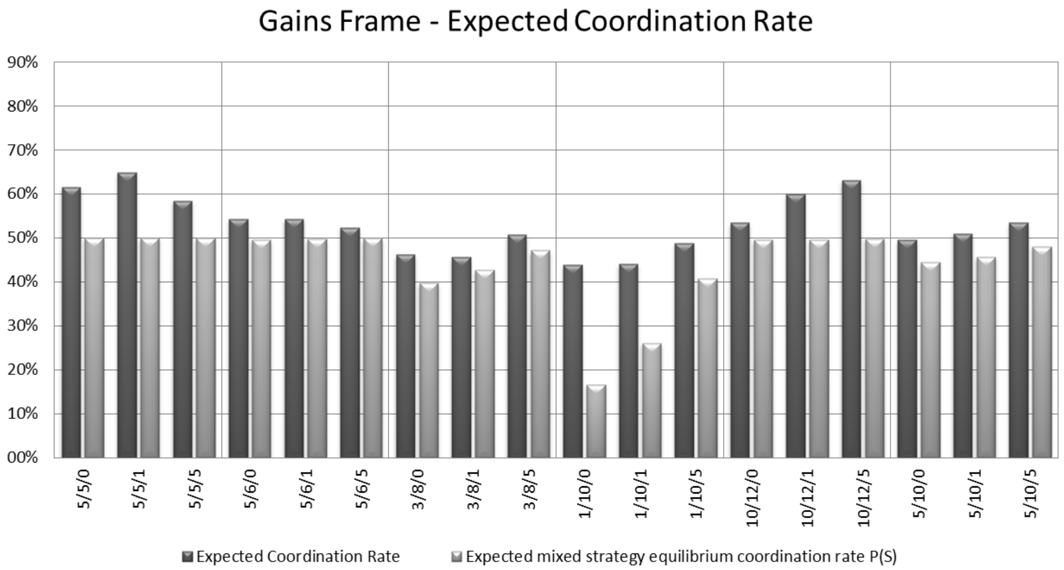


Figure 1.12: Expected Coordination Rate – Gains Frame

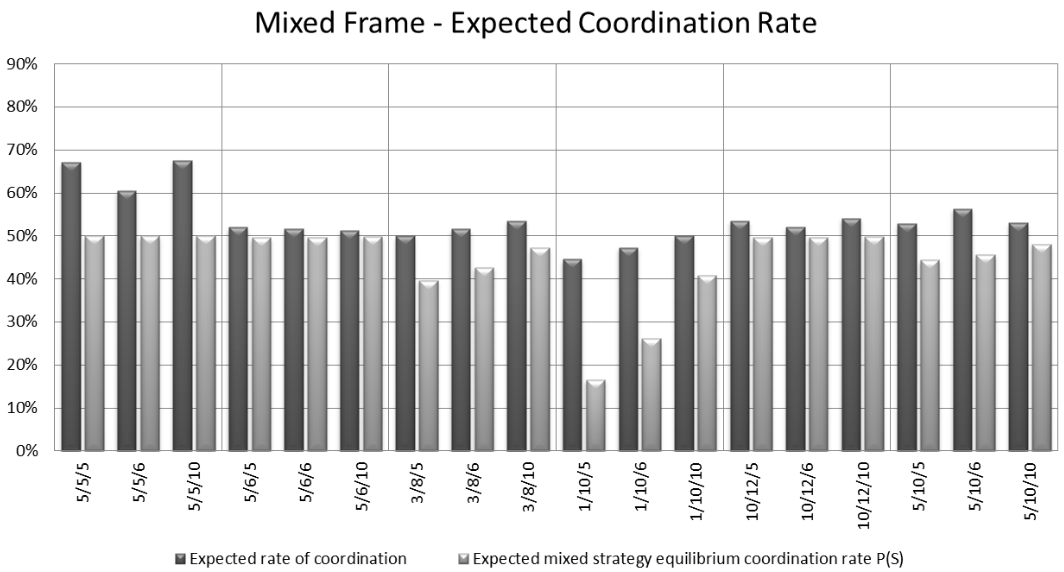


Figure 1.13: Expected Coordination Rate – Mixed Frame

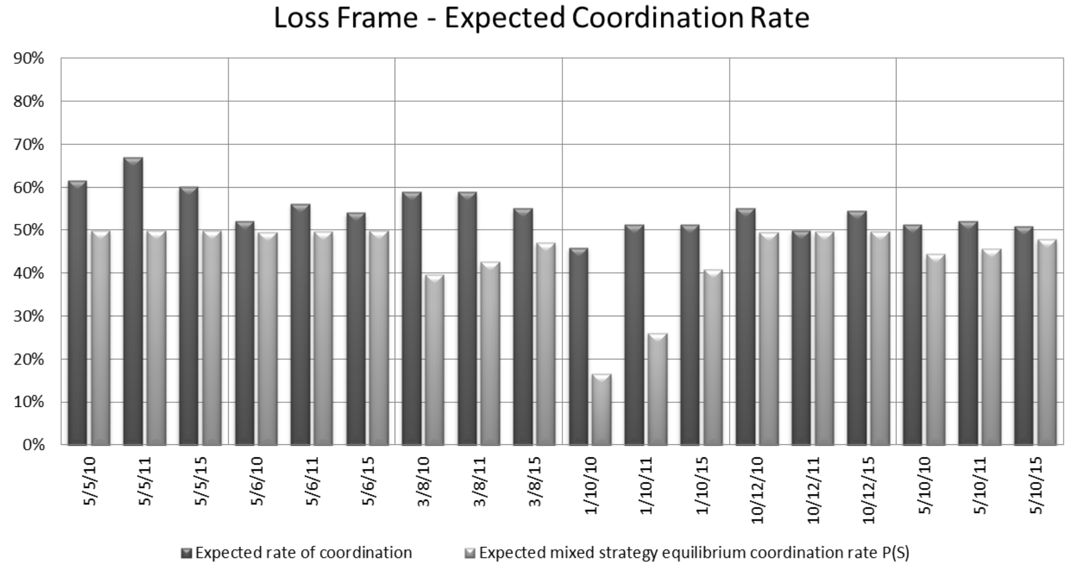


Figure 1.14: Expected Coordination Rate – Loss Frame

Hypothesis 3. In this section I analyse the effect of payoff asymmetry on the expected coordination rates. Figures 1.12, 1.13 and 1.14 depict the expected coordination rate as well as the theoretically predicted rate for successful coordination on the two pure Nash equilibria (P(S)) for the Gains, Mixed and Loss frames. In order to analyse the impact of the level of asymmetry, I compare the overall expected coordination rates of games grouped by their $\beta - \alpha$ values. For that I grouped games with the same $\beta - \alpha$ values over all treatments and level of c. I first compare the coordination rate of the games with $\beta - \alpha = 0$ to games with $\beta - \alpha = 1$. Across all three frames, the range of expected coordination for the symmetric games ($\alpha = 5$, $\beta = 5$) is between 58.4% and 67.6%. The average over all games is 63.7%. For the ($\alpha = 5$, $\beta = 6$) games, the range of expected coordination is between 51.2% and 56.2% and over all games the expected coordination rate lies at 53.2%. This drop in coordination rate is statistically significant (χ^2-Test, $p = 0$ .011). The games ($\alpha = 3$, $\beta = 8$) and ($\alpha = 5$, $\beta = 10$) lie in the category of $\beta - \alpha = 5$. Over all frames the game ($\alpha = 3$, $\beta = 8$) has an expected coordination rate of 51.9% and the games with ($\alpha = 5$, $\beta = 10$) lie at 52.3%. This difference is not statistically significant (χ^2-Test, $p > .90$). Compared with $\beta - \alpha = 1$ games, the expected coordination rate did not significantly drop (χ^2-Test, $p > .90$). I omitted the analysis of the games on the category of $\beta - \alpha = 5$ as these games have a range of expected coordination rates between 50.0% and 63.0%, which is a larger range than the ($\alpha = 5$, $\beta = 6$). Lastly, games in the category of $\beta - \alpha = 9$ have an overall expected coordination rate of

48.2%. The difference to games in the category of β – α = 1 is also not significant (χ^2-Test, $p > .10$). Hence, expected coordination rates do not significantly decrease as β – α increases, however, they decrease in comparison to symmetric games.

Figures 1.15, 1.16 and 1.17 depict the expected coordination rate of the Near and Far equilibria for the Gains, Mixed and Loss frames. The figures generally show that the coordination on the Near equilibrium is much higher than the coordination on the Far equilibrium. The coordination on the Near equilibrium seems highest in the symmetric games as well as the games with low payoff-differences (α = 5, β = 6), (α = 10, β = 12). As payoff-differences increase (α = 1, β = 10), (α = 3, β = 8) and (α = 5, β = 10), the difference between the coordination on the Near equilibrium and the Far equilibrium diminishes. As payoff-differences become larger, the coordination on the Near equilibrium decreases and the coordination on the Far equilibrium increases. Thus, with an increasing payoff-difference, the power of the focal point decreases. If these groups of games with low payoff-asymmetries and high payoff-asymmetries are aggregated and compared, the difference is significant ($\chi^2 = 13.66$, $p < .001$). When payoff-asymmetry increases, coordination on the Near equilibrium decreases. Overall, findings lend some support to Hypothesis 3.

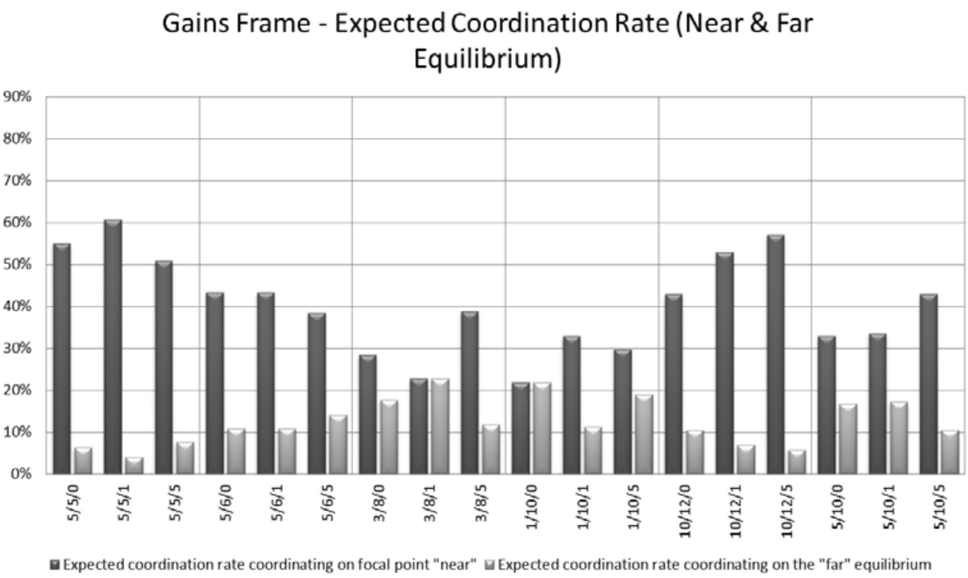


Figure 1.15: Expected Coordination Rate (Near & Far Equilibrium) – Gains Frame

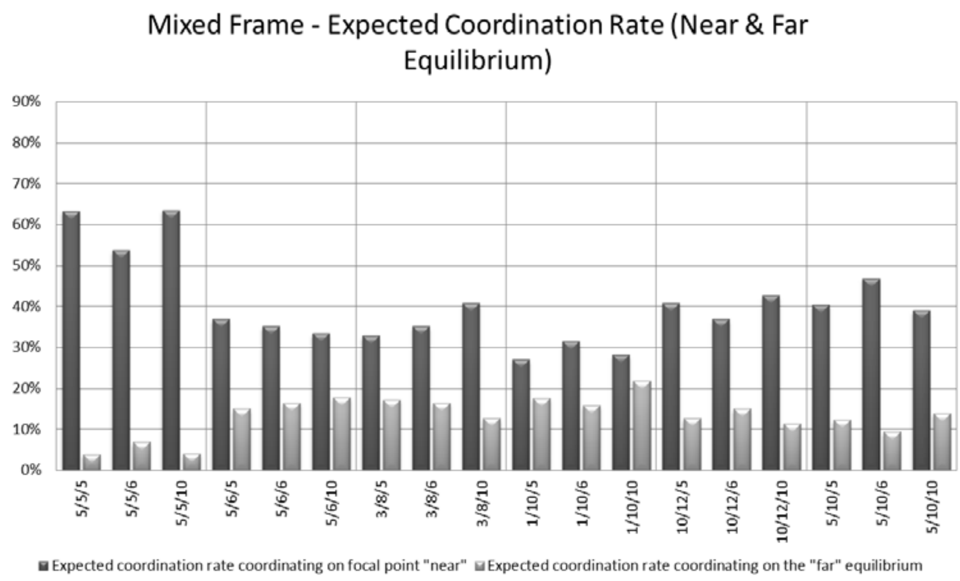


Figure 1.16: Expected Coordination Rate (Near & Far Equilibrium) – Mixed Frame

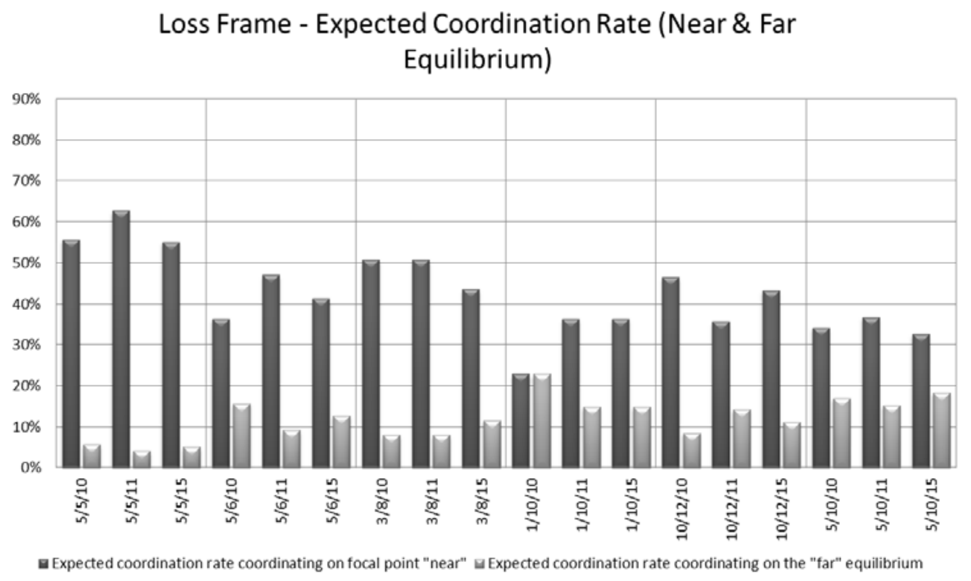


Figure 1.17: Expected Coordination Rate (Near & Far Equilibrium) – Loss Frame

5.2.3 Summary

The degree of asymmetry between α and β seems to have some effect on the level of the expected coordination rate. Asymmetry lowers the expected coordination rate in comparison with symmetric games. The degree of differences in α and β in asymmetric games is not statistically significant. In addition, it can be observed that an increasing payoff-difference across all frames descriptively weakens the power of the focal point. The less favoured Left player chooses increasingly the Right object with a growing payoff-difference, depending also on the absolute level of α and β.

The favoured Right player seems unaffected by the payoff-asymmetry. In aggregate, this leads to lower focal point play across all players. Hypothesis 2 and 3 are partially confirmed.

5.3. The framing effect

In section 5.3, the framing effects are examined, i.e. the comparison of all 18 games with the corresponding sets of parameters of α, β and c in the Gains, Mixed and Loss frames ($\Delta = 0, -5, -10$).

5.3.1 Choice behaviour

Hypothesis 4. In this section the influence of the framing effect on the choice behaviour of the players is examined. It quickly becomes apparent that loss aversion has an effect on the coordination behaviour of the decision-makers – however the impact is quite different for the favoured (Right) and the less favoured (Left) player. Figure 1.18 shows the average frequency of Left and Right players choosing the Left object across all games, comparing the average results from the Gains, Mixed and Loss frames.

Comparing the average of all 18 games across all three frames, an increase of Left players choosing the Left object can be observed, which constitutes a framing effect. As the variable Δ decreases, Left players seem to choose the near option more often. In the Gains frame 54.7% of the Left players choose the Left object (Near), while 59.7% choose that option in the Mixed frame and 67.0% in the Loss frame (Figure 1.18). The increase from the Gains to the Loss frame is statistically significant ($\chi^2 = 18.3$, $p < .001$).

The increase from the Gains frame to the Mixed frame is marginally significant ($\chi^2 = 3.23$, $p = .07$), while the increase from the Mixed to the Loss frame is significant ($\chi^2 = 6.14$, $p < .05$). Across all frames, the difference of choosing the Left and Right objects for the Left player is statistically significant, *p*s < .05.

Looking at all 18 games individually, a clear treatment effect cannot be observed in every game. However, moving from the Gains to the Mixed frame and from the Mixed to the Loss frame, in 14 out of 18 games a percentage increase of Left players choosing the Left object could be observed (see Figure 1.19).

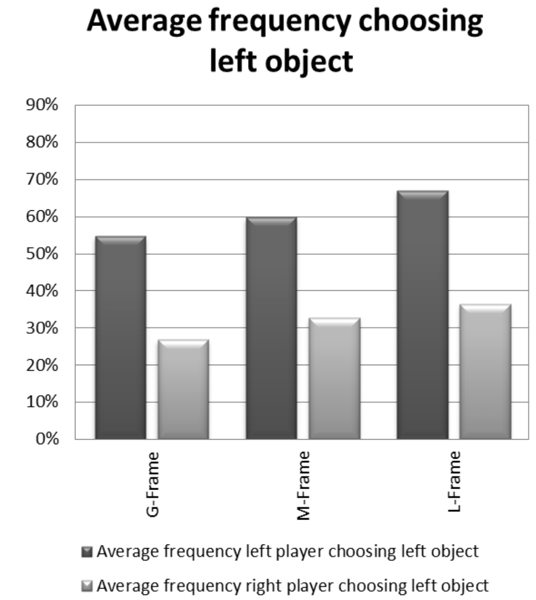


Figure 1.18: Average frequency of Left and Right players choosing the Left object across all frames

Comparing the Gains frame with the Loss frame, in 17 out of 18 games a percentage increase of Left players choosing the Left object could be observed. Testing the individual games of the Gains, Mixed and the Loss frames with a χ^2-Test, the increase of Left players choosing the Left object is statistically significant, $p < .01$, for 12 of the 18 games.

The strongest framing effect for Left players choosing the Left object was present in the group of games ($\alpha = 3$ and $\beta = 8$,) with an average increase of 27.9% ($\chi^2 = 14.41$, $p < .001$) between the Gains and the Loss frames. The group of games with $\alpha = 1$ and $\beta = 10$ also shows a stronger framing effect with an average increase of 12.7% ($\chi^2 = 2.83$, $p = .09$). In the case of payoff-symmetry ($\alpha = 5$ and $\beta = 5$), the average increase of Left players choosing the Left object between the Gains- and the Loss frames is 15.1%. For the other groups of games, the percentage increase of Left players choosing the Left object is below 10%. In 4 out of 6 groups of games, the percentage increase of Left players choosing the Left object is larger comparing the Mixed frame and the Loss frame than comparing the Gains frame with the Mixed frame. The analysis on an individual game level provides some evidence that, as overall nominal payoffs become more negative, Left players have an increasingly strong incentive to choose the Left object.

As the scale variable Δ becomes increasingly negative moving from the Gains to the Mixed to the Loss frame, the Right players tend to increasingly choose the Left object (Figure 1.18). Aggregating all games in the Gains frame, 26.7% choose the object on the left, in the Mixed frame 32.6% of the Right players choose the object on the left, and in the Loss frame this number increases to 36.4%. The increase is statistically significant ($\chi^2 = 12.9$, $p < .01$).

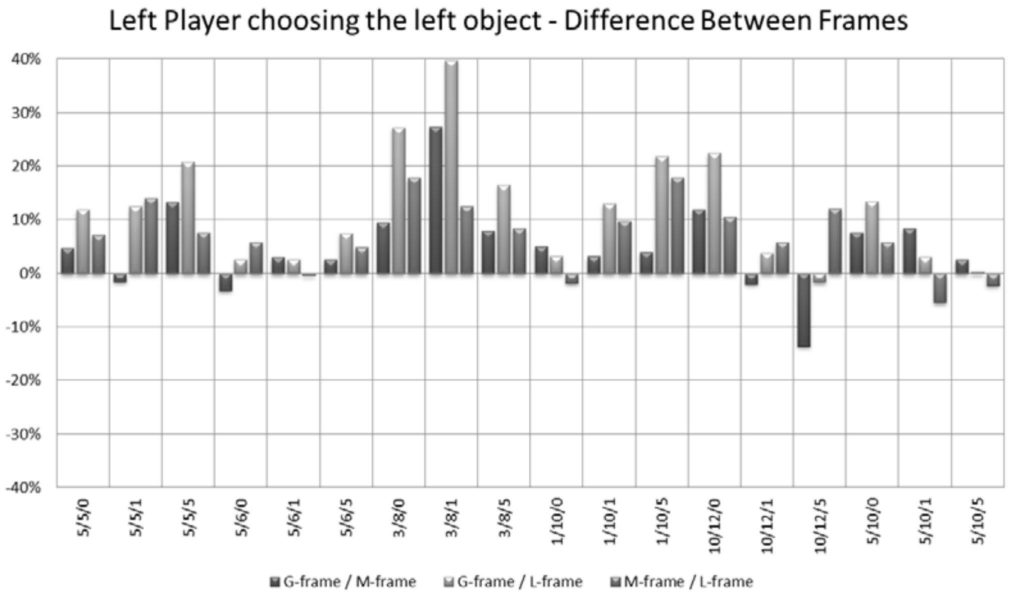


Figure 1.19: Comparison of choice behaviour in the three frames-Left players choosing Left object

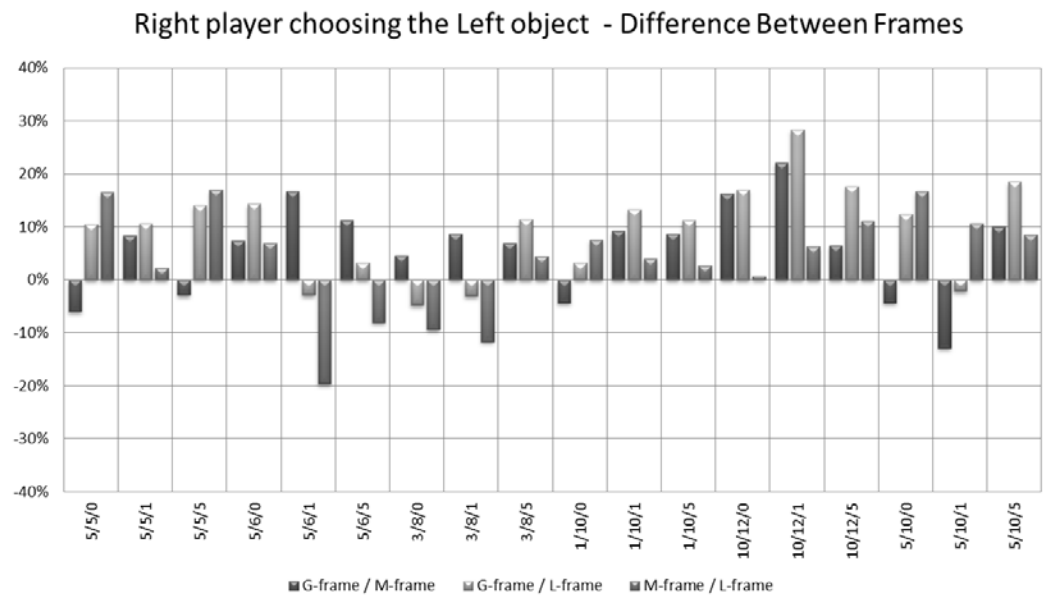


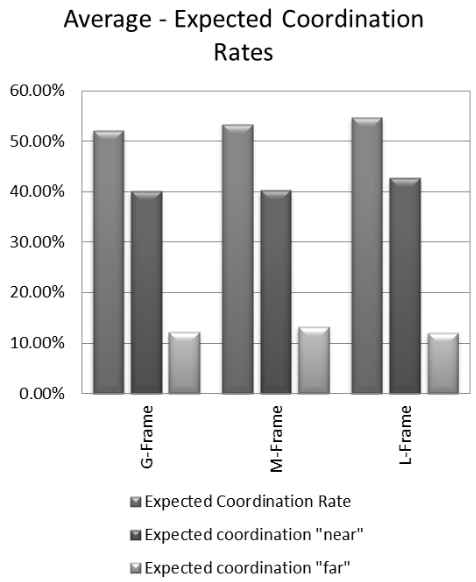
Figure 1.20: Comparison of choice behaviour in the three frames –Right players choosing Left object

Comparing the differences of the Gains and the Mixed frames, the increase is significant, $\chi^2 = 5.21$, $p < .05$. The difference from the Mixed to the Loss frame however is not statistically significant ($\chi^2 = 1.64$, $p = .19$). This suggests that for the Right player introducing losses as a framing effect has a statistical effect on choice behaviour, but increasing losses further does not statistically change behaviour. Similar to Figure 1.19 for the Left player, Figure 1.20 shows the difference of choice behaviour for the Right player in each individual game across the Gains, Mixed and Loss frames. The choice behaviour of the more favoured Right player shows that the framing effect causes generally an increase in the choice of the Left object also on an individual level. The more favoured (Right) player chooses more often the Left object (Far) as a result of the framing effect on an aggregate and individual game level. The difference across all frames is statistically significant using a χ^2-test (ps < .010) except for the ($\alpha = 1$, $\beta = 10$, $c = 0$) game. Descriptively, a particular trend in Figure 1.20, cannot be established. Overall there is only partial evidence to support Hypothesis 4 as only Left players choose the Near option more often, while right players seem to choose the Far option more frequently when losses are introduced. This suggests a payoff-bias in the choice behaviour as both players choose the lower money amount when losses are introduced.

5.3.2 Coordination

Hypothesis 5. Next, I analyse the framing effect on coordination rates. Considering the above choice behaviour of the Left and the Right player, it is not surprising that the average expected coordination rate as well as the expected coordination rate on the Near and Far equilibria do not show significant increases. Figure 1.21 depicts the average coordination rate on the Near and Far equilibria. In the Gains frame, the coordination on the Near equilibrium is 40.3%, while the coordination rate on the Far equilibrium is 12.1%. Moving onto the Mixed frame, the coordination on the Near equilibrium remains at 40.2%, while the expected coordination on the Far equilibrium is 13.1%. These figures are intuitive as both Left and the Right players increasingly choose the Left object as losses increase. The coordination on the Near equilibrium remains at the 40.0% level since the increase in the observed frequency for the Left player choosing the Left object neutralises the decreasing observed frequency with which the Right player chooses the Right object.

The same neutralising effect can be observed for the expected coordination rate on the Far equilibrium. The increase of 1% is marginal and an effect resulting from the method calculating the expected coordination rate[3]. Comparing the Mixed and the Loss frame, the average expected coordination rate on the Near equilibrium is 42.6% and the coordination on the Far equilibrium is at 12.0%. The increase in the coordination rate of the Near equilibrium can again be explained by the change in proportion of the Left player choosing the Left object and the Right player choosing the Right object which do not neutralise each other in terms of the expected coordination rate. Statistically, the marginal changes in the expected coordination rates are insignificant ($\chi^2 = 0.57$, $p = 0.74$).



Figures 1.21: Average expected coordination rates: across all frames, and average expected coordination rate on the Near and Far equilibria across all frames.

Considering the expected coordination rates of the Gains, Mixed and Loss frames as depicted in Figure 1.21, a marginal increase between the frames can be observed. The Gains frame shows an expected coordination rate of 52.2%, while the Mixed (53.4%) and Loss 54.6% frames show marginally higher expected coordination rates. Testing with a χ^2-test against the null hypothesis that the

[3] For the "Near" equilibrium, this is the observed frequency of the Left player choosing the Left object multiplied with the observed frequency of the Right player choosing the Right object.

proportion of expected coordination compared with all pairs in a particular frame is the same, the result shows that the null hypothesis cannot be rejected ($\chi^2 = 0.075$, $p = .96$). The observed increase of expected coordination rate is thus statistically not reliable.

To investigate effects of different levels of α and β, I test the expected coordination rate individually in all 18 games (Figures 1.12, 1.13, 1.14). Overall 13 games showed an increase of coordination rates comparing the Gains frame with the Loss frame. The largest differences were observed in the games with a relatively low α- value (Left object) and with a large payoff-difference ($\alpha = 3$, $\beta = 8$) and ($\alpha = 1$, $\beta = 10$). The maximal increase in these two sets of games is 13.4% and 7.2%. On the other hand for games with very large α-values (Left object) and low payoff-differences, (e.g., $\alpha = 10$, $\beta = 12$) a decrease of coordination rates has been measured up to -9.97%. Differences are generally not significant ($p > .05$). When looking at the expected coordination rates on the Near equilibrium (focal point), 14 games showed increases comparing the Gains with the Loss frames. For the games ($\alpha = 3$, $\beta = 8$) and ($\alpha = 1$, $\beta = 10$), the coordination on the Near equilibrium shows an increase of expected coordination of up to 28.1% and 6.55% respectively. Coordination on the Far equilibrium decreased on 10 games comparing the Gains and the Loss frames. Comparing the Mixed with the Loss frames, it can be stated that 12 games showed increasing expected coordination rates. The expected coordination on the Near equilibrium shows an increase in 10 games. On an individual game level, 3 games out of the group of $\alpha = 3$, $\beta = 8$, $c = 0,1$ and $\alpha = 1$, $\beta = 10$, $c = 1$ as well as a game with symmetric payoffs showed significant increases (χ^2-test $p < .05$). Increases in the expected coordination rate were caused by increases on the coordination rate of the Near equilibrium.

Keeping in mind that the strongest framing effects were found for the Left players choosing the Left object in the ($\alpha = 3$, $\beta = 8$ and $\alpha = 1$, $\beta = 10$) games, the increase in coordination on Near equilibrium can be explained. In the observed games, the frequency of the right player choosing the Left object changed only marginally. Overall, coordination rates do not show a significant improvement as a result of the framing effect. On an individual game level some evidence of an improved coordination rate is found. However, in total there is little evidence to support Hypothesis 5.

5.3.3 Summary

Comparing the Gains, Mixed and Loss frames, a framing effect regarding the choice behaviour of the Left and the Right players emerged from the data. On an aggregate level, the Left and Right players were more likely to choose the Left object as a result of framing. Looking at the 18 individual games, the effect of Left and Right players increasingly choosing the Left object is found as well and is also significant (13 games).

Comparing the expected coordination rate across frames, the expected coordination rate marginally increases as a result of the framing effect; however, statistically this is not significant. The effect of the Left and Right players increasingly choosing the Left object leads to a neutralisation and the expected coordination rate does not change. However, looking at each of the games across the three frames, a significant increase of the expected coordination rate can be detected caused by the strong increase of the Left player choosing the Left object and a marginal increase of the Right player choosing the Left object.

Conclusively, I cannot confirm that expected coordination improves between frames with increasing losses (Hypothesis 5). Further, the data do not confirm that in light of increasing losses in the Gains, Mixed and Loss frames players would choose increasingly the Near option (i.e. the focal point; Hypothesis 4). Further, for the Left player, it cannot be determined whether the motive for choosing the Left object is focality or a bias towards the low payoff.

5.4 The effect of cost c

In this section, I analyse the effect of the cost variable c on choice behaviour (Hypothesis 6) as well as the expected coordination rate (Hypothesis 7). Proposition 1 predicts an increasing expected coordination rate with an increasing factor c. Schelling's (1960) reasoning as well as loss aversion theory would suggest that players choose the label salient focal point more often in order to avoid coordination failure.

5.4.1 Choice behaviour

Hypothesis 6. According to Hypothesis 6 players choose the Near option as a result of potential losses from coordination failure. Figure 1.7 in section 5.1.1 depicts the average choice behaviour of choosing the Left object across all three frames, comparing the behaviour of the Left and the Right players. Left players chose the Left object with a much higher frequency than the Right players. Further, Figure 1.7 shows that in aggregate, over all three frames the impact of c on choice behaviour for the Left and Right players is rather small in games with a low difference between α and β. The lower the value of α, and the higher the payoff-difference, the larger seems the effect of the cost c. For the ($\alpha = 3$, $\beta = 8$), ($\alpha = 1$, $\beta = 10$) and the ($\alpha = 5$, $\beta = 10$) games, there seems to be a continuous increase of Left players choosing the Left object for $c = 0$, $c = 1$ and $c = 5$. For the ($\alpha = 3$, $\beta = 8$) game, the frequency increases from 51.5% ($c = 0$) to 58.8% ($c = 5$). For the ($\alpha = 5$, $\beta = 10$) game, the increase is also rather small, from 55.1% ($c = 0$) to 57.7% ($c = 5$). Using a χ^2-test, these differences are not statistically significant ($p > .10$) and remain descriptive. However, for the ($\alpha = 1$, $\beta = 10$) game, the frequency increases from 35.1% ($c = 0$) to 45.4% ($c = 1$) to 53.6% ($c = 5$), and this difference is significant at the 5% level using a χ^2-test ($\chi = 6.785$, $p < 0.05$). Looking at the frames individually, Figures 1.8, 1.9, and 1.10, choice behaviour can be observed in more detail, however mainly no significant results were found. The choice behaviour of the Left player choosing the Left object games can also be categorised into two groups - games with a low payoff-difference and a large payoff-difference. In the Loss frame (Figure 1.10) for the ($\alpha = 1$, $\beta = 10$), game players chose the Left object with 35.7% for $c = 0$ and with 67.9% for $c = 5$. This increase is significant at the 5% level ($\chi^2 = 5.81$, $p < 0.05$).

Regarding Figure 1.7, for the Right player in most games no significant difference in choice behaviour could be observed with an increasing cost of c. In four groups of games in aggregate, Right players chose less frequently the Left object when comparing games with $c = 0$, $c = 1$ and $c = 5$. In three groups of games that frequency dropped when comparing the games of $c = 0$ and $c = 5$. Notably in the group of games with ($\alpha = 1$, $\beta = 10$) 32.5% of Right players chose the Left object for $c = 0$, 25, 8% for $c = 1$ and 41% for $c = 5$. The overall difference in choice is marginally significant using a χ^2-test ($\chi^2 = 5{,}31$, $p < 0.07$). The games in each of the individual frames as depicted by Figures 1.7, 1.9 and 1.10, show no statistical significance in the choice behaviour of the Right player ($p > .10$).

Also, I tested whether the probability of focal point play depended on both losses and player type (Left vs. Right). Binomial tests revealed that the probability of focal point play increases for Left players as losses increased. Specifically, for Left players, the probability of choosing the Left object increases from 51.5% to 58.8% as c increases from c = 0 to c = 5, a significant increase as shown by a binomial test, $p < .010$ (one-tailed). The difference in probability between c = 1 and c = 0 was in the predicted direction but not significant ($p > .19$, one-tailed). However, focal point play was largely unaffected by increases in losses for Right players, *p*s > .50. This suggests that increases in observed coordination are primarily due to the Left players choosing the Left object more often as losses increased.

Elucidating the above result, I tested whether increases in cost c predict overall salient focal point play (Near, Near). I used a repeated-measures logistic regression while controlling for player type (Left vs. Right). The regression confirmed that increasing the cost from c = 0 to c = 5 predicted more choices with regards to the focal point, odds ratio = 1.46, z = 2.11, $p = .035$. Hence the results in this section partially support Hypothesis 6, such that increasing losses increase focal point play. However, this seems to be primarily due to Left players choosing the Near option more frequently.

5.4.2 Coordination

Hypothesis 7. According to Hypothesis 7, the overall coordination rate should increase as a result of increasing costs c. As can be seen from Figure 1.22, the expected coordination rate increases slightly from 52.7% to 54.3% as *c* increases and coordination failure becomes more expensive. However, a χ^2-test of the expected frequency of coordination revealed no significant difference between the expected coordination rate in the three loss conditions, ($\chi^2 = 0.12$, $p > 0.94$). Further, the overall expected coordination rate on the Nash equilibrium (Near, Near) increases slightly as losses increase. However, a χ^2-test revealed that this increase was also not significant, $\chi^2 = 0.59$, $p > .74$.

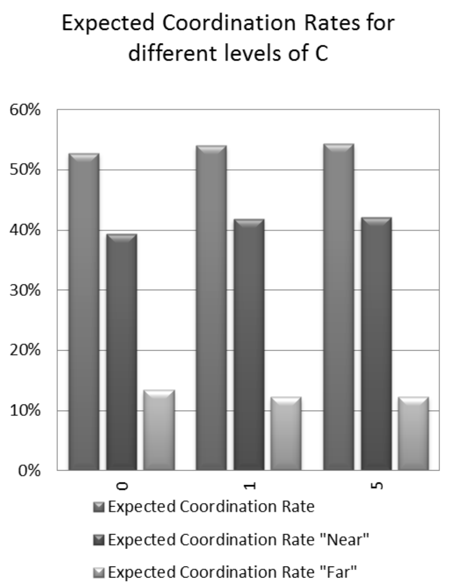


Figure 1.22: Expected coordination rates across all frames; Expected coordination rates on the Near and Far equilibria.

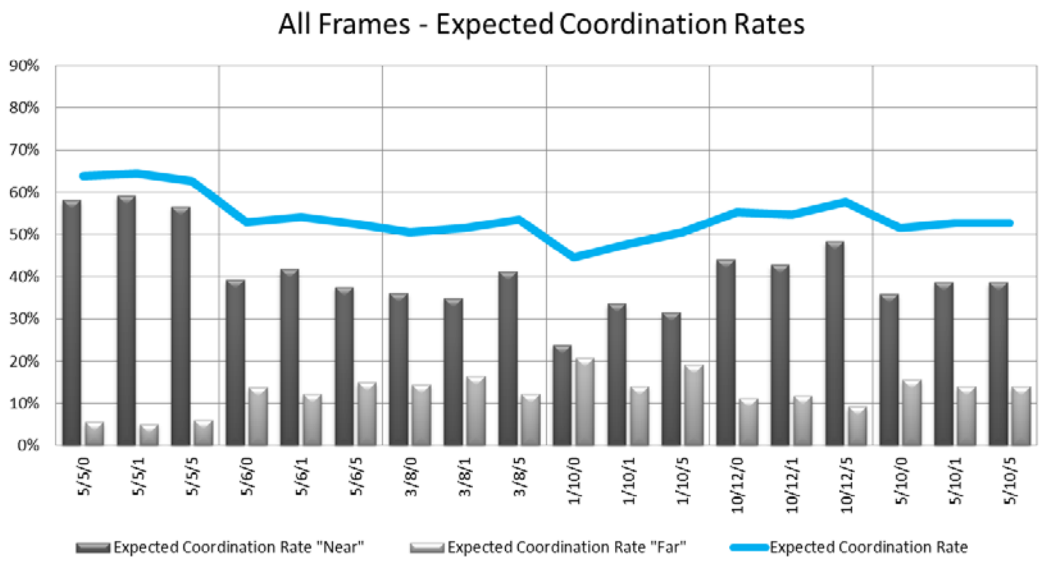


Figure 1.23: Expected coordination rates across all frames for the individual games.

A more detailed analysis of each individual game confirms the above result. The blue line in Figure 1.23 depicts the expected coordination rate across all games (x-axis depicts value combinations for α, β and c). The changes are not significant for any group of games (*ps* > .68). Also, the changes within each group of games (e.g., the α = 5, β = 5 set of parameters with c = 0, 1 and 5) of the expected coordination rate for the Near and Far equilibria do not show significant changes (*ps* > .67).

Finally, an analysis of the individual framing conditions revealed (Figures 1.12-1.14) that the games do not show any significant changes in terms of expected coordination rate (Gains frame *p*s > .77, Mixed and Loss frames *p*s > .89). Overall the data do not seem to be support Hypothesis 7.

5.4.3 Summary

The cost factor c has an impact on choice behaviour for the less favoured Left players in games with a large payoff-difference. For the favoured Right players raising the cost factor c does not yield a clear effect. Four of the 6 groups of games yield an increase of the focal point choice comparing c = 0 and c = 1. This provides partial evidence in support of Hypothesis 6. The impact of c on the expected coordination rate is statistically insignificant. An improvement of coordination rates can be measured for games with a large payoff-difference. At the aggregate level, a continuous increase of the expected coordination rate can be observed in the ($\alpha = 1$, $\beta = 10$) games, which have the highest difference in payoffs. The results from the individual frames confirmed this result. Overall there is not sufficient evidence to support Hypothesis 7.

6. Conclusion & discussion

The research presented in this chapter investigates the effect of losses in symmetric and asymmetric battle of the sexes games. In order to adequately address this question, I used a series of 18 two-player coordination games. Players were randomly placed on the left and right side of a bargaining table. The games were presented to the subjects with six different symmetric and asymmetric payoff-combinations, in which a higher payoff was always presented on the right side of the bargaining table. Each of the six payoff-combinations was paired with a cost level c, which represented the coordination failure payoff. Cost level c had three different values (c = 0, 1, 5). Some games were framed differently by subtracting a scale variable Δ from all game payoffs. The scale variable had three values ($\Delta = 0, -5, -10$) constituting the Gains, Mixed and Loss frames. In the Mixed frame, game payoffs presented were partially positive and partially negative. In the Loss frame, game payoffs were negative or zero but never positive. This design enabled testing whether negative payoffs and potential losses impacted players' decision-making. The different levels of asymmetry allowed to better measure the use of the "rule of closeness" which constituted the label-salient focal point in these games (Schelling, 1960).

Prospect theory and loss aversion in particular suggest that players will more strongly prefer to avoid a certain loss rather than making an equivalent gain. My experiment setup presented in this chapter provided a possibility for players to make use of strategy labels (i.e., the "rule of closeness") in order to cooperate and avoid a loss. An increase in coordination in games with losses, as well as an increasing number of players' choosing the label-salient focal point across all games was expected.

The results of the experiment (Isoni et al., 2013) demonstrated that in absence of the Left and Right spatial distribution, players coordinated less. In their design, the objects were placed in the central area of the bargaining table, such that for both players the distance to the objects was exactly the same. The salience of the focal point is an integral part of the experiment design as in absence of or a weakly salient strategy label would force players to randomise between their choices.

The first hypothesis was confirmed and players indeed used the power of the focal point by overwhelmingly choosing the object that is closest to them. This finding is in accordance with other works such as Schelling (1960), Mehta et al. (1994a), Crawford (2008), and Isoni et al. (2013) and suggests that the "rule of closeness" is a salient focal point to the players. Furthermore, in my experiment setup, this strategy provides an option to avoid a loss.

In terms of increasing payoff-asymmetry, research shows that the power of a strategy label is diminished (Crawford et al. 2008). Isoni et al. (2013) contended that label salience is still powerful in asymmetric games and that the degree of salience strongly depends on the framing of the experiment. In comparison to Isoni et al. (2013), my experiment was not focused on elucidating different framing aspects of asymmetric bargaining games. My experiment setup presented in this chapter uses just one particular type of spatial distribution. However, as in Isoni et al. (2013) and Mehta et al. (1994a,b), my experiment uses the "rule of closeness" as a label-salient strategy.

My findings suggest that asymmetry influences the Left and Right players differently. Less favoured Left players chose with increasing asymmetry of the payoffs, ceteris paribus, more often the more valuable object on the right. This also corresponds with the findings of Crawford et al. (2008), where players favoured the high payoff in games with high asymmetries. The data from my experiment showed that the more favoured player was largely unaffected by the increase in asymmetry (i.e., also in games with a low payoff-asymmetry, the Right player chooses the object on the right). As in Crawford et al. (2008), when label salience contradicts payoff salience, players do not coordinate. The work of Crawford et al. (2008) reported that with low payoff-asymmetries, both players favoured the payoff of the other player leading to coordination failure.

The choice behaviour of the Left player thus implies also a clear payoff-bias, as the object on the right with the potentially higher payoff is more frequently chosen as potential losses increased. However, the player on the right remains unaffected by increasing asymmetry. Nonetheless, it is difficult to speculate whether the choice is unchanged because of the power of the focal point or because of a payoff-bias by the decision-maker. In my experiment setup, the strategy label and the higher payoff are mutually reinforcing. Another possible explanation is that players were influenced by the possible losses. Overall, there is some evidence to support Hypothesis 2, such that increasing payoff asymmetry can lead to a stronger payoff bias.

Given the simple choices in my experiment, the findings presented in this chapter regarding the effect of asymmetry partially correspond with Nash equilibrium theory. However, the absolute level of expected coordination decreases with the increasing level of asymmetry only descriptively. Compared with symmetric games the expected coordination rate is significantly lower. Hence, evidence partially supports Hypothesis 3. Compared with Crawford et al. (2008), the expected coordination rate is slightly higher, however not significantly so and might be due to the different framing of the two experiments.

Considering the differences across the Gains, Mixed and Loss frames, the findings of my experiment present new insights into the use of focal points. Against the expectation that players would make use of the label-salient focal point (i.e., the “rule of closeness”), it was observed that both players were significantly influenced by the framing effect such that they increasingly chose the less valuable object on the left. For the Right player, this means that as losses increase the power of the label-salient focal point diminishes due to a clear payoff-bias. This finding suggests that loss aversion induces a payoff-bias into the decision-making process of the more favoured player, making him choose the lower payoff in order to avoid the looming loss. For the Left player it cannot clearly be discerned whether the decision stems from a label or from a payoff-bias.

One possible way to examine the data would be a Level-K model as presented in Crawford et al. (2008). However, there are several drawbacks of using such a model. Differently to Crawford et al.’s (2008) X-Y game experiment, the current games were no one-shot games but presented in a sequence to the subjects. In this way, a Level-K model needs to be tested to ensure that it can be used to explain the data. Additionally, in the assumptions of Crawford et al. (2008), the percentage of level 0 thinkers is presumed to be zero. Informal analysis of the questionnaire at the end of my experiment suggests otherwise. I conjecture by looking at the cumulated behaviour of the Left and the Right player, that loss aversion creates a *preference* for the lower payoff for both players. This would suggest that the strategy label of the focal point does not influence the decision-makers as a result of losses being present. The behaviour suggests that in light of loss aversion, players forgo the possible high payoff and rather attempt to prevent the loss by voluntarily taking the lower payoff.

This in turn leads to marginal differences of the expected coordination rate across the three frames, as both players increasingly chose the Left object and thus the lower payoff. In certain instances with a high payoff-asymmetry, the Left bias for the Left player is particularly strong, such that the expected coordination on the Near equilibrium increases drastically, and also the overall expected coordination rate. A high payoff-asymmetry makes the low payoff more salient, as players recognised the low payoff as a viable strategy in order to prevent a loss. Additionally, payoff-salient choices do not necessarily influence the overall coordination rate. Hence, in summary there is little evidence to support Hypotheses 4 and 5.

The effect of the cost c on players’ choice behaviour reveals a similar effect as the framing manipulation. Again, for the Left player a Left bias can be observed, however only in games with a high payoff-difference. The choice behaviour of the Right player is statistically not affected by the cost. Overall, however, analyses showed cost c is a good predictor for choice behaviour.

Higher payoff-asymmetries as well as higher losses might have increased statistical significance of the Left bias. Another possible explanation for the results might have been sample size. Regarding the expected coordination rate, no significant results can be reported. Descriptively, we find the same tendencies as in the framing condition. As c is a significant predictor of choice behaviour, results suggest that at least Left players exhibit a Left bias in their choices. Given that the effect of the cost c is rather weak on the Right player, it cannot be concluded with certainty what the underlying motivation is for the Left player choosing increasingly left. In summary, the evidence on focal point play and overall coordination do not fully support Hypotheses 6 and 7.

I conclude that the results clearly show losses have an effect on players' choice behaviour. Loss aversion creates a preference for choosing the lower payoff for both players as a "safe strategy". In light of the evidence, it can be concluded that losses do not strengthen the salience of the label-salient focal point. As a result of choice behaviour, the expected coordination rate is mainly unaffected by increasing losses. Overall, the losses in the Loss frame seemed salient to the players while the cost c did not have an effect with the same magnitude. The findings from my experiment bring to light that losses in an interactive coordination game do not necessarily improve coordination, as players do not regard label salience as a determinant in their decision-making process. However, losses seem to establish a payoff-salient focal point (i.e., the low payoff-object). In a coordination game with losses, the power of the label-salient focal point seems to be weakened, contradicting Schelling's (1960) theory about focal points. The results show that losses in a bargaining scenario induce readiness to compromise regarding the division of the pie.

Future research should attempt to explain the preference of players for the lower payoff by focusing on games with large payoff-asymmetries and higher costs for coordination failure. The potential payoff-bias should perhaps be investigated with a cognitive hierarchy model. Also, in order to make losses more salient, it is recommended to introduce real losses into the experiment setup. This could be done in a field experiment, such that the salience of losses can be observed in a more real environment. Further, it should be investigated whether these findings extend to an interactive alternating offer bargaining scenario, such that it is possible to observe if players do compromise more. Also, a similar experiment should be conducted in which the focal point “rule of closeness” is replaced with a perhaps even more label-salient focal point.

Chapter 2
The Effect of Culture and Self-Interest on Intercultural Bargaining Games

1. Introduction

Given the globalization of the world's economies, intercultural negotiation processes, haggling and bargaining efforts are becoming increasingly complex phenomena. For that reason, economists alongside other scientists have attempted to explore the deeper meaning of intercultural behaviour and bargaining outcomes. As a consequence, there is a crucial need to understand the role of "culture". Bargaining experiments have shown that different cultural groups can substantially differ in their bargaining behaviour, which affects bargaining offers and outcomes (Henrich, 2000, Henrich et al. 2001, Croson et al., 1999, Roth et al., 1991, Ferraro & Cummings, 2007– henceforth FC, Gurven et al. 2008, Chen & Tang, 2009).

In various fields of science, cultural effects in bargaining situations have been well documented. Management studies have shown a drop of the joint bargaining surplus of up to 25% in intercultural bargaining situations compared to intracultural bargaining settings (Brett & Okumura, 1998; Adler & Graham, 1989; Adair et al., 2001). For example, some of these experiments measured the bargaining behaviour of Japanese and American managers in complex multi-issue negotiations. These researchers attempted to attribute the drop in bargaining efficiency in intercultural settings as a function of individualism, information, trust and communication. A recent study was conducted by Hofstede et al. (2012) to examine culturally differentiated behaviour using a model based on an ABMP[4] negotiation architecture. Hofstede et al. (2012) found that culturally differentiated behaviour can be generated according to their cultural model (Hofstede, 1984, 2001 - the combined works are hereafter denoted as HS).

[4] ABMP – Agent-Based Market Place negotiation as defined by Jonker & Treur, 2001. In this model agents are able to use any given set of incomplete information along with "guessing" the other player's preferences based on past negotiations to improve the overall bargaining outcome in a one-to-one, cooperative, multi-issue bargaining situation.

While cultural differences have been examined extensively in different scientific fields, the topic has not yet been widely investigated in the field of experimental economics, bargaining and game theory. In recent times, the trend in game theory has shifted towards researching non-pecuniary aspects such as determining factors of game theoretic and bargaining outcomes (Camerer, 2003). Researchers from several different disciplines have been interested in studying the development, interaction and inefficiencies (e.g. difficulties in communicating properly as well as acting in conflicting ways in any arbitrary situation) of intercultural bargaining. Psychological games (Pearce, 1984), identity (Akerlof & Kranton, 2000), or the role of fairness in economic games (Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000) do not sufficiently introduce the effect of values in a strategic interaction, regardless of whether it may be of a social, political or business nature. Standard bargaining theory of Nash (1950) and Rubinstein (1982) as well as repeated bargaining situations as investigated by Muthoo (1999) do not consider intercultural value systems as part of the bargaining process. Regarding international and intercultural conflicts, game theory has for instance been employed for investigating in coordination strategies, such as the Cold War in Thomas Schelling's 'The Strategy of Conflict' (1960).

Emerging literature in experimental economics has started to focus on several strands of research designed to explain the impact of culture on bargaining behaviour and outcomes. Hennig-Schmidt et al. (2002) as well as Croson et al. (1999) focus on bargaining power asymmetry as one of the causes for different bargaining behaviour and outcomes in intercultural scenarios. Among others, Croson et al. (1999) and Roth et al. (1991) mainly focus on intercultural differences in bargaining outcomes. Chen & Tang (2009) investigate the impact of cultural traits and religious beliefs on bargaining behaviour among culturally different groups in China using a series of ultimatum games. This study concluded that the observed difference in offer and acceptance rates among the different groups were attributable to differences in culture. Further research focused on discrimination as a main determinant of an intercultural influence on bargaining (Barr & Oduro, 2002, FC). The latter work focused on two distinct cultures living in the same space in an industrialized society. While controlling for demographic differences in the subject pool, this study used strategic ultimatum games to elicit beliefs, and it showed clear differences in bargaining behaviour. In the ultimatum games, subjects were asked to hypothetically split an amount of $10 and state where their offer and acceptance levels were. This study showed that behaviour was subject to racial discrimination, as players could observe which players they were bargaining with (i.e., whether there were more players of their own ethnicity in the bargaining session or not). This model further differentiated between “rational stereotyping” and “preference-based discrimination” (FC). FC further contended that observed discrimination in intercultural settings between the cultural groups involved can be generally split into rational stereotyping or statistical discrimination (Arrow, 1973; Phelps, 1972) and preference-based discrimination (Becker, 1971). Statistical discrimination describes an agent’s behaviour as a reaction to average behaviour of another group. Preference-based discrimination describes if an agent simply has the preference to behave differently when interacting with an individual from a given group (FC). The findings of FC show that even within the same society, two distinct cultures can exert different bargaining behaviours based on mainly preference-based discrimination.

Given the experimental studies across various academic domains, the question arises whether the bargaining and cooperation process is more efficient in terms of a joint surplus and rounds needed to reach an agreement in an intracultural setting compared to an intercultural setting (FC). Also, in terms of bargaining outcomes, one particular set of culture-based preferences might provide a systematic advantage in the bargaining process (Maynard-Smith, 1982). In order to shed light on these issues, it might be helpful to include preferences based on cultural values and cultural background into the bargaining process. This makes it possible to construct an adequate model for predicting bargaining outcomes as well as strategic interaction in intercultural scenarios and to establish the key parameters and forces involved in that process. The above-mentioned research mainly uses circumstantial evidence to highlight intercultural effects (e.g., Chen & Tang, 2009). Previous research often attributes the difference in behaviour between people from different countries to the differences in culture, but fails to acknowledge particular social preferences that underlie a particular behaviour (Oosterbeek et al. 2004).

Contributing to existing research, this chapter focuses on whether nationality and corresponding levels of individualism determine the level of self-interest and bargaining behaviour among the subjects. In the current experiment presented in this chapter, I measured offer and acceptance rates in a series of ultimatum and alternating offer games using a direct response method, in combination with a measure of self-interest. Also, my experiment was designed to show whether different levels of individualism and self-interest lead to significantly different levels of payoffs, and thus might have a systematic strategic advantage as a result of their cultural background and corresponding level of self-interest.

For the purpose of my experiment, other possible determinants of decision-making were not considered. Putting the focus on simple ultimatum and alternating offer games rather than complex negotiation procedures allows me to measure the bargaining behaviour of the two involved distinct cultural groups.

The remainder of this chapter is structured as follows. In the next section, I discuss cultural implications of my experiment. Section 3 outlines the recruiting, design and procedure of my experiment. Section 4 states the expected hypotheses. In Section 5, I discuss the results and experiment findings. A discussion in Section 6 concludes. Theoretical implications of the experiment are considered in Appendix 2.1 and 2.2.

2. Culture

Across various academic fields (including anthropology, sociology, business and management studies) as well as economics, a consensus regarding the terminology of culture has been reached, establishing that culture and cultural values are learned and shared by a large group of people (e.g., HS, Hoecklin, 1995). Samovar & Porter (1985) defined culture as a deposit of knowledge, values, hierarchies, religions and concept of the universe acquired by a large group of people. The anthropologist Kluckhohn (1951) stated: “Culture consists of patterned ways of thinking, feeling and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional ideas and especially their attached values” (Kluckhohn, 1951 – p.86). In order to explain the impact of culture and cultural values on intercultural bargaining, I conjecture that it would be necessary to devise a cultural model that explains the impact of religion, outside forces, societal norms and its derivations and consequences on intercultural bargaining separately. The complexity of the issue can be best shown by Hofstede's (2001) diagram of stabilizing culture patterns (see Figure 2.1).

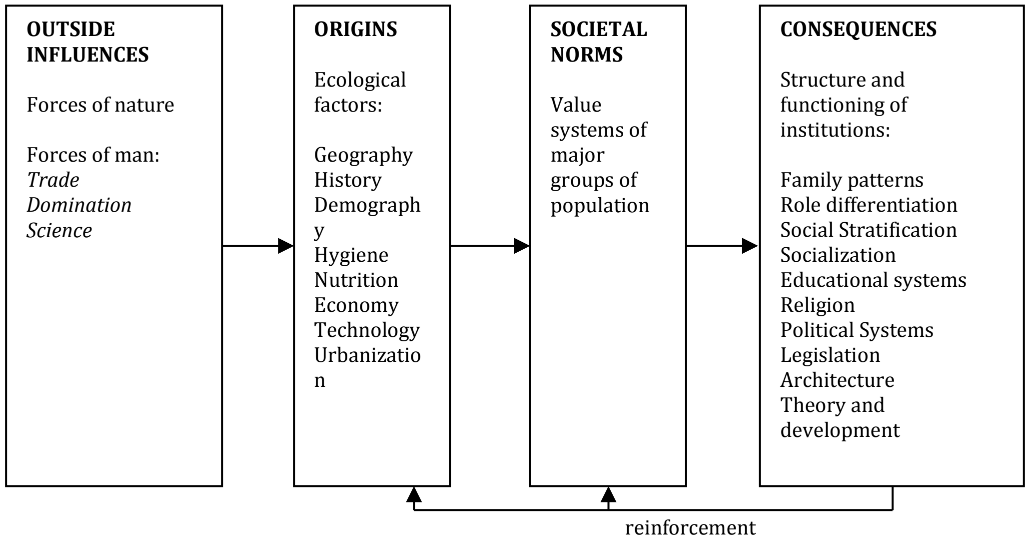


Figure 2.1: Culture Cycle according to Hofstede (2001)

An important conclusion of Hofstede (2001) is the interdependence of forces of nature, ecological factors, value systems and emerging institutions, all of which should be investigated separately for the purposes of economics in order to make accurate predictions. In everyday life, the visible manifestations of culture are practices, such as symbols, following leaders and performing rituals. Thompson & Hickson (2002) defined the values of a society as stemming from the existence of heroes and their social reactions, which are emulated by the population in order to enhance the self-image.

A more comprehensive view of culture is largely based on the work of HS, where the learning of culture is described as mental programming. This refers to a fixed set of routines being physically determined by the state of our neural circuitry and not directly observable, yet aiding in the predictability of behaviour. The work by HS mainly focused on cultural dimensions in societies, meaning the systematic circumstances that define a particular society (e.g., institutions, values and the framework of mental programming). HS did not necessarily explain the resulting behaviour and preferences of an individual from a particular society. Culture in this instance, can only be measured as a statistical average of a larger group. HS described culture as a five dimensional model with the dimensions of power distance, individualism, masculinity, uncertainty avoidance as well as long-term orientation. Power distance describes how less powerful members of a society accept the fact that power is distributed unequally. Individualism is defined as the degree of interdependence (or independence) between the members of a society. Masculinity defines to which degree people act as achievers and wanting to be best-in-the-field. Uncertainty avoidance is defined by how people deal with unknown and ambiguous situations. Long term orientation measures whether a society is able to hold a pragmatic future-oriented perspective. In order to understand the culture of a society in Hofstede's dimensional model in a holistic way, all five dimensions are necessary.

Other research has been conducted regarding culture and the effects of cultural differences on bargaining. In their study on negotiation, Brett & Okumura (1998) used the cultural dimension model of Schwartz (1994), exerting that it is superior to that of HS. Schwartz (1994) used seven categories of cultural values, namely Conservation, Hierarchy, Intellectual Autonomy, Affective Autonomy, Competency, Harmony and Egalitarian Compromise. *Conservation* defines the preference for conformity and traditionalism. *Hierarchy* outlines the preference for fixed hierarchical roles. *Intellectual Autonomy* describes values that define a person as its own entity – independence. *Affective Autonomy* is synonymous with pleasure seeking. Competency comprises the values for success and a varied life. *Harmony* defines a harmony with nature. Lastly, *Egalitarian Compromise* is the value set which values the wellbeing of others. The work of Schwartz (1994) criticized the mere focus of individualism versus collectivism in terms of cultural dimensions. Researchers over the years have developed several other approaches regarding cultural modelling (Triandis 1995, Triandis & Gelfand 1998). Some research does not focus on cultural dimensions but on resulting behaviour such as communication (FC).

Although some consistency exists in the terminological use of "culture", the concept itself seems to be difficult concept to grasp for social scientists and many different approaches of defining it exist. Generally, it can be stated that it is almost impossible to obtain a complete picture of all cultural aspects along with corresponding value systems and resulting behaviours in a single experiment. In cultural terms, the experiment of the current chapter focuses on the presumed difference in culture background and corresponding social preference level of self-interest with regard to *origin* and *nationality*. For the purpose of my experiment, Eastern and Western cultures are grouped by the corresponding individualism scores from Hofstede's five dimensional model (HS). This view has been the most widely adopted and researched definition of cultural differences (Hofstede 1980).

There is a particular statistical variance of preferences in each cultural group (HS). Hence, people in general do not automatically have the same preference pattern.. In my experiment, however, despite the relatively small sample size for the purposes of measuring cultural phenomenon, I assumed that subjects on average behave according to their cultural background. FC phrased this general idea as the "statistical distribution of beliefs, values and modes of thinking that shape behaviour among a group of people (e.g. notions of fairness)" (FC). For the purpose of my experiment, I adopted the above-stated definition by FC regarding culture.

In my experiment, I measured the level of self-interest, and tested if there is a correlation to the level of individualism as defined by HS. The distinction between individualism and self-interest is an important one. According to HS's (2001) dimensional model, an individual from an individualistic culture is self-focused rather than focused on the collective of society. However, the level of individualism does not necessarily predict a certain level of self-interest. For example, a collectivist person, focusing on the larger group rather than on one-self, might do this out of self-interest if the group-orientation yields him the larger payoff. This distinction between the level of individualism as well as self-interest is an integral part of my experiment. Past research (Brett & Okumura, 1998, Adair et. al, 2001) showed that individuals focusing on themselves tend to be more self-interested. The underlying assumption implied by Hofstede (2001) is that the level of self-interest, similarly to fairness, is a behaviour or social preference directly related to an underlying cultural set of values. My experiment aims to investigate bargaining behaviour and outcomes in relation to the cultural trait of individualism as well as self-interest.

3. Experiment

3.1 Recruiting

The overall aim was to create two distinct subject pools consisting of subjects with a different level of individualism as defined by HS. The work of HS is based on cultural surveys that were conducted in different countries. Hofstede measured scores in each country (more than 50 countries) for his proposed 5 dimensions (power distance, masculinity, uncertainty avoidance, long term orientation and individualism). These scores describe the average preference of the citizens of a particular country regarding problem solving, decision making and overall behaviour. For example, an individualism score of a particular country, thus, describes the average preference and predisposition of the people for making independent decisions and acting independently. A high score means that subjects from that country behave, on average, individualistically (i.e., do not prefer the group influencing their decision making, problem solving and considerations). For two nations to have similar set of cultural preferences and values in terms of HS, all five scores need to be similar. In such a case it can be conjectured that people would have similar preferences and are more similar in their decision making compared to countries in which the scores are divergent.

In the current study I focus on the degree of independence of subjects (i.e., individualism) as this dimension influences bargaining the most (Brett & Okumura, 1998). Typically experiments in the literature compare bargaining behaviour of two distinct nationalities or particular ethnic groups within a country. Due to a limited number of international students at the University of East Anglia I grouped countries with a similar IDV-score from which I recruited subjects. Other dimensions in terms of the HS model were not considered, as it would have not been possible to find countries for which all scores are similar, and to then find sufficient subjects from these countries. Hence, the countries were selected according to two criteria. I first looked at the IDV-score (individualism score) of Hofstede's 5 dimensions model (HS). I chose countries for my sample in a narrow score range. One group of countries selected had an IDV-score[5] of 20-25 on a scale from 1 to 100 with 100 being the highest score. Other group of countries selected had scores between 80 and 91. Second, to refine the first selection of countries I considered the cultural and socio-political heritage (HS).

The main part of the subject pool belonged to either the UK or China. The dimensional scores of China and the UK as stated by HS can be compared to better

[5] Different IDV (individualism) country scores are taken from Hofstede (2001) and can also be reviewed on the website of the Hofstede center at geert-hostede.com.

understand the subject sample. China has a power distance score of 80 whilst the UK has a score of 35. This means that subjects from China should be more accepting of the fact that power is distributed unequally. Both countries have a masculinity score of 66, meaning that competition and success is equally important. Both countries have a similar uncertainty avoidance score (China 30 and the UK 35), meaning that a similar level of competition and drive to win exist. The countries have a divergent score with regard to long term orientation (China: 87, UK: 51), meaning that people from China are more pragmatic than the people from the UK. This allows Chinese individuals to adopt long standing traditions and values more easily to a new situation. Most importantly, the individualism score is also divergent (China 20, UK 89), meaning that Chinese individuals are supposed to be more group oriented on the average, while UK citizens are more individualistic. As described, when recruiting, the IDV-score was used as decision criterion.

The largest student group with a high IDV-score were British students. This group was named the Western group as the UK is geo-politically part of the Western world. In order to increase the subject pool in this group, subjects from the US, Canada and Australia were recruited, as these countries were former colonies of England and share to a large part language, religion, traditions, beliefs and socio-political heritage (HS). This group of nations scored in the high range in terms of IDV-score. Similarly, the highest number of subjects from the group of countries with low IDV score was available from China. In order to increase the subject pool for my experiment I chose other countries with a similar IDV-score as well as with a historical cultural and socio-political dependence on China. Countries in this group comprised of Hong Kong, Thailand and Vietnam all within the larger cultural sphere of China (HS). This group of countries scored on the low end in terms of IDV-score. The group was called the Eastern group in my experiment.

A subject belonged to the Eastern group if the subject had the nationality and corresponding ethnicity of one of the countries in the selected group. Similarly a subject belonged to the Western group if the subject had a nationality from one of the countries selected for that group. Hence, recruiting subjects for the experiment was primarily subject to their nationality (as registered at the university).

In my experiment, overall 168 subjects were recruited from the student population in the University of East Anglia using the ORSEE recruitment system (Greiner, 2004). The Western subject pool counted 73 subjects. The Eastern group comprised of 95 subjects. While nationality was used as the primary selection criterion, the sample of students needed further refinement. It is entirely possible that subjects were born and raised in one country and recently switched their citizenship. Also it is possible that subjects were holding the citizenship of one country but were raised in a particular ethnic group. In such a case preferences in terms of individualism could not be determined by nationality alone. For example, subjects with a British nationality but a clear Asian ethnicity were not included in this group, using the selection criterion of first and last name prior to the experiment. There were no cases in which a subject was holding an Asian name and had a caucasian ethnicity. However, some contamination was possible, if a particular ethnicity and corresponding cultural background was not detectable by nationality and first and last name basis. It was also possible that a subject had a diverging ethnicity to the stated nationality, but adopted the values of the country he or she was holding citizenship in. This is often found in America for instance. However, by observation, the recruiting mechanism was functional and no student had to be turned away because of possible sample contamination.

The university regulations did not allow detailed information of the subjects regarding income, ethnicity and origin to be systematically recorded. Hence, in my experiment, I did not control for socio-economic as well as gender differences in the subject pool. Also, due to existing university regulations, it was not possible to use or generate reliable socio-economic information. Given that all subjects were generated from the student population of the University of East Anglia, it is assumed that the subject pool is homogenous in terms of age range as well as profession (student). Possible limitations of this subject pool are discussed in Section 6.

3.2 Experiment design

In the experiment design of the current study, players were confronted with three separate types of games. Players are asked to play distributional games in which they choose between two resource allocations in order to determine their level of self-interest. Further, they were asked to play ultimatum games as well as alternating offer games and distribute a fixed surplus. In order to measure the level of self-interest, each subject was asked to make 24 selection tasks based on a social value mechanism (SVO) as described by Griesinger & Livingston (1973), Van Lange

(1999) and others, and thus predicting the level of cooperation of an individual (for an alternative method, see Murphy, Ackermann, & Handgraaf, 2011). The SVO-measure generally divides between “pro-self” and “pro-social” orientations for individuals (De Cremer & Van Lange, 2001; Smeesters, Warlop, Van Avermaet, Corneille, & Yzerbyt, 2003; Van Lange & Liebrand, 1991). A pro-self orientation constitutes that an individual is mainly concerned with maximizing her own profit, while a pro-social orientation shows that an individual also thinks about other people’s outcomes and wants to maximize joint gains as well as minimize differences between payoffs (De Cremer & Van Lange, 2001; Van Lange, Joireman, Parks, & Van Dijk, 2013). While pro-social individuals tend to focus on both their own and others’ payoffs, pro-self individuals are primarily concerned with maximizing their own payoff (Fiedler, Glöckner, Nicklisch, & Dickert, 2013) and reach their decisions more quickly (Piovesan, & Wengström, 2009). For pro-social subjects, decisions are seen in light of moral considerations (e.g., Stouten, De Cremer, & Van Dijk, 2005). In contrast, pro-self individuals anticipate competition and defection (Liebrand, Jansen, Rijken, & Suhre, 1986; Van Lange & Kuhlman, 1994). In theory, social preferences represent the motivation that maximizes joint gains under fairness considerations and the anticipation of the strategy choice of the co-participant (Liebrand & McClintock, 1988).

Consolidating the terminologies across the different fields of sciences, an agent that has a pro-self orientation with a corresponding SVO-measure is self-interested. The general SVO-framework defines four sub-categories underlying a pro-self and pro-social orientation; individualistic, competitive, cooperative and altruistic orientations. An individualistic orientation describes an individual that is concerned with solely maximizing her own gain. A competitive orientation combines an individual’s goal to maximize her own gains with minimizing gains for other individuals. However, a cooperative orientation defines individuals that seek to mutually maximize outcomes. And lastly, an altruistic orientation describes an individual with the lowest possible level of self-interest. Some research suggests that the spectrum of orientations should be wider (Griesinger & Livingston, 1973).

I employed the ring measure (Van Lange, 1999) in order to determine whether a subject has a high or low level of self-interest. The SVO-measure has received some interest in psychological and sociological studies over the years. For instance, the SVO-measure has been used successfully in combination with ultimatum games in recent studies (Yamagishi et al., 2012). The aforementioned authors investigated whether there was a correlation between a rejection of unfair offers and the tendency to show pro-social behaviour in other scenarios.

Similarly, in my experiment, I measured the SVO-score together with offer and acceptance rates in the ultimatum games[6]. The SVO-measure presents a series of distribution choices to a subject consisting of two choices for a monetary allocation giving him and a co-participant a certain amount of money. It is assumed that players exhibit a simple utility function

$$U(Pa, Pb) = a * Pa + b * Pb, \{a + b = 1\}$$

where Pa and Pb are the gains of the subject and the co-participant and $a, b > 0$ represent the weight an individual places on either outcome. The ring measure allows for a representation of the own outcome of a player and the outcome for the co-participant in a Cartesian coordinate system. Typically, the own outcome of a player is depicted on the x-axis and the outcome for the co-participant is depicted on the y-axis.

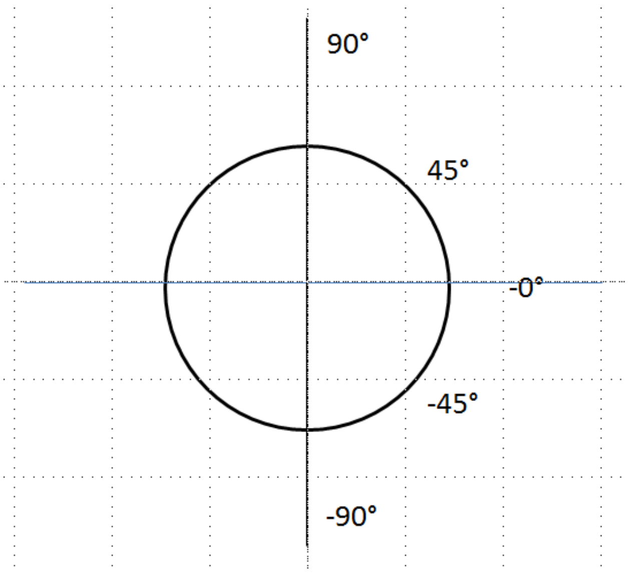


Figure 2.2: Ring measure

In order to determine an orientation-level of a subject, the outcome for the x-axis and the y-axis is plotted and is connected with the origin by a line. The angle of the line

[6] The ultimatum games are similar to the ones researched by Güth et al. (1982).

exhibits a subjects' level of self-interest. The numerical values for the distribution tasks are selected in a way so that if an individual consequently chooses only the highest payoff for himself, the angle of his line should be 0°, and thus the subject is maximizing the own outcome. A result of 45° would suggest a perfectly cooperative individual and a result of -45° would suggest a perfectly competitive individual. As illustrated in the study by Van Lange (1999), 24 distribution tasks were given to the subjects with payoffs ranging between -£3 and +£3. The SVO-score for each individual then is determined by the following formula:

$$\pm ArcCos \frac{\frac{1}{2}\left(\sum_{t=1}^{24} C_p^t\right)}{\sqrt[2]{\frac{1}{2}\left(\sum_{t=1}^{24} C_p^t\right)^2 + \frac{1}{2}\left(\sum_{t=1}^{24} C_c^t\right)^2}}$$

where C_p and C_c denote the choice by the subject for himself and his co-participant. The dictator games that the subjects were presented with can be seen in Figure 2.3.

The measured SVO-score of each individual is cross-referenced with the offers made and offers accepted in the ultimatum and alternating offer games. For the theoretical implications of these two games, please see the appendix. While in theory the subgame perfect Nash equilibrium is to accept any amount greater than zero, any proposer should offer the minimum amount. Thus, given a pie of π and a minimum offer $\Omega_{min} > 0$ by the proposer, the proposer should always receive π-Ω_{min} and the responder should get Ω_{min}. However, given an international comparison of ultimatum games, Oosterbeek et al. (2004) found that on average proposers offered 40% of the pie to the responders. Similar results can be found in Camerer (2003). Nowak et al. (2000) predicted that decision-makers would offer between 40% and 50%, given fairness considerations. In anticipation of possible 50% splits of the pie, I chose an uneven amount to distribute (namely £13) and offers could be made in £1 increments only. I propose that this setup helps to determine whether subjects, that would otherwise favour an even split, favour a higher or lower outcome for themselves. The more obvious choice of £15 as the initial amount to split was not chosen due to budget constraints. Subjects were able to still offer near 50 % by choosing between either £6 or £7 (i.e., choosing between 46 % and 54%) offers.

Offers of £6 or £7 received special consideration in the analysis of the results. Generally, the ultimatum game has been successfully used in prior intercultural bargaining studies with participants of different cultures, such as Chen & Tang (2009), Fershtman & Gneezy (2001) and FC.

	X			Y	
Game	Self	Other		Self	Other
1	1.5	2.6		2.1	2.1
2	0	-3		-0.8	-2.9
3	3	0		2.9	-0.8
4	-2.9	0.8		-2.6	1.5
5	-2.6	-1.5		-2.9	-0.8
6	-0.8	2.9		0	3
7	0	3		0.8	2.9
8	-0.8	-2.9		-1.5	-2.6
9	0.8	-2.9		0	-3
10	2.1	-2.1		1.5	-2.6
11	2.9	-0.8		2.6	-1.5
12	-2.1	-2.1		-2.6	-1.5
13	2.9	0.8		3	0
14	-1.5	-2.6		-2.1	-2.1
15	-2.1	2.1		-1.5	2.6
16	0.8	2.9		1.5	2.6
17	2.6	-1.5		2.1	-2.1
18	-1.5	2.6		-0.8	2.9
19	1.5	-2.6		0.8	-2.9
20	-3	0		-2.9	0.8
21	2.6	1.5		2.9	0.8
22	-2.6	1.5		-2.1	2.1
23	2.1	2.1		2.6	1.5
24	-2.9	-0.8		-3	0

Figure 2.3: Distributional Games

3.3 Experiment procedure

For my experiment, 15 different sessions were conducted. The sessions lasted between 40 and 60 minutes each. If there were several sessions in one particular day, there was an interval of at least 60 minutes in between the sessions to prevent subjects who completed the experiment passing on their insights to new subjects that came for the next session. The experiment was conducted in the CBESS computer laboratory and the sessions had group sizes ranging from between 6 and 14 people. Sessions with less than 6 subjects were not conducted since this would not have allowed for credible random matching. All sessions had an even number of subjects.

Overall, three treatments were conducted: One only with subjects of Western nationalities, one with subjects only of Eastern nationalities and one treatment in which both Western and Eastern nationalities were present. The treatment with Western subjects included 4 sessions. The treatment with Eastern subjects included 6 sessions. The treatment with subjects of Western and Eastern nationalities included 7 sessions. On a particular day only sessions of one treatment were held.

Prior to the experiment, subjects were asked to wait in front of the laboratory where they were registered. Subjects were able to observe the ethnicity of the other participants, however subjects were neither explicitly informed in which group they were, nor that my experiment investigated intercultural effects during the bargaining process. Every session needed an even number of subjects. If a session consisted of an odd number of subjects, the last subject having showed up received a show-up fee of £2 and was asked to return at a later point or sign up for a different session. For the non-mixed (in-group) sessions, the order of seating in the computer laboratory was irrelevant. For the mixed sessions conducted, half of the subjects were Eastern and half of the subjects were Western. Both of these two distinct groups were assigned a group type that was only known to the experimenter. Subjects were not aware that they were assigned to any particular group and they were seated at computer stations for their particular group type. The subjects were sent into the laboratory in a random order so that it was less obvious that Eastern subjects were playing against Western subjects and vice versa.

In mixed games, group types (type 1 and type 2, which could either be Eastern or Western respectively) were assigned by the experimenter randomly. A type 1 player was always matched with a type 2 player and vice versa. Player types determined whether a player was a proposer or responder first. Proposer and responder roles were then switched in consecutive games so that both players fulfil their roles as proposer and responder. In intracultural sessions, the player types were randomly assigned.

The experiment was programmed and conducted using the software z-Tree (Fischbacher, 2007). After subjects were seated, they were introduced to the programme by the experimenter, who read out an introduction and instructions of the experiment, which could be simultaneously followed by each subject on his or her screen. After the instructions were given out, subjects were asked three clarification questions relating to the procedure of the experiment (See Appendix 2.3). Subjects could read the instructions as often as they wanted and they could ask questions to the experimenter. Verbal communication between the subjects during the experiment was not allowed. All subjects could only proceed to the experiment after they had all answered the three questions correctly and all interactions between the subjects were conducted via computer terminals only.

Subjects were anonymously and randomly matched with one another in all sessions. Thus, they did not have any information about any other subject (including the one that they were matched with). This feature is an integral part of my experiment design in order to prevent subjects making strategic decisions (e.g. punishment for bargaining behaviour). During the sessions and in each game, the ethnicity or nationality of any given subject was not known to the subjects. Whether a subject was the proposer or responder was randomly determined by the programme and each subject has been in the role of proposer and responder at least once in each session.

In the verbal/written instructions, subjects were informed about the random matching as well as the type of tasks they would face and the order in which they would be presented. Each game was described and shown as an example. Further, subjects were informed about 1) the potential earnings that they could make, 2) how their earnings were calculated and that 3) one of the games that they were facing would be selected at random as the payoff-relevant game. On top of the in-game payoffs, subjects were promised a £2 show-up fee. Subsequently, the total payment for each subject consisted of the randomly-selected in-game payoff and the show-up fee. It was possible to incur nominal losses and in some of the SVO-games payoffs were negative. In my experiment, the total payoff range for the subjects was between £2 and £18. Real losses were not possible due to the show-up fee. Subjects did not learn the outcome of each particular game they were playing during the SVO games and the ultimatum games. However, in the alternating offer games players naturally learned at what stage a game ended and were aware of the payoffs. Two alternating offer games were the last tasks for the participants. At the end of the experiment, the game that was selected as the payoff-relevant game was displayed and subjects were informed of their earnings.

Note that in each session there were 28 games. Subjects were confronted with the 24 selection (SVO) tasks first. Each selection task lasted one round. The selection tasks were presented to the subjects in random order, differently for each subject. Each scenario could only be completed if all of the players made their choice. Each subject was asked to choose between a payoff-distribution outlined by option X or option Y (Figure 2.2) by selecting it on screen, regardless of whether they were proposer or responder. This way every player received their SVO-score. The task in the 24 distributional games was to decide for one of two options to split a surplus by clicking on it. For payoff purposes players were matched with a different co-participant in each of the 24 games and they were informed that they would have to make a choice in each of the games but it would be determined randomly whether they would be a proposer or a responder in terms of payoff. If a game from the set of the 24 games was chosen as the payoff-relevant game, the proposer received the outcome he selected, while a responder received the outcome the co-participant selected.

Once all subjects successfully made their 24 selection choices for the SVO-measure, they were asked to play 2 consecutive ultimatum games, lasting one round each. For the ultimatum games, players were also randomly matched. For the mixed sessions, a subject from the Eastern group was matched with a subject from the Western group. Each subject has been once in the proposer and once in the responder role in each of these two ultimatum games. It was randomly determined if the player was a responder or proposer first. The tasks in the ultimatum game for the proposer were to enter a monetary amount they wanted to offer to their co-participant. In that stage the responder waited until he saw the input made by the proposer. Once the input was visible, the responder could accept or reject the offer by clicking on the respective option. Once all responders made a choice the next game would commence. There was no particular time limit for the choices.

Given the results from the first sessions in my experiment, two alternating offer games were added in order to shed more light onto the intercultural bargaining behaviour. In the alternating offer game, subjects were aware that the game did not end after one round. This allowed observing whether intracultural bargaining pairs reached a higher joint gain and faster agreements than intercultural pairings. Of interest was not just the offer level but also whether subjects from the Eastern or the Western group had a systematic advantage in terms of finding favourable agreements, without a game ending after the first rejection.

Subjects were told that the game ended either if an offer was accepted or if the amount to be split reached £0. During the alternating offer bargaining games, a proposer made an offer followed by an acceptance or rejection by the responder. The offer was made by inputting the amount offered on the screen. During that time the responder waited. Once the offer was visible the responder then could accept or reject the amount offered by making the selection on screen. The proposer waited during this decision. If the offer was accepted and an agreement was reached, the game ended. In case of a rejection, £1 was deducted from the sum to be split representing a shrinking pie. In this case, the responder became the proposer and the second round of the bargaining game commenced. Overall the game could last at a maximum 13 rounds, depending on when an agreement was found. Subjects were randomly matched and randomly assigned to the proposer and responder role during each of the two alternating offer games. For the two alternating offer games, it was randomly determined whether a player would be the first proposer. Thus, a given subject could be twice in the role of the first proposer at the beginning of each of the two alternating offers bargaining games. During the mixed sessions, a subject from the Eastern subject pool was always matched with a subject from the Western subject pool.

As a result of random and anonymous matching, subjects did not know the ethnicity or nationality of their co-participant they were matched with. The only possible way to infer whether a co-participant could be of a different ethnicity was by observing the participants prior to the start of the experiment. As in the ultimatum games, subjects could make offers in £1 increments and I requested subjects to divide a sum of £13. Solving the game by backward induction, it can be shown that the subgame perfect Nash equilibrium is for the proposer to offer £6 in the first round (Appendix 2.1).

After the last round was played, players saw on their screen the scenario that was selected and their respective role in order to determine their final payoff. If the randomly selected game was a selection (SVO) task, the final payoff for a player consisted of the fixed sum from the selection task in addition to the show up fee. If the randomly selected, payoff-relevant game was an ultimatum or alternating offers game, players received their bargaining result as well as the show-up fee. Players were paid at their desks. After payment, they were asked to leave the computer laboratory. I now present the hypotheses for this chapter.

4. Hypotheses

Given the evidence by Hofstede (2001) as well as Brett & Okumura (1998), Western players should be more individualistic as well as more self-interested. Hence the first Hypothesis is:

> ***Hypothesis 1:*** The level of self-interest corresponds with the cultural background of the subjects, where Western subjects tend to have a higher level of self-interest.

Following the above reasoning, players who make lower initial offers but high enough to not lead to a break-down of negotiations earn more. This leads to the following hypotheses regarding interaction effects between nationality and offer levels:

> ***Hypothesis 2:*** Subjects with a Western nationality tend to make lower initial offers in bargaining games.

> ***Hypothesis 3:*** Due to discrimination, Western subjects make lower offers and Eastern subjects make higher offers in intracultural games than in intercultural games.

Cultural discrimination effects by observing the participants prior to the session should lead to different behaviour in intercultural bargaining situations. Given the higher individualism score, Western subjects focus on themselves. When bargaining in an in-group scenario, they anticipate that and make lower offers than in an intercultural session. Eastern subjects tend to make higher offers in an intracultural session.

Following the above reasoning, players who have a pro-self social value orientation should make lower offers, as they can potentially earn more. Hence, with regard to the interaction effect between the level of pro-self orientation (SVO-Score) and offer levels:

> ***Hypothesis 4:*** Offers correspond with the level of self-interest as predicted by the SVO-score. Players with higher SVO-score (i.e., more prosocial value orientations) tend to make higher offers.

> ***Hypothesis 5:*** Players from a particular culture, given corresponding SVO-scores have a systematic advantage in bargaining and receive higher payoffs.

Hypotheses as predicted by game theory (see Appendix 2.1 and 2.2) are as follows.

> ***Hypothesis 6:*** Nash equilibrium theory (see Appendix 2.2) predicts in ultimatum games under subgame perfection (Harsanyi & Selten, 1988) that proposers offer the minimum possible amount, while responders accept.

> ***Hypothesis 7:*** In alternating offer games, following backward induction (see Appendix 2.1), first round proposers offer £6 to the responder and the responder accepts.

5. Results

Players with a SVO-score of in excess of 90° or less of -90° gave themselves negative payoffs, although it would have been possible to allocate positive payoffs to themselves and at the same time punish or not punish the other participant. This behaviour is irrational and subjects with an SVO-score in excess of 90 or less than -90 were excluded as it could be that they did not follow the instructions of the experiment correctly. After excluding these participants, the remaining subject pool for the analysis consisted of 164 subjects.

5.1 SVO-measure

Hypothesis 1. Initially, I tested Hypothesis 1 (i.e., that SVO-scores depend on nationality and thus the level of individualism). The overall SVO-scores of the data sample have a mean of 12.57° and a median of 10.61°. This suggests that on the average, subjects could be categorized as rather self-interested with a pro-self value orientation. In addition to the established three benchmarks of -45° as perfectly competitive, 0.00° for perfectly self-oriented, and 45° for perfectly cooperative (e.g. Van Lange, 1999), I added sub-categories of -22.5° for moderately competitive and 22.5° for moderately cooperative value orientations (Liebrand & McClintock, 1988). This made it possible to refine the measure for competitive and cooperative subjects. The measured SVO-scores ranged from -31.18° to 90° which is perfectly altruistic. For the purpose of this experiment, five distinct groups were formed. Players with scores of $SVO > 45.00°$ were grouped together, being considered altruistic. The second group comprised players scoring $22.50° < SVO \leq 45.00°$, being considered perfectly cooperative. The third group consisted of players scoring $0.00° \leq SVO \leq 22.50°$ and being considered moderately cooperative. A score in between $-22.50° < SVO \leq 0.00°$ indicated players being moderately competitive. The last group with scores ranging from $-45.00° \leq SVO \leq -22.50°$ was considered perfectly competitive. There were not many scores measured significantly higher than 56°. Roughly 3.0 % of the subjects measured in the range of pure altruism. Figure 2.4 shows the distribution of the subjects. The category for participants of a score lower than -45° was left out because no observations were made. The distribution of the groups can be seen in Figure 2.4.

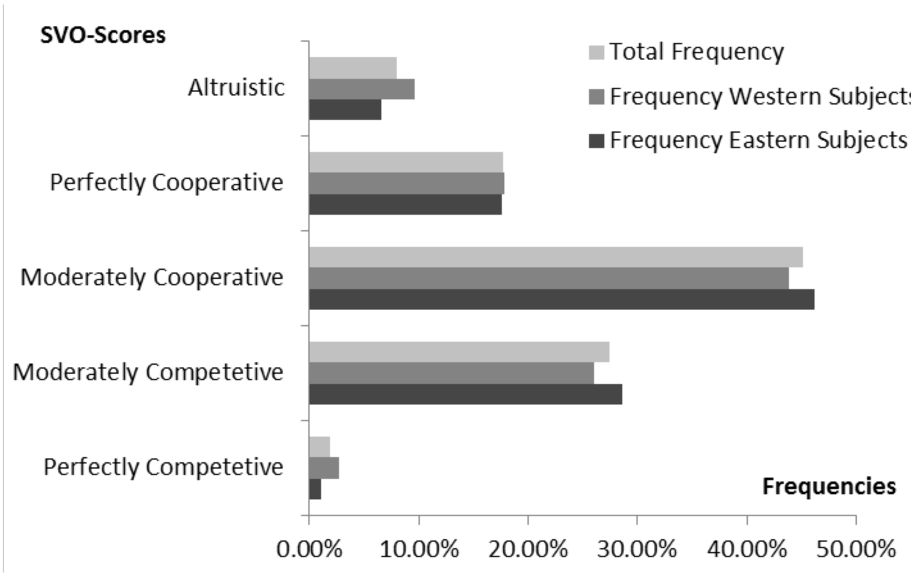


Figure 2.4: Relative frequencies of SVO-score distribution

Figure 2.4 shows that subjects tended to be slightly more cooperative rather than competitive as the majority of the subjects have a positive SVO-score. In Figure

2.4, over 40% of the population can be grouped into the category $0.00° < \text{SVO} \leq 22.50°$, which is considered moderately cooperative. The Eastern group had a mean of 12.17° and the Western group 13.06°, with the respective medians of 10.18° and 11.04°. Although the Western group had a slightly higher mean, this result suggests that the groups were fairly similar and moderately cooperative. In fact, the SVO-measure was not statistically different by the Eastern and Western nationalities, Mann-Whitney-U-Test, $z = -0.245$, $p = .807$. Testing the frequencies of Eastern versus Western nationalities in each SVO-category separately yielded the same outcome, $\chi^2 \leq 1{,}351$, ps > .24. Thus, the obtained results did not show evidence to support Hypothesis 1.

5.2 Cultural and SVO effects in bargaining

Hypothesis 2. Next, I investigated Hypotheses 2 (i.e., Western subjects make lower initial offers). First, I present the results of the ultimatum games. In the ultimatum games, the mean offer across the entire sample was £6.14 and the median was £6. Proposers from the Eastern group had an overall mean offer level of £6.22 and a median of £6. Proposers from the Western group had an overall mean offer level of £6.04 and a median of £6. These numbers suggest that the offer rates are similar between the two groups, while the Western group seemed to make slightly lower offers.

The offer range for the Eastern subjects was between £1 and £13, while the offer range for the Western group is in between £3 and £11. The frequency distribution in Figure 2.5 showed that 56% of Western subjects and 48% of Eastern subjects preferred to make an offer of £6. As approximately 80% of all offers were made in the range £5 and £7, it can be observed that the offer distribution was very similar for the Eastern and Western groups. For the Eastern group, 5% of the offers were in the range of £1 and £4 and 14 % of the offers were above £8. For the Western groups, these frequencies were both at 5%. This suggests that subjects from the Eastern group tended to make offers more in the range that favoured the co-participant, however, their offer levels were not significantly different from the Western group, Mann-Whitney-U-Test, $z = 0.425$, $p = .671$. This result gives little support for Hypothesis 2 in ultimatum games.

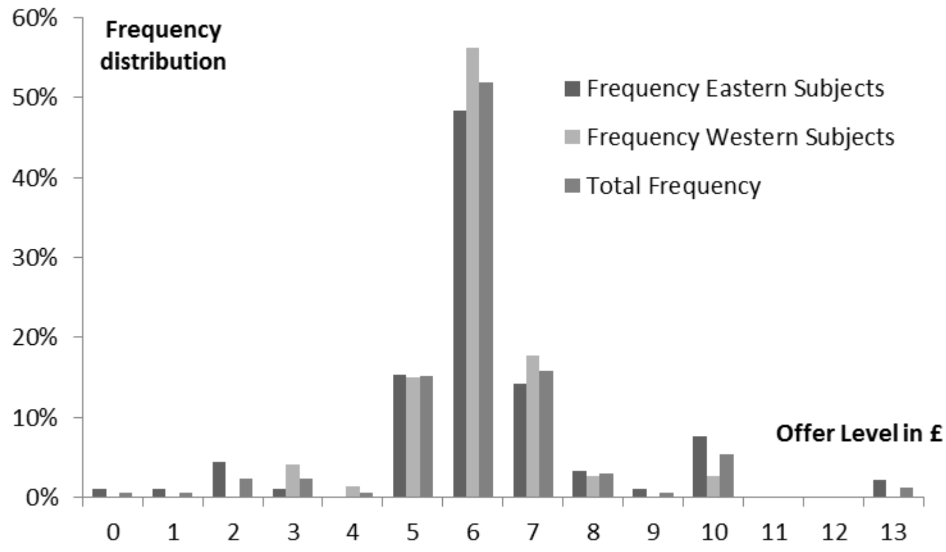


Figure 2.5: Ultimatum Game – Offer Level Frequency Distribution

Similar evidence was found in the alternating offer games. In order to understand choice behaviour in the alternating offers bargaining game, offer levels, were investigated with respect to differences by nationality. I investigated offer levels and rounds played for each of the bargaining pairs. For the first game, the overall mean for offers was £6.10 and the median was £6.00. For the second game, the overall mean was £6.16 and the median was £6. At first glance, this suggests that overall offer levels were not differing from the ultimatum games. Given the offer levels in the first game (AO1), it can be observed that the Eastern group made approximately 80% of all offers in the range of £5 to £7, 8% of the offers were made in the range from £0 to £4 and 11% of the offers were made in the range of £8 and £13 (AO1). The Western subjects made 100% of the offers in the range of £5 to £ 7 (AO1, Figure 2.6a).

Eastern subjects made an offer of £6 with 52% of the time and Western subjects made this offer with 67% of the time. The frequency distribution of the second game revealed that subjects made similar choices in AO2 (Figure 2.6b). There was no difference between the initial offer levels between the two alternating offer games, Wilcoxon-Signed-Rank-Test $z = 0.257$, $p = .797$. The overall mean of offer levels of the Western group was £6 and that for the Eastern group £6.15. The mean offer levels did not depend on the cultural background, Mann-Whitney-U-Test, $z = 0.552$, $p = .581$. This result does not support Hypothesis 2.

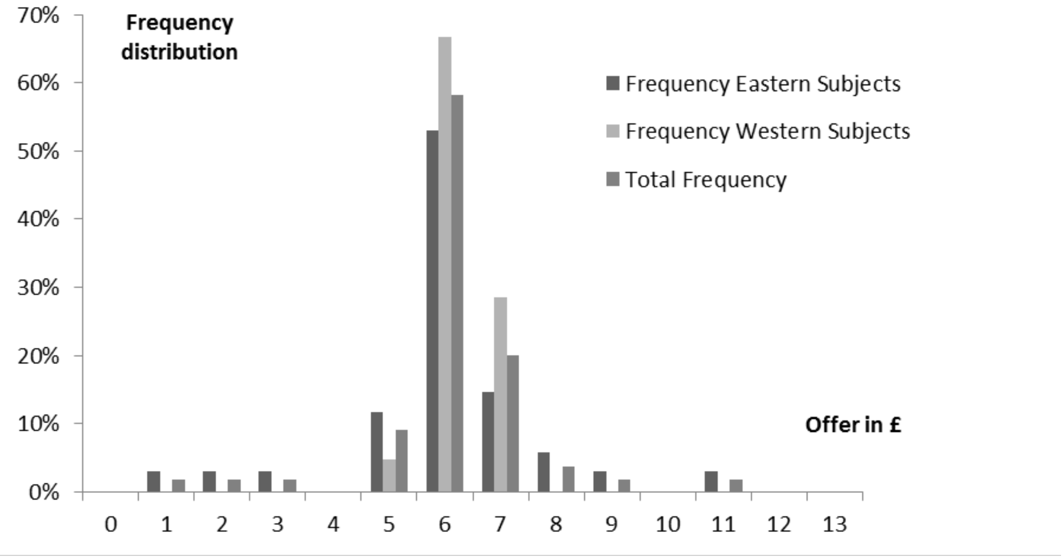


Figure 2.6a: AO1 – Offer levels

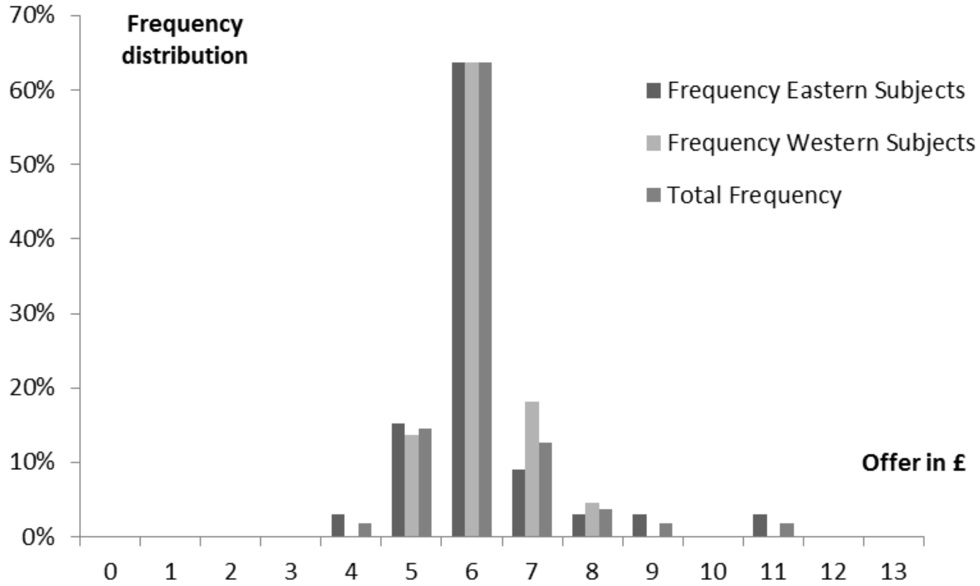


Figure 2.6b: AO2 – Offer levels

Hypothesis 3. I next investigate whether players make different offers in In-groups than in mixed groups (Hypothesis 3). In mixed groups more subjects offered £7 (23%) than in in-groups (9%). Overall, the subjects did not tend to make significantly higher offers in a mixed game compared to an in-group game, Mann-Whitney-U-Test, $z = -0.883$, $p = .377$. However, Western subjects made significantly higher offers in mixed games ($M = £6.06$) compared with in-group games (M =

£5.77), Mann-Whitney-U-Test, z = -2.107, p = .035. Eastern subjects did not tend to give higher offers in mixed games compared to in-group games, Mann-Whitney-U-Test, z= 0.396, p = .692.

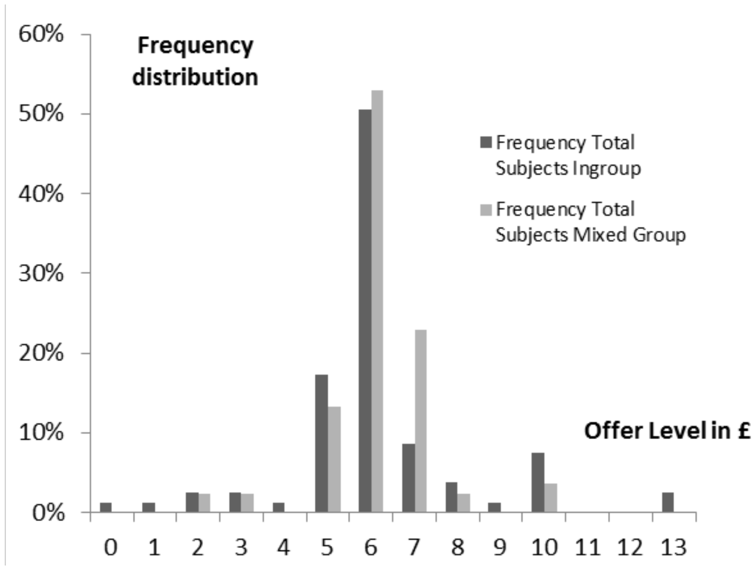


Figure 2.7a: Ultimatum Game – Offer Level Frequency Distribution Total In-group vs. Mixed Group comparison.

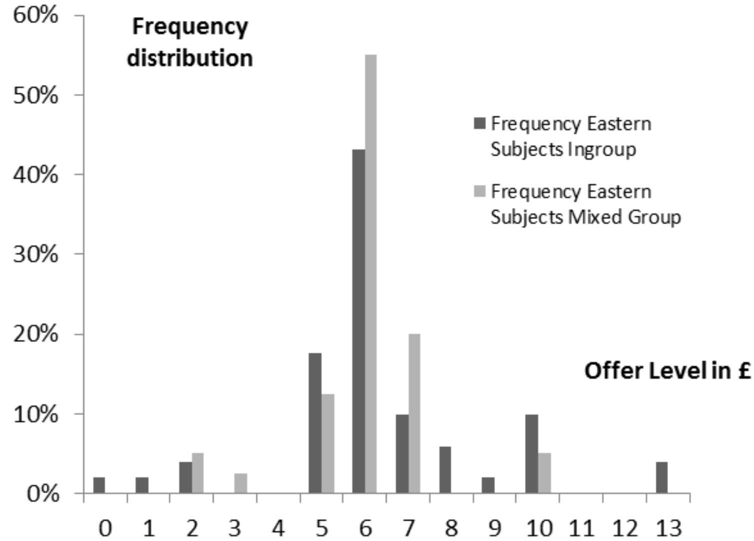


Figure 2.7b: Ultimatum Game – Offer level Frequency Distribution Eastern In-group vs. Mixed Group comparison.

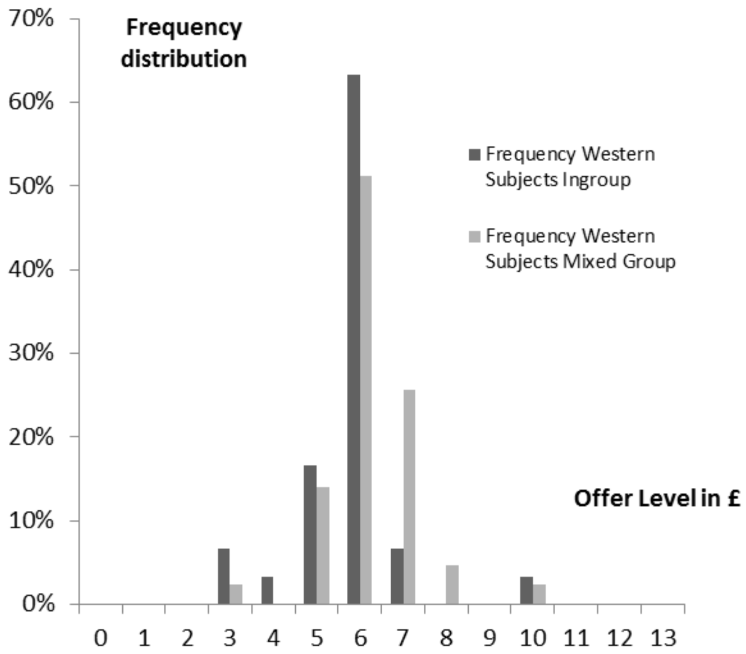


Figure 2.7c: Ultimatum Game – Offer level Frequency Distribution Western In-group vs. Mixed Group comparison.

In order to discern whether offer levels where different between mixed and in-group games, near equal splits need to be investigated. My design did not allow for splitting amounts equally and proposers needed to offer either the higher or the lower amount to the responder. As the majority of offers were in the range of £6 to £7, this will help to understand the preference of the proposer. In a mixed group £7 was relatively more often chosen, $\chi^2 = 3.685$, $p = .054$. The initial offer of £6 versus £7 for Eastern subjects did not depend on the group they were in, $\chi^2 = 0.536$ $p = .464$. In contrast, Western subjects chose an offer of £7 significantly more often in mixed games, $\chi^2 = 3.98$ $p = .046$. Overall, there seems to be some support for Hypothesis 3 in ultimatum games, as Western subjects made higher offers in mixed games. However, Eastern subjects were unaffected across treatments.

Sample sizes in the alternating offer games were significantly different, with 24 In-group observations and 83 mixed group observations. Hence, a test of Hypothesis 3 was omitted for the alternating offers game. If an offer was rejected in the first round, players normally found an agreement in the second round (only once an agreement took three rounds). The agreement offers in the second round were always in the range of £6 to £7.

Hypothesis 4. Next, I investigated whether SVO predicts offer levels (Hypothesis 4). To measure possible influences of cultural background as well as SVO-score on subjects and possible interaction effects, I used regression analyses. A regression with cultural background (East versus West), SVO-sore and their interaction showed that only SVO-scores significantly predicted ultimatum game offers, (b = .017; t = 2.01, p = .046; see Table 2.1, Column 1). This means that a more pro-social SVO-score yielded a higher offer in the ultimatum game regardless of cultural background, which itself was not predictive. A regression analysis with cultural background, SVO, and their interaction revealed that first offers in the AO games were also significantly predicted by SVO, b = 0.026; t = 4.28; p < .001; see Table 2.1 Column 2. These results provide evidence for Hypothesis 4. Additionally, the interaction between cultural background and SVO was marginally significant, b = -0.02; t = -1.67; p = .097. Closer inspection of this interaction revealed that SVO was a better predictor of offer levels for Eastern subjects than Western subjects.

Table 2.1: Regression results for offers

	(1) Ultimatum Offer	(2) AO Initial Offer	(3) AO Initial Offer
Ultimatum Offer			0.441*** (7.18)
EastWest (East = 0; West = 1)	-0.229 (-0.75)	0.097 (0.33)	
SVO	0.017* (2.01)	0.026*** (4.28)	
EastWest *SVO	0.003 (0.023)	-0.020^{+} (-1.67)	
Constant	6.018*** (29.56)	5.812*** (8.51)	3.376*** (8.51)
Observations	164	110	110

t statistics in parentheses; + p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001; AO initial offer = alternating offers bargaining initial offers; Ultimatum offer = offer made in the ultimatum games; SVO = Social Value Orientation

Hypothesis 5. Further, in order to elucidate whether Eastern or Western subjects had an advantage in bargaining (Hypothesis 5), the average expected payoffs were investigated. The calculation was conducted for proposers and responders separately. Generally, the results showed that average expected payoffs for all players over all ultimatum games were between approximately 43 % and 56 % (of the possible £13). Proposers earned slightly more than responders (Table 2.2), however this was not significant (Mann-Whitney-U-Test $z = 0.185$ $p = .854$). Overall, Eastern proposers (M = £ 6.42) earned slightly less than western proposers (M = £ 7.12), however, this difference was not significant (Mann-Whitney-U-Test $z = 1.361$ $p = .174$). The largest differences between proposer and responder payoffs were observable in the sessions with Western proposers. Descriptively, earnings seemed similar.

Type	Session	Average expected payoff	%
Eastern Proposers	In-Group	£5.57	42.84%
Eastern Receivers	In-Group	£6.16	47.36%
Western Proposers	Mixed	£6.65	51.15%
Eastern Receivers	Mixed	£6.03	46.35%
Western Proposers	In-Group	£7.23	55.64%
Western Receivers	In-Group	£5.77	44.36%
Eastern Proposers	Mixed	£6.14	47.23%
Western Receivers	Mixed	£5.65	43.47%

Table 2.2: Ultimatum Game – Average expected payoffs

A similar picture was found in the alternating offer games. In order to analyse the agreement structures, the payoff-distribution was investigated. Statistically, the final payoff-levels did not differ between the two AO games (Wilcoxon-Signed-Rank-Test, $z = 0.142$ $p = .887$). Additionally, the difference in final payoffs was not significant for Eastern and Western subjects (Mann-Whitney-U-Test, $z = 1.409$ $p = .159$). Overall, there was no evidence supporting Hypothesis 5.

Type	Session	Average expected payoff AO 1	% AO 1	Average expected payoff AO 2	% AO 2
Eastern Proposers	Mixed	£6.55	50.35%	£6.67	51.28%
Western Responders	Mixed	£6.28	48.29%	£6.24	47.96%
Eastern Proposers	In-Group	£6.33	48.72%	£6.67	51.28%
Eastern Responders	In-Group	£6.67	51.28%	£6.25	48.08%
Western Proposers	Mixed	£6.76	52.01%	£6.70	51.75%
Western Responders	Mixed	£6.09	46.85%	£6.30	48.58%

Table 2.3: AO – Average Expected Payoffs

5.3 Hypotheses based on theoretical predictions

Hypothesis 6. Considering Hypothesis 6 (i.e., proposers offer the minimum possible amount and the responder accepts) in ultimatum games, I found that the acceptance rates (Figure 2.8) suggested that subjects were willing to accept almost any offer in the ultimatum game. Overall, only 6% of the offers were rejected. The Eastern group had a rejection rate of around 6.5% while the Western group had a rejection rate of 5.4%. In the Eastern group, offers were mainly rejected in the offer range of £1 to £4. The Western group rejections were seen in the offer range below £2 as well as in the offer range of £6 and £7. Again, it was not possible to observe a clear pattern, as the actual numbers of rejection were too low. Overall, observed acceptance rates among the groups did not differ $\chi^2 = 0.003$, $p = .956$.

Also, I found that the frequency with which players offered an amount above £1 is statistically significant (χ^2-Test, $p < .001$). Players' offers seemed to be congruent with most experiment results regarding ultimatum games, where players offered near even splits with a frequency of 40% (Camerer, 2003). However, the acceptance rates gave some support for Hypothesis 6, which states that the responders accepted any result above 0 (subgame perfect Nash equilibrium).

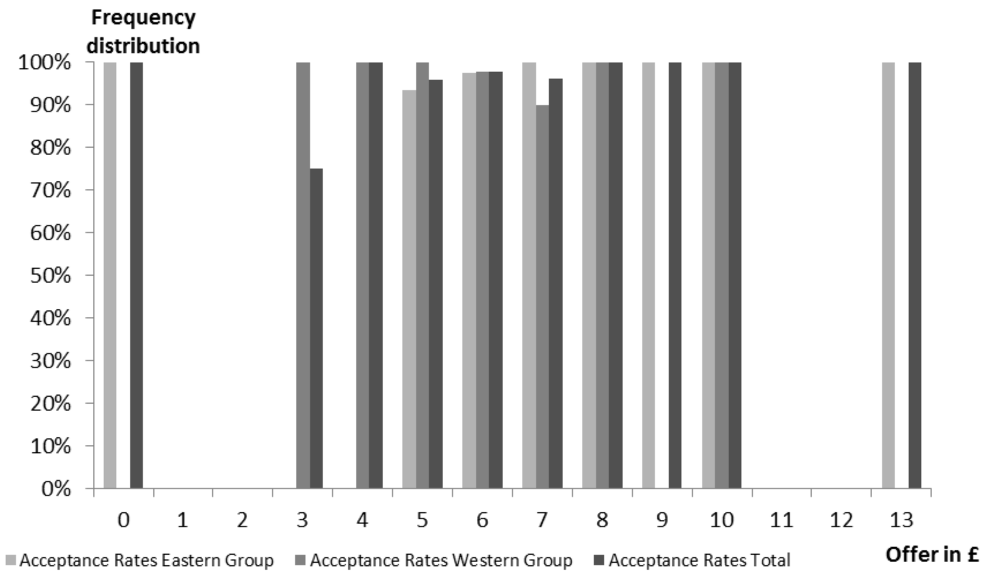


Figure 2.8: Ultimatum Game – Acceptance levels

Hypothesis 7. Now I test whether the proposer offers £6 in the first round and the responder accepts according to the backward induction result (Hypothesis 7). Overall, players made the £6 offer more often than other offers with a statistical significance, $\chi^2 = 4.091$, $p = .043$. Players were making offer levels mainly according to the backward induction result. Subjects in approximately 10% of the pairings in AO1 and AO2 rejected the initial offer. That means the acceptance rate of the initial offer was approximately 90%, which was comparable with the acceptance rates from the ultimatum games. As in the ultimatum game, the sample distribution of rejection rates between the Eastern and the Western group seemed to be similar. This result provided some evidence to support Hypothesis 7.

5.4 Consistency of choice

Throughout the experiments players made consistent offers. A regression revealed that the offer levels in the ultimatum game could predict the offer levels in the first alternating offers game ($b = .441$; $t = 7.18$; $p < .001$; see Table 2.1, Column 3). This result showed the continuity in the players' choice behaviour. A summary of the regression results of this section can be seen in Table 2.1.

6. Discussion

This study examined whether intercultural differences in individualism (between an Eastern and a Western subject pool) resulted in a systematic difference in pro-self and pro-group value orientations; and whether these differences in culturally-based self-interest led to systematic differences in bargaining behaviour. In order to test this, a SVO-mechanism along with two ultimatum games and two alternating offer games was used. The sessions took place at the University of East Anglia comprising of a subject pool of 168 subjects. Subjects were recruited by their stated nationalities including English, American, Australian, Canadian, Chinese, Hong Kong Chinese, Vietnam and Thailand. The two subject pools were grouped by the individualism score of their nationality as defined by HS, as well as their cultural and socio-political heritage. Overall, the purpose of my research was to contribute to existing literature in economics and other disciplines attempting to find an additional element for predicting intercultural bargaining behaviour. Past research has shown that the focus on self-interest as part of cultural behaviour is a promising lead.

Results from my experiment showed that subjects of the Eastern and Western groups did not have a significantly different level of self-interest (Hypothesis 1). In the current sample, the two distinct groups showed comparable level of self-interest with means of SVO = 12.17° and SVO = 13.06°. Both groups can be seen as equally self-interested with a slight tendency for being moderately cooperative. Individualism was not a sole predictor for the level of self-interest as defined by the SVO-score. This result can be due to sample size, as for finding average effects among a certain population a large number of subjects was necessary, and due to the homogeneity of the student population.

Further, the results showed that in ultimatum games offer levels could not be predicted by cultural background and the corresponding level of individualism (Hypothesis 2). In fact, average offer levels for both cultural groups were in the range of 40% to 50% of the total amount to be distributed as predicted by Nowak et al. (2000). In the ultimatum game, Western subjects made significantly higher offers in the mixed games compared to the in-group games. Eastern subjects did not make significantly different offers in in-group games and mixed games. This gave some support to Hypothesis 3.

As part of my experiment design, the offer levels of £6 and £7 were of particular interest. The pie size of £13 and offer increments of £1 were chosen to prevent even splits of the amount to be distributed. As predicted, approximately 80% of the offers were made in the range of £5 to £7. Again, Western subjects made significantly more £7 offers compared with £6 in the mixed games. Eastern subjects did not make this distinction. This suggests that Western subjects discriminated more than Eastern subjects. The acceptance levels in the ultimatum game were mainly at 100% for numbers above £7. In the ultimatum games offer levels could be significantly predicted by the SVO-score, but not by nationality. This indicated that self-interest levels were the main determinant for players to make their offers and to start out bargaining.

The alternating offers game showed partially similar results. For both the alternating offers and the ultimatum game, the acceptance rate of nearly 100% cannot be significantly predicted by level of self-interest. The resulting joint gains for all subjects were approximately between £11 and £13. Belonging to one or the other cultural group did not yield systematically higher payoffs. Also, the SVO-score did not predict acceptance levels.

For the alternating offer bargaining games, the offer levels, acceptance rates and rounds needed for reaching an agreement were investigated. In the first alternating offers, subjects needed significantly more rounds to reach agreements in the mixed sessions. This was not the case in the second game, possibly due to the effect of learning. Subjects needed between 1 and 3 rounds to find an agreement. The number of rounds played was not influenced by cultural background, such that only one particular group needed more rounds to find an agreement. This result showed that there was a discrimination effect, where subjects were not ready to accept offers in a mixed scenario. Also, FC found that subjects discriminated by making different offers in a mixed session. This result corroborates their finding.

Further, following the regression analysis, the SVO-score also predicted offer levels in the alternating offers game. This interaction effect showed that subjects made offers depending on how self-interested they were. Overall, there was sufficient evidence to show that SVO-scores were good predictors for offer levels in bargaining games with self-interest being more strongly a determinant for Eastern subjects. This seems to confirm Hypothesis 4.

Also, regarding payoffs, players of neither group, Western or Eastern had a systematic advantage (Hypothesis 5). Eastern proposers (M = £ 6.42) earned slightly less than Western proposers (M = £ 7.12), however, this difference was not significant. In my study, the level of individualism is no determinant of bargaining success in terms of payoffs.

In terms of predicted bargaining behaviour by Nash equilibrium theory, players in ultimatum games offered more than the minimal amount possible (Hypothesis 6). This is in line with most experimental results regarding ultimatum games. Subjects seemed to however accept almost any offer given, which partially supports Hypothesis 6. Offer levels in the alternating offer games were close to the predicted level by backward induction, providing also some evidence for Hypothesis 7.

While some studies found significant differences among different cultural groups in terms of bargaining behaviour (FC, Adair et al., 2001, Brett & Okumura, 1998, Oosterbeek, 2004), there have been other studies in which no significant differences were found (Okada & Riedl, 1999). The experiment of Okada & Riedl described a 3-person coalition formation ultimatum game with subjects from Austria and Japan. In their study, the absence of measurable cultural differences in bargaining behaviour was attributed to a focal point effect and to implicit competition between responders. Okada & Riedl (1999) found that the impact of culture on behaviour depends on the context in which people acted. While in the intercultural bargaining games that did find culturally-related differences in offer levels and payoffs (FC, Adair et al., 2001, Brett & Okumura, 1998), subjects recruited were either business managers from different locations or they were recruited from culturally-distinct parts of a population within the same area. Okada & Riedl (1999) matched this recruitment, however, the authors portrayed a different, less complex bargaining situation than Brett & Okumura (1998).

In my study, statistically-significant cultural effects could be less dominant as a result of a difference in the subject pool as I recruited students and not managers. The subject pool in my study was more homogenous than in the study of Brett & Okumura (1998). Subjects might perceive themselves as being students first, and put their nationality, as well as any preferences second. The emotional affiliation of the subjects with the student population might serve as a focal point altering their behaviour. Possible evidence is the slightly higher than normal pro-group SVO-score. If subjects would choose in their best interest, they would receive a lower score (0°) and higher payoffs. Approximately 30% scored in between $11.25° < SVO \leq 37.5°$, which made them moderately cooperative. The means that both populations were approximately at 12.00°.

According to De Cremer and Van Lange (2001), people might cooperate because they have a greater concern for fairness. Others are perceived to cooperate because of a strategic advantage for fulfilling their preference for self-interest (Van Dijk, De Cremer, & Handgraaf, 2004). Further, Nowack (2000) predicted offer levels between 40% and 50% given fairness considerations of the subjects. The offer levels in my experiment are clearly in this range. It could be possible that subjects were not put in an intercultural context and so they developed a preference for in-group (the group being the student population) fairness. Offer and acceptance levels of all subjects showed mainly a homogenous bargaining behaviour.

In summary, my experiment adds to the existing literature by showing that self-interest is a clear determinant for offer levels in bargaining situations. Further, this study shows that self-interest is a better predictor of offer levels in Eastern cultures than in Western cultures. Nationality is not a determinant for offer levels or higher gains in bargaining. Also, my study corroborates findings of previous research, in that subjects show a tendency to discriminate by making different offers in mixed games and taking more rounds to find an agreement in alternating offer games. While the current study extends the literature with respect to the impact of social value orientation for bargaining behaviour and the influence of culture, the results have to be interpreted with some caution. Lab restrictions made it difficult to systematically collect individuation information of the subjects (e.g., the participants' gender, age, income, field of study, personal background, prior bargaining experience).

However, such information could be important for a more refined prediction of participants' bargaining behaviour. For example, it is possible that female participants exhibit stronger reciprocity than males (Croson & Buchan, 1999), which could influence both ultimatum and alternative offer games. Also female subjects use mixed strategies twice as often (Schade et al., 2010). Mixed strategies, however, were not available my set-up. Furthermore, age and income are variables that can affect economic decision making to some extent. Older subjects tend to have more income.

Also, participants with a higher income might be less motivated to maximize their gains in the current study and therefore could exhibit more altruistic behaviour than participants with lower income. Additionally, prior bargaining experience could lead participants in the study to adopt different strategies than participants with no prior exposure to such games. It should be noted however, that economics students were deliberately excluded from the sample to avoid participants with extensive theoretic knowledge about strategic bargaining.

Next to the incomplete information on participants, another possible limitation of the current study was the selection process of the participants. Those subjects that were invited to participate in the study were primarily recruited based on their nationality. While this was in line with the reasoning on cultural differences by HS, the recruitment process does not guarantee that the selected sample can easily be generalized to the different Eastern and Western populations. This is the case for (at least) two reasons. First, being of a specific nationality does not automatically lead to a stronger identification with that particular culture. It is therefore possible, that participants who were of Eastern nationalities identified more strongly with Western culture because they grew up in the UK. Secondly, the type of sample in the current experiment was comprised only of students which self-selected to participate in the study. Naturally, the motivations as well as exhibited strategies of a student sample can differ from non-student samples (such as business managers, Brett & Okumura, 1998).

Nonetheless, certain aspects of the current study are likely to be similar if other samples would have been selected. For example, personality differences such as SVO are usually conceptualized as relatively stable traits (Van Lange, 1999). Thus, bargaining behaviour of students might be similarly influenced by SVO as managers' bargaining behaviour. Future research should investigate the generalizability of the current results by recruiting a less homogenous subject pool. Additionally, other cultural dimensions besides individualism (e.g., uncertainty avoidance) should also be examined with regards to bargaining behaviour. Finally, a different selection process conducted in different countries could further strengthen the results of this chapter.

Chapter 3
The Effect of Payoff-Irrelevant Cues and Fairness on the Hold-Up Problem

1. Introduction

1.1 The hold-up problem

Due to the prominence of the hold-up problem in various academic fields spanning from law to politics and business, much research has addressed the underlying issues and mitigating factors. A well-known example would be an energy company attempting to find a natural resource in a remote location. Prior to the endeavour, the company closes a deal with a transport company for a fixed time to transport the resource to the market. However, the energy company then finds it difficult to extract the resource and incurs a more lengthy process than anticipated. At that point, costs have already been incurred. After the agreement with the transport company has expired, the transport company wants to renegotiate the transport prices. Suppose that the transport company retains all the bargaining power, as there are few alternatives available for conducting transports from a remote location. If the transport company raises prices such that the energy company could no longer profit from extracting the natural resource, it would incur a loss. In this particular case, the energy company would not take the risks of searching for natural resources in remote locations in the first place, if it did not have control over the prices of the transport company. The hold-up problem often leads to a company's decision to vertically integrate[7] in order to rule out any possible exploitation (Klein, Crawford and Alchian, 1978) or to find other methods to escape exploitation by formulating contracts that define a specific cost for cheating (Williamson, 1975).

More formally, the hold-up problem (as outlined by Williamson, 1975; Klein et al. 1978; Grout, 1984; and Tirole, 1986) arises if two parties enter into an agreement or bargaining situation in which at least one of the parties (in the literature often referred to as the seller or the investor) has to make an initial, relationship-

[7] An example of vertical integration would be a manufacturing company purchasing either the supplier of their needed resources, or purchasing the transport company that is shipping the manufactured goods to the vendor.

specific investment, leading to a total sum to be bargained over. Once the initial investment has been made, and the costs are sunk, the non-investing party (in the literature often referred to as the buyer or the contractor) can then easily take advantage of the investor by claiming a share of the total sum that leaves the investing party with a loss in the bargaining situation. Hence, in the absence of binding agreements, the investing party incurs the risk that less money is obtained from the bargaining than the initial investment made. This often leads to underinvestment as the investing party is lacking credible guarantees that the investment will be at least recovered (Holmström & Roberts, 1998). As often not all factors of a transaction can be regulated in a contract, agreements remain not fully defined. The central question of how to remedy a potential hold-up between two parties remains a debated question.

1.2 Related research

Research has shown that hold-up regarding relationship-specific investments can be at least partially mitigated by (1) communication between the bargaining parties (Ellingsen & Johannesson, 2004a,b – henceforth E&J-a and E&J-b), (2) the condition of publicly available (versus private) information (i.e., investment or outside options are mutually known; Ellingsen & Johannesson, 2005), as well as (3) pre-investment allocation of ownership rights regarding the surplus generated (Fehr et al., 2008). In most strands of research, the behaviour of the bargaining parties could be explained by notions of fairness or inequity aversion postulated by Fehr & Schmidt (1999) who define fairness concerns of decision-makers in terms of disadvantageous and advantageous inequality where the utility of each payoff is set in relation to the payoff of other people. This relation is expressed in a specific utility function, which is described in Section 2.3. The following three strands of research shed light on the mitigating factors of the hold-up problem.

1.2.1 Communication & fairness concerns

One strand of research found that communication between the bargaining parties regarding a possible distribution of a generated surplus prior to relationship-specific investments increased investment rates (E&J-a,b). In both experiments, the investing party permitted communication prior to a one-sided investment.

In the experiment of E&J-b, a two-player coordination game was used to split the surplus after an initial investment phase. In treatments in which communication was possible, either the investing or the non-investing party could send a simple written message to the co-participant prior to investment. In the bargaining stage, both parties wrote down simultaneously the proposed split of the pie. If the combined claims exceeded the size of the pie, both players received nothing. Their results showed that investment rates with prior communication were significantly higher than without prior communication. Investment rates of sessions with communication by the investing agent and sessions with communication by the non-investing agent were very similar. In terms of bargaining without direct communication, in 40% of the bargaining cases expected profits were lower than investment costs. With prior communication, bargaining games lead to an even split of the generated net surplus (i.e., the total amount to split less the investment cost). In all communication cases, the non-investing party was fully informed of the investment cost involved to generate the total amount to be distributed. Most importantly, the authors found that the model of fairness according to Fehr & Schmidt (1999) fits the investment behaviour best as it can explain the tendency of players to split the net surplus evenly if pre-investment communication was possible.

Also, research found that pre-investment threats and promises as a form of communication remedy the problem of underinvestment (E&J-a). Different to E&J-b, the bargaining stage was constructed as an ultimatum game in which the non-investing party made an offer. The investing party can then accept or reject the offer. In case of a rejection, both parties earned nothing. Three main results were obtained during the experiment. First, investment levels with communication, predominantly when the investing party was able to communicate, were higher than those without communication, a result similar to E&J-b. Second, messages could be mainly divided into promises (i.e., that the investing party proposed a favourable or fair split to the other party) and threats (i.e., an indication that a particular offer below a certain level would be rejected). In this environment, promises seemed to be more credible than threats, as observed players' offer levels in the bargaining stage were often not influenced by threats but by promises. Hence, mean profits of the investing party were highest when the non-investing party proposed a split of the surplus.

Third, E&J-a found that bargaining behaviour could be best explained by the α- and β-value distribution (Fehr and Schmidt, 1999) as well as a preference of players to keep to their pre-investment promise during the bargaining stage. Fairness concerns let decision-makers consider sunk investment costs in the decision process in contrast to standard economic theory in which a rational agent should only consider future costs in the decision-making process. In addition to the work of E&Ja,b, similar results were found by Ellingsen & Johannesson (2005) and Hacket (1994).

1.2.2 Private information & fairness concerns

Experiments have shown that the lack of full transparency regarding the amount of the investment prior to a bargaining situation causes non-investing agents to be less likely to accept low offers during the bargaining stage, thus causing higher disagreement rates. Uncertainty about the other agents' preferences or availability of outside options generally led not only to underinvestment but also to inefficiencies in bargaining outcomes and causing otherwise efficient offers to be rejected. However, in aggregate, investment rates are not significantly affected by the private information condition. If the information regarding how much was invested by the investing party was private, the investing party tended to ask for a higher share of the sum to be bargained than if public information were available. If the investment cost was small, players tended to ask for a smaller sum under public information than if the investment cost was high (Ellingsen & Johannesson, 2005). The aforementioned authors speculated that this behaviour might be caused by fairness concerns in the sense of Fehr & Schmidt (1999).

In the preceding experiment, the offer of the investing party to the non-investing party was done prior to bargaining. In the ensuing ultimatum game, the non-investing party can accept or reject the offer. Other research has bolstered some of the findings of Ellingsen & Johannesson (2005), particularly that the presence of private information did not influence investment rates cf. Sloof (2005) and Sloof (2008). Sloof (2005) contended that investment levels were not affected by private information if notions of fairness and reciprocity were strong enough. Another finding of Ellingsen & Johannesson (2005) was that private information had an effect on bargaining behaviour. This was supported by the theoretical work of von

Siemens (2009) showing that the signalling effect of a particular investment could influence investment behaviour by affecting the beliefs of non-investor's regarding the type of the investor.

1.2.3 Ownership & reciprocity

Another central question regarding hold-up is whether the allocation of ownership rights leads to higher investment rates. Studies found that ownership structures affected relationship-specific investments (Fehr et al, 2008). The aforementioned experiment tested the influence of single ownership versus joint ownership of an asset on underinvestment in a bilateral bargaining scenario with two-sided investment options. Their results showed that joint ownership of an asset led to higher investments compared with single ownership. Ownership structures were determined by the players prior to investment by the parties regulating the allocation of the pie. Their experiment featured three treatments. In the first treatment, only one party owned the pie generated by investment. The owner of the asset could either sell half of his share of the asset to the other party or had to offer the other party a certain wage (share of the pie). In case any offer was rejected, both players immediately received a payoff of 0. In the second treatment, both parties owned the asset jointly at the onset of the experiment. The option for one player was to sell a share of the asset for a fixed price to the other party. If the offer is rejected, both players receive a payoff of 0. In the control treatment, the game does not end in case of a rejection and investment is conducted under joint ownership (giving both parties 50% of the pie). In all treatments, both players had the same investment options, and investments were observable and were made sequentially. The reasoning for a sequential investment in the experiment was that players in a simultaneous investment would have to form beliefs about the other player's type regarding bargaining behaviour prior to allocating ownership rights and investing. Fehr et al. (2008) conjectured that these beliefs would be difficult to control.

Due to the sequential nature of the investments, one key finding was the reciprocity[8] during investment, where high investments made by the first decision-maker were matched by high investments of the second decision-maker. Also, players reached the most efficient ownership allocation regardless of which ownership structure was given at the start of the treatment. Players seemed to be inequality averse in the sense of Fehr and Schmidt (1999). Also, fairness seems to be a more enforceable convention under the joint-ownership structure, compared with single-ownership.

1.3 Expanding on current research and aim

My experiment aimed to show that the hold-up problem could be remedied by introducing payoff-irrelevant cues (i.e., spatial proximity giving players a sense of ownership of their investment). Further, this research was designed to investigate the role of players' fairness concerns by introducing proportional equity as implied by the equity theory (Adams, 1963, 1965) in addition to inequity aversion (Fehr & Schmidt, 1999). The remaining sections of the introduction detail my approach. The remainder of this chapter is then structured as follows. I introduce the model (Section 2) as well as the experiment design (Section 3) along with the main hypotheses. The results are presented in section 4. Section 5 concludes and interprets the main findings.

1.3.1 Expanding on ownership

One of my research questions investigates whether the mere perception of ownership can influence players' investment and bargaining decisions. Ownership is supposed to spark efficiency, and it has been shown that a notion of "possession" of a certain good can act as a focal point in bargaining and coordination games (Mehta et al., 1994a,b; Isoni et. al, 2014). While pre-investment allocation of ownership rights in combination with sequential investment seemed to lead to an efficient regulation of ownership rights, where joint ownership (equal split of the pie)

[8] Reciprocity is defined as behaviour that rewards good intentions (behaviour) and punishes bad intentions (behaviour; see Rabin, 1993, as well as and Dufwenberg & Kirchsteiger, 2004). Falk & Fischbacher (2006) find that reciprocity is influenced by differences in environment.

generates higher investment rates (Fehr et al., 2008), the question remains whether this effect can be found in which ownership rights are only perceived.

The perception of ownership due to spatial proximity (i.e., an object near an agent is perceived more to be owned as an object further away) has been thoroughly researched by works such as Mehta et al. (1994a,b), Isoni et al. (2013, 2014) and others. Recent work regarding focal point theory has demonstrated that non-payoff-relevant cues can influence players' decision-making during the bargaining stage (Isoni et al., 2014). The authors of the aforementioned work used spatial proximity by placing objects worth a certain monetary value in several configurations on a spatial grid near two rectangular bases, each belonging to a player, to induce a sense of ownership of the objects. Spatial proximity was used in this experiment as a potential non-pecuniary focal point. Results of the experiment indicated that in coordination games in which only asymmetric payoffs were possible, spatial cues were used to achieve distributional effects, such as deciding who of the players would receive the larger share of the sum to be distributed. The use of the spatial grid as well as the employment of the "rule of closeness"[9] has been successfully used to provide non-payoff-relevant clues to players as coordination and distribution device in bargaining situations cf. Mehta et al. (1994a,b) and Isoni et al. (2014). These experiments placed objects with a certain monetary value in several configurations on a spatial grid, and players attempted to coordinate on claiming these objects. Generally, their results showed that the "rule of closeness" served as a non-payoff-related focal point.

Mehta et al. (1994a, 1994b) as well as Isoni et al. (2013, 2014) found that the concept of Schelling's (1960) theory of focality applies also to the "rule of closeness". The closer an object is to an agent, the more likely it is regarded as the property of that agent. This idea is based on the underlying notions of "possession", "prescription" and "accession" (Mehta et al., 1994a,b). Possession describes the idea of extending rights regarding a certain object to the agent who owns it for the first time. Prescription describes the notion of owning an object for a long time and thus exerting ownership rights. Accession describes the notion of extending ownership to

[9] The rule of closeness is defined as assigning a certain object to another object to which it is associated most (Mehta et al., 1994a,b). According to the authors, this does not only apply to physical closeness, but also to colors, shapes, labels, etc.

a new object based on previous ownership of another object that is related to the new object.

The “rule of closeness” (Mehta et al., 1994a,b) was used in a coordination game in which players observed a grid similar to Figure 3.1. Subjects had to assign a number of circles to the bases on the bargaining table. This was done simultaneously and in case of successfully allocating the circles, both players received a payoff. Under the condition of payoff-symmetry, Mehta et al. (1994a,b) found high rates of coordination. In most experiments, payoffs to players were symmetrical, and it was assumed that the power of a focal point is sufficiently strong even if payoffs were not symmetrical (Sugden 1995, pg. 548). In my experiment, the “rule of closeness” served as a device to find efficient solutions for bargaining and thus increased investment.

While some of the literature regarding focality investigated simultaneous move coordination games with symmetric payoffs (Schelling, 1960; Bacharach, 1997), research showed that payoff-irrelevant cues such as the “rule of closeness” lose their power whenever payoffs asymmetrical Crawford et al. (2008). In case of payoff asymmetry subjects focussed on the nominal in-game payoffs in their decision making. Also, the extent of coordination failure in asymmetric games depended on how large the payoff-difference was.[10]

This, however, was contested by Isoni et al. (2013). More generally, research found that focal points were viable selection criteria in simultaneous move bargaining games with multiple equilibria and without permitted communication, as players utilised given non-payoff-related clues to coordinate their strategies (Mehta et al., 1992).

Expanding on the experiments of Fehr et al. (2008) and Isoni et al. (2013, 2014), I used a spatial grid for both players on which the amount to be distributed was placed, in two specific configurations. The spatial grid is symmetric and contains two bases associated with the two players. In one configuration, the amount earned by investment was placed next to the investor’s base, using the “rule of closeness” as defined by Mehta et al. (1994a,b) as a payoff-irrelevant cue to inspire a

[10] The work of Crawford et al. (2008) uses a Level-K model to explain why with increasing payoff asymmetry, players became more payoff biased in their choices, increasingly favoring their own payoff, and disregarding the label salient strategy choice for coordination.

sense of ownership for the particular gains from investment. The second configuration places the amount to be distributed at equal distance to the two bases on the spatial grid with no regard of who of the two parties generated the surplus to be distributed. Prior to each game, both players are informed which configuration is used.

This experiment is designed to test whether the “rule of closeness” as described by Mehta et al. (1994a,b) is having a distributive effect in the bargaining behaviour. Given previous research, this should be the case (e.g., Mehta et al., 1994a,b; Isoni et al., 2014). This in turn should have an effect on investment behaviour, as players anticipate the power of the non-payoff-relevant focal point (“rule of closeness”) and invest more when they know that the investment is placed near their base. However, results of this experiment show that investment as well as bargaining behaviour did not differ between the two spatial alignment configurations, suggesting that spatial proximity does not significantly affect bargaining and investment behaviour.

1.3.2 Expanding on communication

Literature on hold-up problems has shown that direct communication prior to investment significantly increases investment levels (E&Ja,b). However, in my experiments, direct communication is not allowed because this is one of the features of my investigation. Players have full information regarding investment and bargaining procedures, however, there is no possibility to formulate any ex-ante agreements or know the other player’s preferences. Results of my experiment showed that given the experiment setup, players made higher investments in games with similar investment options and payoffs than players in the experiments of E&Ja,b. This might be attributed to the presence of the bargaining table as well as to the fact that players had different investment options. This design was chosen in order to observe whether players could use the power of the focal point in order to successfully invest and distribute gains.

This feature has important economic relevance. Often situations do not allow for communication, such as the investment of two anonymous companies investing in equity shares of the same firm or asset in the market place. In order to turn the purchased firm into profit, it needs to be split up and sold. For this decision, a majority vote of the shareholders is needed. Only if both companies agreed, then a majority can be reached. In that situation, the company owning less shares can press the company owning more shares for a higher amount of the realized profit, regardless of the initial investments. In situations without direct communication, it could be helpful to learn whether non-payoff-relevant cues helped market players to overcome the hold-up problem without direct communication.

1.3.3 Expanding on fairness

Concerning the hold-up problem, social efficiency or some concept of fairness in the sense of Fehr & Schmidt (1999) and Bolton & Ockenfels (2000) is used to explain behaviour. Experiments have shown that in the case of one-sided investments, where only one party invests, sunk costs were considered in finding a distribution of the generated surplus and that distributions showed signs of inequity aversion (E&Ja,b). Further, the experiments have demonstrated that the population distribution according to their inequality preferences (Fehr & Schmidt, 1999) explains the behaviour of agents better than the assumption of rational, profit maximising decision-makers. In past research fairness concerns have explained how a certain distribution in the post-investment bargaining process can influence the investment choices. In my experiment, I investigate whether players match investment levels. Results of my experiment provide evidence for equity theory[11] (Adams, 1963, 1965) as well as for the notion of inequity aversion as observed by Fehr & Schmidt (1999). Expanding on Fehr (2008), I provided players with different levels of initial endowment which can be invested by one or both players. Further, players can invest at different fixed levels similar to Fehr (2008). Two sided simultaneous investments with asymmetric initial investment possibilities provide the advantage of observing investment preferences in conjunction with bargaining behaviour. Recent research finds that the dynamics of the hold-up problem are fundamentally different between one-sided and two-sided investments. Specifically,

[11] Equity theory is a concept used in social psychology and defines fairness as the fair return of an initial investment with regard to the return to an initial level of investment or effort by another person. For example, a fair distribution would entail that someone who provides a larger input also receives a larger return. Equity theory was investigated as a theory of input and outcome relations by Pritchard (1969). In a goods exchange situation players were aware of price and service inequities and if inequity was too high they stopped the transaction (Huppertz, 1979).

the hold-up problem in one-sided investments depends on bargaining inefficiencies, while in the two-sided investment case inefficient bargaining procedures and inefficient investment do not necessarily coincide (Akcay et al., 2014). In addition, experiments showed that two-sided investments with fixed distribution rules were not in line with inequality averse preferences but with a concern for social efficiency (Faravelli et al., 2013). Given the above-mentioned research goals, I now present the model of my experiment.

2. Model

Suppose two players entering a bargaining situation in which one or both players had an opportunity to make a relationship-specific investment prior to the bargaining session, contributing to the total amount to be split. The procedure is as follows: first both players invest simultaneously in Stage 1, after that they bargain over the amount created by investment.

2.1 Investment

Suppose two players (A, B) enter a two-player bargaining situation, Stage 2, that is preceded by an investment stage, Stage 1, in which an investment decision has to made by either one or both players, the individual investment decisions are noted as I_a and I_b. The decision during Stage 1 determines the amount to be bargained over (P = pie size). For the investment stage, players received an initial amount of tokens as starting endowment, E_a and E_b, where $E_a > E_b \geq 0$. Given the relationship of E_a and E_b, the player receiving E_a is henceforth the “favoured” player (A), and the player receiving E_b is henceforth the “less favoured player” (B). Both players can invest an amount subject to $0 \leq I_a \leq E_a$ and $0 \leq I_b \leq E_b$. Any money invested is then multiplied by an exogenous factor σ. In this model, for any particular game, the factor σ is identical for both players. The production function for pie P is increasing in I_a and I_b:

$$P = \sigma(I_a + I_b)$$

Players make their decisions simultaneously not knowing what the other player chooses. Due to the simultaneous nature of the investment, players choose investment levels independently. For each investment choice, the multiplier σ must be greater than 1, as otherwise the pie generated would be lower than the investment, in which case, the players would not have an incentive to invest, so $\sigma > 1$. For each individual investment of player A and player B σ is set at $\sigma < 2$, as otherwise, given perfect divisibility[12] of the generated surplus, an even split (which is a common focal point in bargaining; Nash, 1950; Muthoo, 1999) would ensure both players at least the recovery of their investment regardless of the level of investments. In case of asymmetric investment levels, $I_a \neq I_b$, the player that invests less will make a net gain in case of an even split of the surplus, given $\sigma > 1$. The player investing more would only benefit in case of an even split of the pie, if $\sigma > \frac{2I_a}{(I_a+I_b)}$, assuming that $I_a > I_b$, and $\sigma > \frac{2I_b}{(I_a+I_b)}$ assuming that $I_a < I_b$. In case of $I_a = I_b$ any value of σ greater than 1 would yield a gain for both players in case of an even split. In this model σ is fixed for all levels of investment, however, in order to make post-investment exploitation more salient, I set $\sigma \leq \frac{2E_a}{(E_a+E_b)}$. This assumption assures that in case of full investment of both players, the favoured player cannot gain more than the original endowment if the generated pie is split evenly[13]. Any endowment not spent is kept by the players, so players retain any amount that is $(E_a - I_a) > 0$ and $(E_b - I_b) > 0$.

2.2 Bargaining

In the following bargaining stage, players are first informed about the total size of the pie. Both players then state simultaneously an amount of the pie that they want to claim. Claims are made in a certain time period and can be changed within this period any number of times independently from the claim of the other party.

[12] Perfect divisibility suggests that any distribution can be freely chosen by the players. An amount would not be perfectly divisible if there would be only 1 unit worth a certain amount of money, in which case only one player would be receiving the entire amount.

[13] Numerical example: Suppose the favored player has an endowment of £ 6 and the less favoured player has an endowment of £ 2. Suppose both players invest the maximum total amount. In this case the combined investment needs to be less than twice the endowment of the favoured player, hence less or equal than £ 12, otherwise an anticipated even split of the surplus will lead to a gain for the favoured player.

Both players have the same amount of time available to make their claims. Claims made are immediately seen by the other party. Both players can agree to end bargaining if they are agreeing with the distribution. As both players have sufficient time to signal the other party their preferences about the split of the pie, no advantage is assumed for any player making a proposal first. This model has been employed by Isoni et al. (2014), and differs from the typical one-shot games usually found in this type of experiment, cf., E&Ja,b and Fehr et al. (2008). The aim is to rule out the type of coordination failure found in take-it or leave-it one shot Games (E&Ja,b) and to give players the opportunity to adjust their strategies according to the situation.

Only the last offer made before the end of bargaining process, either by agreement or by time expiring, is the binding one. Both players make their final claim (C_a, C_b) and receive their respective Claim only if $C_a + C_b \leq P$, otherwise they receive a payoff of 0. In the final phase of the bargaining period, if no agreement has been reached, players are confronted with a game of chicken, leaving room for some coordination failure (e.g., if both players do not back down and $C_a + C_b > P$ is the result after bargaining ends) and an inefficient distribution of the surplus (both adjust their claims reaching a result of $C_a + C_b < P$). The interpretation of the bargaining behaviour of the players in the experiment of Isoni et al. (2014) suggests that more aggressive players tend to wait longer in order to see if concessions are made by the other party first. Payoff-functions for the favoured and the less favoured player become respectively:

$$\pi_a = \begin{cases} C_a + E_a - I_a \; if \; C_a + C_b \leq P \; and \; P > 0 \; ; \\ E_a - I_a \; if \; C_a + C_b > P \; and \; P > 0 \\ E_a \; if \; P = 0 \end{cases}$$

and

$$\pi_b = \begin{cases} C_b + E_b - I_b \; if \; C_b + C_b \leq P \; and \; P > 0) \\ E_b - I_b \; if \; C_b + C_a > P \; and \; P > 0 \\ E_a \; if \; P = 0 \end{cases}$$

2.3 Equilibria & Strategies

Bargaining consists of a finite number of simultaneous observable moves over a fixed amount of time. Only the claims at the final stage of the bargaining process prior to reaching an agreement are binding. The final stage of the game is equivalent to a Nash Demand Game (Nash, 1953). In the beginning stage of the bargaining game, claims communicated to the other player are 'cheap talk'. However, research shows that 'cheap talk' facilitates coordination in bargaining situations (Farrell, 1987). Strategies for players consist of an investment choice as well as a final claim. The strategy pairs for players A and B are (I_a, C_a) and (I_b, C_b) respectively. Claims of both players are depending on the size of the pie, hence, the claim is a function of pie P, where $C_a = f_a(P)$ and $C_b = f_b(P)$.

Generally the game has many subgame perfect Nash equilibria in pure strategies with combinations of (I_a, C_a) and (I_b, C_b) as strategies are defined by $f_a(P)$ and $f_b(P)$ in the bargaining stage that are best responses to one another. Necessary conditions for a subgame perfect Nash equilibrium are $C_a + C_b = P$ (if $I_a > 0$ or $I_b > 0$) as well as $C_a \geq I_a$ and $C_b \geq I_b$. In addition, there are also equilibria in mixed strategies. Efficiency requires that $C_a + C_b = P$ and $I_a = E_a$ and $I_b = E_a$. Any claims of $C_a < I_a$ and $C_b < I_b$ are strictly dominated. As both players claim at least their investment, claims need to be restricted to $C_a \leq P\text{-}I_b$ and $C_b \leq P\text{-}I_a$. In order to simplify the analysis of the game, I considered four plausible division rules for $f_a(P)$ and $f_b(P)$.

The first plausible rule (1) follows from a common outcome in bargaining games in which players split the pie evenly (Camerer, 2003). In this case, player A and player B claim $C_a = ½P$ and $C_b = ½P$. This rule about splitting the pie does not take investment decisions or endowment levels into account. Given that $\sigma < 2$, and given the that both players claim half the pie, not investing ($I_a = 0$ and $I_b = 0$) is a subgame perfect Nash equilibrium. Not investing is both players' best response option to the other player's choice, as investing is strictly dominated, thus players choose (0, ½P), (0, ½P) and keep their endowment. If both players invest their respective endowments payoffs are $\pi_a = ½P + E_a - I_a$ for player (A) and $\pi_b = ½P + E_b - I_b$ for player B, where $P = \sigma(I_a + I_b)$. If none of the players invests their payoffs are their initial endowments. If player A invests and player B does not invest the payoffs for player A and player B are $\pi_a = ½P + E_a - I_a$, and $\pi_b = ½P + E_b$, where $P = \sigma I_a$. If player B invests and player A does not invest their respective payoffs are π_a = ½P + E_a and π_b = ½P + E_b – I_b, where P = σI_b. Including the remaining endowments after investment, payoffs of the game are depicted in Table 3.1a, where the term on top is the payoff for player A and the term on the bottom the payoff for player B.

	Player A invests	Player A does not invest
Player B invests	$[E_a + \frac{\sigma}{2}I_b - (1 - \frac{\sigma}{2})I_a]$; $[E_b + \frac{\sigma}{2}I_a - (1 - \frac{\sigma}{2})I_b]$	$[E_a + \frac{\sigma}{2}I_b]$; $[E_b + (1 - \frac{\sigma}{2})I_b]$
Player B does not invest	$[E_a - (1 - \frac{\sigma}{2})I_a]$; $[E_b + \frac{\sigma}{2}I_a]$	$[Ea]$; $[Eb]$

Table 3.1a: Payoffs for player A and player B if P is split evenly.

Research has shown that inequity-aversion is a strong determinant for players to split a surplus (Fehr & Schmidt, 1999). Hence, the second (2) salient rule on how to divide up P is splitting the entire amount including the remaining endowment that was not invested with claims C_a = ½ (P - (E_a- I_a) + (E_b -I_b)) and C_b = ½ (P + (E_a- I_a) - (E_b -I_b)) for player A and player B respectively, where 0 < C_a < P and 0 < C_b < P. Given this rule, if both players invest, their overall respective payoffs become $\pi_{a,b}$ = ½(P + (E_a - I_a) + (E_b – I_b)), where P = σ(I_a + I_b). P is then split to achieve the total equal payoff, depending on the absolute difference of E_a and E_b. If none of the players invest, they keep their initial endowments. If player A invests and player B does not invest, the total payoff for players A and B becomes $\pi_{a,b}$ = ½(P + (E_a - I_a) + E_b), where P = σI_a. If player A does not invest and player B invests, the symmetric total payoff becomes $\pi_{a,b}$ = ½(P + (E_b – I_b) + E_a), where P = σI_b. Payoffs then are depicted in Table 3.1b.

	Player A invests	Player A does not invest
Player B invests	$[\frac{1}{2}(E_a - (1 - \sigma)I_a + E_b - (1 - \sigma)I_b)]$	$[\frac{1}{2}(E_a + E_b - (1 - \sigma)I_b)]$
Player B does not invest	$[\frac{1}{2}(E_b + E_a - (1 - \sigma)I_a)]$	$[E_a]$ $[E_b]$

Table 3.1b: Payoffs for player A and player B if the entire sum is split evenly including endowments.

The above payoffs depend on the absolute difference of E_a and E_b. Further, the optimal strategy depends on σ. So far, $E_a > E_b \geq 0$ and $1 < \sigma < 2$ and $\sigma \leq \frac{2E_a}{(E_a+E_b)}$ are assumed for the model. Given the assumptions of the game one subgame perfect Nash equilibrium is that player A invests nothing while player B invests, claiming the whole pie. As $E_a > E_b$, player B can increase the investment until payoffs are equal, claiming the whole pie or until $I_b = E_b$. Given $\sigma \leq \frac{2E_a}{(E_a+E_b)}$ player B invests at $I_b = E_b$. For player A, a small investment is not feasible as the whole payoff would go to player B. Player A can increase his investment up until the payoffs for player A and player B are equal. If both players invest fully, player A and player B would get $\sigma(E_a + E_b)/2$. As $\leq \frac{2E_a}{(E_a+E_b)}$, and it is more feasible not to invest for player A. Player B will invest fully and will claim P. If inequity aversion is extending to the total payoffs, and players factor in the total amount, then player A compensates player B by forgoing most of the surplus generated by investment.

A third rule (3) inspired by inequity aversion (Fehr & Schmidt, 1999) is the split of the net surplus from investment. In that case, both players would claim $C_a = I_a + ½(P – I_a – I_b)$ and $C_b = I_b + ½(P – I_a – I_b)$ respectively. Thus, if both players invest, their profit would be $\pi_a = E_a + ½(P - I_a - I_a)$ and $\pi_b = E_b + ½(P - I_a - I_a)$ respectively, given $P = \sigma(I_a + I_b)$. If both players do not invest they retain their endowments respectively. If player A invests and player B does not invest, the profit for the two players become $\pi_a = E_a + ½(P - I_a)$ for player (A) and $\pi_b = E_b + ½(P– I_a)$ for player B, where $P = \sigma I_a$. Similarly, when player B invests and player A does not invest, the payoffs become $\pi_a = E_a + ½(P – I_b)$ and $\pi_b = E_b + ½(P– I_b)$ respectively, where $P = \sigma I_b$. Payoffs are shown in Table 3.1c.

	Player A invests	Player A does not invest
Player B invests	$[E_a + \frac{\sigma-1}{2}(I_a + I_b)]$ $[E_b + \frac{\sigma-1}{2}(I_a + I_b)]$;	$[E_a + \frac{\sigma-1}{2}I_b]$ $[E_b + \frac{\sigma-1}{2}I_b]$;
Player B does not invest	$[[E_a + \frac{\sigma-1}{2}I_a]$; $[[E_b + \frac{\sigma-1}{2}I_a]$	$[Ea]$; $[Eb]$

Table 3.1c: Payoffs for player A and player B if the net surplus is split evenly.

Players A and B retain their endowment in any case, and since $\sigma > 1$, any unit invested is increasing the surplus. Investing the full amount and splitting the surplus evenly is an efficient subgame perfect Nash equilibrium, given the assumptions of the game. The result can easily be made more general, as under any division of the net surplus (let λ be $0 < \lambda < 1$, then players claim $C_a = I_a + \lambda (P – I_a – I_b)$ and $C_b = I_b + (1- \lambda)(P – I_a – I_b)$) investing the full amount is an efficient subgame perfect Nash equilibrium. However, given inequity aversion splitting the net surplus evenly is most salient.

The fourth rule (4) is splitting the entire pie by proportion (i.e., reflecting the portion that actually was invested). This rule would also reflect the actual level of investment made by both players. Under this rule player A and player B would claim $C_a = \{I_a/(I_a + I_b)\}P$ and player B would claim $C_b = \{I_b/(I_a + I_b)\}P$. If both players invest their payoff functions become $\pi_a = E_a - I_a + \frac{I_a}{(I_a+I_b)}P$ for player A and $\pi_b = E_b - I_b + \frac{I_b}{(I_a+I_b)}P$ for player B, where $P = \sigma(I_a + I_b)$. If both players do not invest anything they earn their initial payoffs. If only Player A invests, payoff functions become $\pi_a = E_a - I_a + P$ and $\pi_b = E_b$, where $P = \sigma I_a$. In this case player B is the only player investing the payoff functions are by symmetry $\pi_a = E_a$ and $\pi_b = E_b - I_b + P$, where $P = \sigma I_b$. The game is shown in Table 3.1d, where again payoffs of player A are in the top row and payoffs for player B in the bottom row:

	Player A invests	Player A does not invest
Player B invests	$[E_a - I_a + \sigma I_a]$; $[E_b - I_b + \sigma I_b]$	$[E_a]$; $[E_a - I_a + \sigma I_a]$
Player B does not invest	$[E_a - I_a + \sigma I_a]$; $[E_b]$	$[E_a]$; $[E_b]$

Table 3.1d: Payoffs for player A and player B if P is split proportionally by investment contributions.

It is an efficient subgame perfect Nash equilibrium if players invest their whole endowments and making claims by proportion, given the assumptions of the game. Investing one more unit is increasing players' payoffs. The proposed rules are based on notions of inequity aversion as well as proportionality as defined by equity theory. To justify the salience of the above rules and proposed subgame perfect Nash equilibria, inequity aversion (Fehr & Schmidt, 1999) as well as equity theory (Adams, 1965) need further explanation.

2.4 Fairness concerns

Research is providing evidence that a large part of players exhibit inequality aversion (inequity aversion; (Fehr & Schmidt, 1999). Results from ultimatum as well as other games have shown that respondents do not accept an unfair division of the pie**.** In bargaining literature, fairness plays an important role regarding the explanation of behaviour. A plethora of experiments in the hold-up literature show that fairness best explains players' behaviours. E&J, Fehr et al. 2008 and others find that their results can be best explained with the distribution of preferences as presented by Fehr & Schmidt (1999). Fehr & Schmidt state that every player has a utility function that depends on the outcome relative to the other player's outcome. The example for player A:

$$W_a = u_a - \alpha_a max\{u_b - u_a, 0\} - \beta_a max\{u_a - u_b, 0\}, \quad a \neq b$$

The function for player B looks identical. The variable u_u depicts the net payoff of player A and α_a and β_a are variables measuring a players disutility regarding the level of payoff of the other player in relation to the own payoff. The authors assumed that players suffered more from the inequality of a loss than from a gain, hence, $\alpha_a \geq \beta_a$. Further, subjects were assumed to not to want to be better off than others, so $\beta_a \geq 0$. The interpretation of $\beta_a = 1$ is that a player would diminish his payoff with certainty by throwing some of his payoff away in order to reach equality. Thus, the model assumes that players have preferences such that $\beta_a < 1$. A further assumption is that some players would give some of their payoff to the other player to reach equality, which would be reflected of values of β_a in between $\beta_a \geq 0.5$. The model does not put a limit on the variable α, which is the assumption that players can have a strong incentive to sacrifice some of their own payoff to reduce the other player's payoff even further in order to reach equal payoffs. Given their studies of ultimatum games, Fehr & Schmidt (1999) find that players had a range of preferences which can be expressed in several preference groups.

A value $\alpha = 0$ suggests that players are not inferiority averse and accept any amount above 0. The higher the value for α, the higher is the preference for a given player to not receive less than the other player. The higher the value for β, the higher is the preference of the player to not receive more than the other player. Some previous research raises the issue that players preferred equal divisions to others, leading to maybe more efficient results (Camerer, 2003; E&Ja).

Inequity aversion in my experiment concerned players' final claims and agreements during the bargaining session, as well as investment behaviour. The model of Fehr & Schmidt (1999) mostly regards the split of the pie, and only implicitly regards the investment behaviour present in my model. Further, the model of Fehr & Schmidt is mostly concerned with one shot games. In my experiment, players bargained over a period of time and offers can be adjusted. As bargaining is free in form in my experiment, and continues for a certain amount of time, it is less necessary for players to formulate strict beliefs about the other player. If the investment is made, players are able to find an agreement, unless the co-participant is aggressive and risks a payoff of zero. There are two ways to minimize inequity in my experiment, given by rule (2) and rule (3), depending on whether players regard total payoffs including initial endowments, or whether they regard the net surplus of the game. According to the logic of Fehr & Schmidt (1999), there will be players who attempt to formulate agreements that will get them either a larger or a smaller share of the net surplus as well.

Another form of fairness is a proportional distribution, which is taking the actual contribution to the pie into account (Adams, 1965). The theory states that people seek relational equity and are willing to undertake an effort to restore equity. Given the strategy pair of investment choice and claim as a function of pie P, an efficient subgame perfect Nash equilibrium is full investment and a proportional split of the pie (P) as such:

$$\frac{C_a}{I_a} = \frac{C_b}{I_b}$$

Research suggests that players have a preference for reciprocity in consecutive investments (Fehr et al., 2008). In my experiment, a set of strategies that would support reciprocity is the special case of $I_a = I_b = E_b$ where players claim $C_a = ½P$ and $C_b = ½P$. In this case, the favoured player would forgo larger gains in order to achieve equality as well as a proportional division of the pie. This outcome does not fulfil efficiency requirements as $I_a < E_a$. Each player could increase their payoff by not investing. As players made simultaneous decisions and had no knowledge about the other player's investment choice, this strategy would be the safest choice next to not investing at all, as this solution would constitute an equal split of the pie, an equal split of the net surplus as well as a proportional division.

3. Experiment

3.1 Experiment design

In my experiment, bargaining took place on a spatial grid, a “bargaining table” as presented in Figure 3.1 (an accurate version can be found in Appendix 3.2).

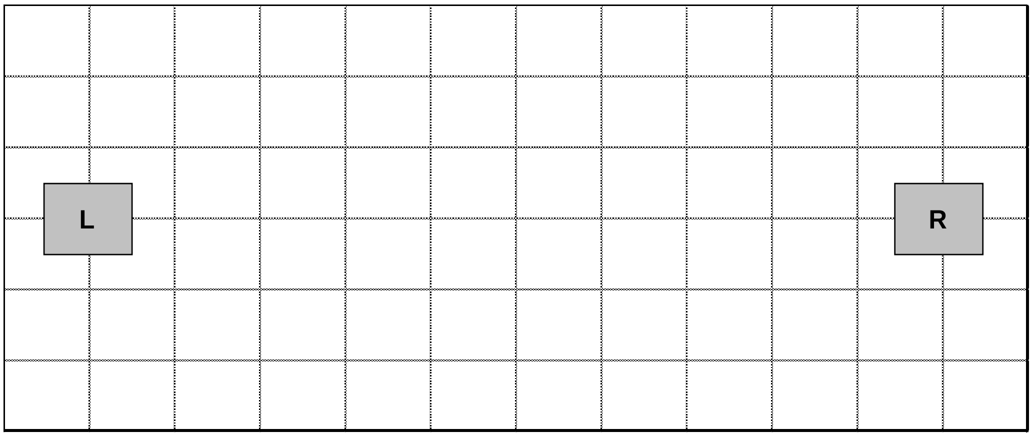


Figure 3.1: Representation of a spatial grid – the “bargaining table”

Players could invest by purchasing objects worth a certain monetary value. Each object had the same money value for both players. Purchased objects were placed by the computer on a bargaining table. The bargaining table had two bases on the far left and on the far the right of the bargaining table. Both players were assigned to one of the two bases on the bargaining table. The favoured player was always assigned to the base on the left and the less favoured player was placed on the right. The bargaining tables took two general forms (Figure 3.2, Figure 3.3), where each game was represented once in each form. Figure 3.2 depicts the “horizontal” alignment where objects are lined up one by one by the computer next to each other starting at the base of the player who made the investment into the direction of the other player’s base. Figure 3.3 depicts the “vertical” alignment, where objects are lined up in the middle at equal distance between the two players from top to bottom, blind to initial investments. During the bargaining game, players made choices regarding how many of the objects they claim. Players could not choose specific objects. Claiming a number of objects as opposed to claiming individual objects on the table as in Isoni et al. (2013, 2014) has the advantage that the distribution mechanism is less of a coordination issue. The assumption is that players should focus more on coordinating to claim an amount of the pie, rather than trying to coordinate to pick different individual objects.

The underlying assumption for the horizontal alignment is that objects closer to one's base are more regarded as one's own than objects further away using the notion of "possession" (Isoni et al., 2014). On the table with "vertical" alignment, the computer started to count top down for the favoured player and bottom up for the less favoured player. Players were informed prior to each game, which table was used in that particular game. In both settings, players were asked during the bargaining stage to simply state the number of objects they would like to obtain. In the horizontal alignment, the selection direction reflects the notion of "possession", as the computer started counting at a player's base, starting with the nearest object to the base. According to the "rule of closeness", the nearer an object is to a base, the more it should be regarded as belonging to that particular player. In the vertical frame, the computer started to count claimed objects from top to bottom for the favoured player on the left and bottom to top for the unflavoured player on the right. This selection direction was arbitrary. During the bargaining process, an agreement had to be reached. If by the end of the bargaining process, any of the objects were claimed by both players (i.e., the total sum of objects claimed was bigger than the sum of objects on the table) payoff for both players would be 0.

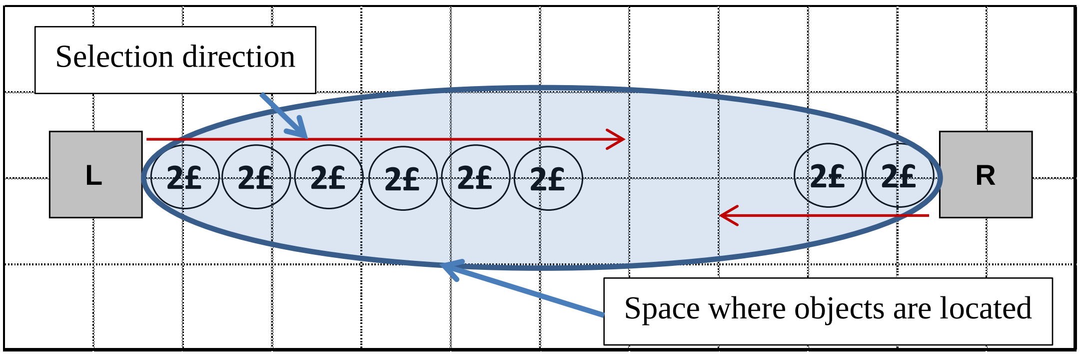


Figure 3.2: Representation of the horizontal alignment

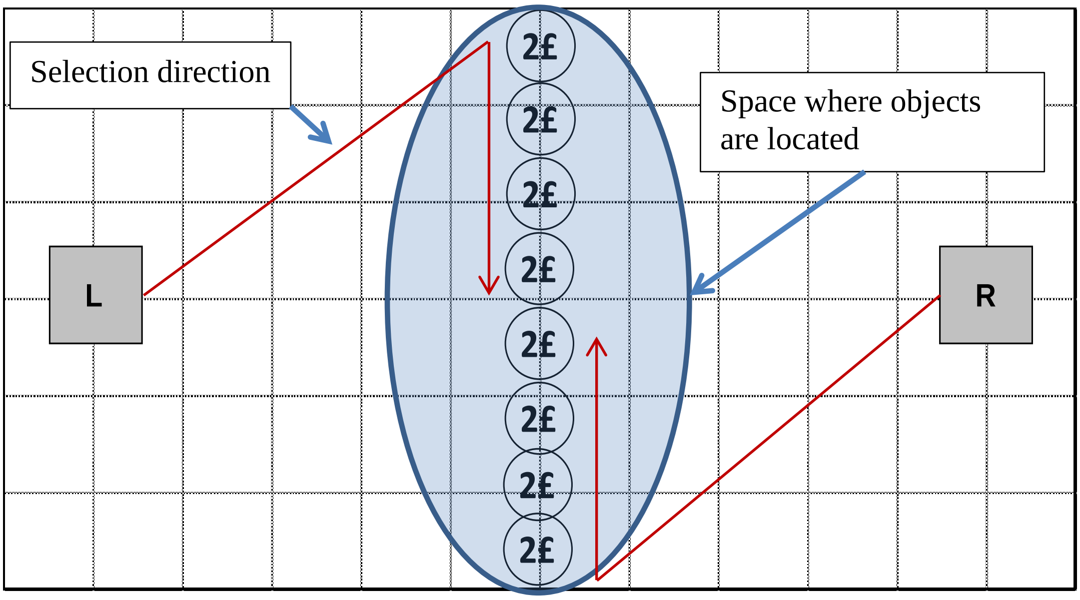


Figure 3.3: Representation of the vertical alignment

Each bargaining scenario with its specific set of parameters (E_a, E_b, σ) has been presented in the horizontal and vertical alignment. The aim is to capture potential effects of the "rule of closeness", as objects placed in a horizontal alignment can more easily be attributed to a particular base. Presenting a scenario in these two frames allows an investigation of whether the "rule of closeness", as defined by Mehta et al. (1994a,b) and Isoni et al. (2013, 2014), acts as a non-payoff related focal point for the players, facilitating an agreement that allows both players to realize a gain, which would be an efficient outcome. The second effect should be that the "rule of closeness" should provide players with a sense of possession regarding their own investment, and this should lead to higher investment rates. Research showed that games without pre-investment communication had a low investment rate as well as inefficient distributions of the surplus created by investment (E&Ja,b). Research also showed that investment rates were higher with regulating ownership of the asset prior to the bargaining stage (Fehr et al., 2008). In my experiment, bargaining is set within a fixed time frame, and players are unable to communicate or make any arrangements prior to investment or during the entire process.

A minimum monetary unit of £1 was used in my experiment. In addition, players received fixed investment options. The favoured player received the options to not invest, to invest the full endowment, as well as either 1/3 and 2/3 of the endowment or 1/4, 2/4 and 3/4 of the endowment, depending on the game. The less favoured player can either invest or not invest in games in which an endowment was provided. Previous experiments such as E&J, Fehr et al. (2008) have shown that investment decisions focused around specific levels, hence fixed investment options seemed practical as players were buying certain objects with tokens, where 1 token equals £1. Any token not invested was converted to £1 and the players could keep it along with the show-up fee. As fixed monetary units were used during the experiments, as well as the exogenous variable σ, serving as a multiplier for tokens invested, objects could be bought in certain clusters (e.g., a cluster of 3 objects worth £1 could be bought for two tokens, giving the variable σ a value of 3/2 = 1.5). An overview of the used parameters can be seen in Table 3.2.

Game No.	Endowment High	Low	Object Value	Investment Option	Possible Max Value	Multiplier Σ
1 / 7	6	2	1	Cluster of 3 Objects with a £ 1 value cost 2 tokens	12	1.50
2 / 8	8	0	1	Cluster of 3 Objects with a £ 1 value cost 2 tokens	12	1.50
3 / 9	9	3	4	1 Object with a £ 4 value cost 3 tokens	16	1.33
4 / 10	6	0	1	Cluster of 10 Objects with a £ 1 value cost 6 tokens	10	1.67
5 / 11	6	2	1	Cluster of 3 Objects with a £ 1 value cost 2 tokens; 9/10 probability	10.8	1.35
6 / 12	10	2.5	1	Cluster of 1 Object with a £ 3 value cost 2,5 tokens	15	1.20

Table 3.2: Game schedule showing the parameters for each game.

Table 3.2 shows the endowments for the favoured player and the less favoured player in each game. The favoured player always received a higher endowment. The column "Object Value" shows the pound value of an object in a particular game. "Investment Option" shows the available purchase options for a player. The investment options varied between games. The column "Possible Max Value" shows the maximum total surplus that could be generated in a particular game. The column "Multiplier" depicts the exogenous variable σ, the parameter a certain investment level is multiplied with. Different levels of σ make investments more or less profitable in comparison. Most monetary values in the experiment, except in Games 6 and 12, are integers due to practicality reasons. Objects presented in the game as well as investment possibility have also integer values. In between the games, the variables E_a, E_b, σ as well as object value and investment options are varied in between games, presenting players with different scenarios. Given that the value of the objects had integer amounts, not all games allowed for an even split of the pie or an even split of the net surplus. As every particular parameter set was displayed in a horizontal as well as vertical configuration, hence there exist two games with an identical parameter set. Games 1 to 6 were presented in a horizontal configuration, while Games 7 to 12 were presented in a vertical configuration. As the order in which games were presented was determined randomly, the sequence of games could vary. Different sets of parameters (i.e., E_a, E_b, σ as well as investment options) allowed investigating investment and bargaining behaviour more thoroughly.

In particular, Games 1 and 7 allowed for two-sided investment. The favoured player received 6 tokens, while the less favoured player received 2 tokens. Both players could contribute to the total surplus by buying objects. In the investment stage, both players could purchase 3 objects with a £1 value for 2 tokens. Thus, in this game, $\sigma = 1.5$. If a purchase was made, only clusters of three objects at once could be bought. If all tokens are invested, a total of 12 objects with a total value of £12 are generated. If players split this amount evenly, both players would receive £6. As the tokens are convertible to £1 each, the favoured player would receive in that case his original investment. As it is possible for the favoured player to gain £6 in case of an even split, however, the favoured player would expect more than he invested, otherwise it does not seem rational to incur the risk of investment. If the endowment is fully invested, the net surplus in the two games is £4.

Games 2 and 8 yielded the same maximum payoff as Games 1 and 7. However, the favoured player received 8 tokens, while the less favoured player received nothing, so in this game only one-sided investment was possible. As in the Games 1 and 7, players can purchase 3 objects with a £1 value for 2 tokens (i.e., $\sigma = 1.5$), with an identical net surplus of £4, if the endowment is fully invested. In comparison, it can now be observed whether the favoured player exhibits a different investment and bargaining behaviour as a result of possible two-sided investment.

In Games 3 and 9, the favoured player received an initial endowment of 9 tokens and the less favoured player received 3 tokens, which gave both players an opportunity to invest. Both players were able to invest by purchasing objects worth £4 using 3 tokens (i.e., σ = 1.34). In total, players can purchase a maximum of 4 objects with a total value of £16. If both players invest their full endowment, the total pie is £16. If it is split evenly, each of the players receive £8, making the favoured player incur a loss. The net surplus, if the full endowment is invested, is £4. As the objects have a £4 value each, the net surplus can also not be split evenly.

In the Games 4 and 6, the favoured player received 6 tokens and the less favoured player received none. The favoured player can purchase a cluster of 10 objects with a £1 value for his 6 tokens. The total value if all tokens are invested is £10 and the surplus generated is £4. Hence, σ = 1.67, which resembles the same surplus as in the games of E&J.

The endowment in Games 5 and 11 for the favoured player is 6 tokens and the less favoured player receives an endowment of 2 tokens. Both players can invest into objects and can purchase 3 objects for 2 tokens. However, in this game, the investment is only successful with a probability of 9/10th. This means that every object gets generated only with a chance of 90%. Given additional noise, the multiplier for this game is σ = 1.35. As it is not certain that an invested token generates objects on the bargaining table, players cannot be sure about the number of objects on the table. With horizontal alignment of the objects on the bargaining table, the investments made are attributable to the player that invested, but the total investment is not predictable. With vertical alignment of the objects on the table, it is not clear who made which investment. This adds to the uncertain situation and might affect initial investment. The aim of adding additional noise was to investigate whether an exogenously-given chance would change players' investment behaviour.

In Games 6 and 12, the favoured player received 10 tokens and the less favoured player received 2.5 tokens. The gain both players could generate by investing is determined by the unit cost factor of σ = 1.2. Players could buy clusters of three objects worth £1 by investing 2.5 tokens. If all tokens were invested, players can generate an amount to bargain over of £15. As the objects have round sum denominations of £1, the sum cannot be split evenly. The total net surplus generated by investing amounts to £2.50 and also cannot be split evenly. The low gain created by investment as well as the lacking possibility to split the amount to be bargained over or the surplus evenly creates an additional deterrent for investing in the first place.

All exogenous parameters in the above games are chosen to produce a potential hold-up scenario. As rule (1) describes, the subgame perfect Nash equilibrium in case of an even split of the pie is that players do not invest. As an example, consider the set of parameters, as well as the investment possibilities in Games 1 and 7 (also Games 5 and 11 if noise is minimal). A payoff representation can be seen in Table 3.3, where $E_b = 1/3\ E_a$ and $1 < \sigma < 2$.

Invest. Level	**0**	$\frac{1}{3}E_a$	$\frac{2}{3}E_a$	E_a
0	$\left(\frac{1}{3}E_a;\ E_a\right)$	$\left(\frac{2+\sigma}{6}E_a;\ \frac{4+\sigma}{6}E_a\right)$	$\left(\frac{1+\sigma}{3}E_a;\ \frac{1+\sigma}{3}E_a\right)$	$\left(\frac{2+3\sigma}{6}E_a;\ \frac{\sigma}{2}E_a\right)$
$\frac{1}{3}E_a$	$\left(\frac{\sigma}{6}E_a;\ \frac{6+\sigma}{6}E_a\right)$	$\left(\frac{\sigma}{3}E_a;\ \frac{2+\sigma}{3}E_a\right)$	$\left(\frac{\sigma}{2}E_a;\ \frac{2+3\sigma}{6}E_a\right)$	$\left(\frac{2\sigma}{3}E_a;\ \frac{2\sigma}{3}E_a\right)$

Table 3.3: Example of anticipated payoffs if players split the pie evenly.

In Table 3.3 the favoured player's investment options are shown in the top row. The investment choices of the less favoured player are shown in the first column on the left. If players consider their investment options independently then the above table suggests that total payoff decreases for both players as their own investment increases. Also, their payoff increases as the investment of the other player increases. As shown in the previous section, in case of an anticipated even split, not investing is the dominant strategy for both players.

3.2 Hypotheses

I first present the Hypotheses concerning players' investment behaviour. According to the possible salient subgame perfect Nash equilibria and Nash equilibrium conditions, players will choose a distribution rule that lets them maximize their payoff, fulfilling necessary criteria for an efficient subgame perfect Nash equilibrium. However, if players have fairness concerns, their investment behaviour will be influenced by the absolute endowment level, as larger differences in endowment lead more easy to inequity in the bargaining stage. If players are concerned with exploitation as a result of the hold-up scenario, they do not invest at all. Also, in the experiment favoured players have the opportunity to not invest the whole endowment. If players are concerned with principles of equity and inequity, they would attempt to invest on the level of their co-participant in order to not minimise the possibility of an unequal split. Hence, Hypotheses 1a, 1b and 1c are derived.

Hypothesis 1a: *Players will invest their full endowment,* $I_a = E_a$ *and* $I_b = E_b$ *as part of a salient subgame perfect Nash equilibrium division.*

Hypothesis 1b: *Players are concerned with principles of fairness and inequity in the investment stage, such that higher differences in starting endowment levels lead to a lower investment rate.*

Hypothesis 1c: *Players are more concerned with principles of fairness and inequity than efficiency, such that players invest but not the full amount.*

Spatial cues should have an effect on players choosing different division rules in the horizontal configuration and the vertical configuration, selecting between the different salient division rules. The presence of spatial cues in the horizontal configuration of the bargaining table gives rise to Hypothesis 2:

Hypothesis 2: *Players anticipate equal splits in games with a "vertical" configuration and do not invest as the threat of exploitation is higher without the spatial cues given.*

Given the reasoning above regarding bargaining, Hypotheses 3 and 4 are derived.

Hypothesis 3: *Given efficiency considerations, and according to the Nash equilibrium condition, players will claim no more than the pie less the other player's investment and more than their own investment producing a mutual gain.*

Hypothesis 4: *Players split the surplus proportionally in games with a "horizontal" configuration of payoffs, due to spatial cues. In games with a "vertical"* *configuration equal splits of the pie should be more common, as suggested by bargaining theory.*

A salient subgame perfect Nash equilibria for distributing the pie include an even split of the surplus generated as well as an even split of the net surplus generated. Research has shown that an even split of the net surplus, whenever possible, is a predominant result (E&Ja). This is attributed to inequity aversion (Fehr & Schmidt, 1999). Also Isoni et al. (2014) found evidence that players attempted to establish equality in the distribution of the surplus. If players had strong fairness concerns, this could affect investments as well as bargaining results. Further, equity theory suggests that players perceive themselves in a relationship with each other and perceive it as fair if they divide the pie efficiently according to the proportion that was contributed by each player. Given the theory, the hypotheses below are derived.

Hypothesis 5a: *Players concerned with proportion seek a division of a pie based on each players contribution to the pie,* $C_a = \{I_a/(I_a + I_b)\}P$ *and* $C_b = \{I_b/(I_a + I_b)\}P$.

Hypothesis 5b: *If players are inequity averse regarding total payoffs, players will split the pie such that the less favoured player is receiving the larger share of the pie and that equal payoffs are generated incorporating initial endowments.*

Hypothesis 5c: *If players are inequity averse regarding the payoffs in the game, players will split the net surplus of the game equally* ($½(P – I_a – I_b)$ *wherever possible.*

In order to shed further light on players' possible fairness concerns, extra noise in the investment process was added in Games 5 and 11; these games are otherwise strategically identical to Games 1 and 7. Every investment produced objects only with a 90% probability. In the "vertical" configuration (Game 11) players then would not know for sure which part of the surplus has been generated by their own investment. This makes it more difficult for players to choose among division rules for the pie:

Hypothesis 6: *Comparing the strategically identical Games 7 and 11, the additional noise in the investment process should result in a higher frequency of equal splits of the pie in Game 11.*

3.3 Experiment procedure

My experiment consisted of a sample of 134 subjects. Each subject participated in the experiment only once. There was a total of 8 sessions with 16 to 18 subjects in each session. Each session lasted in between 40 to 60 minutes. If there were multiple sessions in one day, the sessions were one hour apart, so that subjects who completed the experiment could not pass on their knowledge to arriving subjects for the next experiment. The experiment was held in the computer laboratory in the University of East Anglia. For the experiment, subjects interacted via the software z-Tree (Fischbacher, 2007). The subjects were recruited from the UEA student population via the ORSEE-System (Greiner, 2004). No specific criteria applied for selecting the subject pool. For the experiment, an even number of subjects in each session was recruited. If an uneven number of subjects arrived and if subjects came late, they were told to register for one of the following sessions, and they were paid a show-up fee of £2. For the proceedings of the experiment, a within-subjects design was used. Each subject encountered 12 consecutive two-player bargaining situations during each session. Between one session and the next, the sequence of the bargaining games was randomly changed. In a particular session, the sequence of the bargaining games was the same for any subject. The sequence of the bargaining games for all sessions was determined before the start of the first session using the website www.randomizer.org (Appendix 3.1). Within a particular session, each game was started manually by the experimenter, when the previous game was completed by all participants in the room.

Prior to the start of the experiment, subjects were seated by the experimenter in no particular order in the computer laboratory. At the start of each session, the subjects received on screen a complete set of instructions (Appendix 3.2). The instructions were read aloud by the experimenter and the subjects could follow them on their screen. After that, subjects were asked to answer 3 comprehension questions following the instructions. Only after all subjects answered the questions correctly, the first game was started. Subjects could read the instructions on screen as often as needed and also ask questions to the experimenter. Direct verbal communication between subjects was not allowed. The instructions gave subjects a full set of information regarding the proceedings during the session, the number of scenarios, calculation of payoffs, as well as the matching procedure. In addition, each subject received a set of information before each single game informing them of their role and the setup of the game.

Further, the subjects were informed that one of the 12 scenarios would be selected randomly at the end of the session, determining their final payoff. Players did not know which of the scenarios would be the real one until all games have been completed, so they had to treat each game as if it was the payoff relevant game. This was done out of budget considerations. Also, players were told that their final compensation consisted of the earnings from the chosen payoff scenario in addition to the show-up fee.

After every player completed the questions at the beginning, all players were faced with the scenarios, one after each other. One scenario was completed once all players either successfully finished their tasks or if the timer expired. The amount of the initial endowment that players could invest in each game was determined by the setup of the game as well as by their role. The roles of the players, favoured and less favoured, were randomly determined at the start of each bargaining game. A favoured player was always paired with a less favoured player. Players were informed about their role prior to the game and about their corresponding endowment. In addition, players were informed about the endowment of the other player in each game.

At the beginning of each game, after learning about their role, their initial endowment, as well as the endowment of the other player, players were faced with two tasks in each game. First they had to choose how much of their initial endowment they were willing to invest or whether to invest at all. Players could make an investment by purchasing a number of objects with a certain monetary value using their tokens. The investment was made by selecting one of the presented options on screen by clicking on them. Options showed a number of objects with a certain money value for a specific price. Players that did not have an investment option saw a waiting screen. There was no time limit on investment options. The investment choices of players determined the size of the pie. Once the investment was made the second round in each game commenced.

The total number of objects bought by both players constituted the amount of objects to be distributed in the following bargaining stage. If in a particular bargaining game, no investment was made, no amount to be distributed was generated and thus, there was no bargaining stage following the investment stage. If no investment was made, players received the monetary value of their initial endowments (ratio 1 token = £1) in each bargaining game. The amount of the initial endowment, the monetary value each object had, as well as the cost for each object varied in each of the bargaining games (Table 3.2).

In the bargaining stage, which constituted task two in every round, purchased objects were placed on the bargaining table. Once the purchased objects were placed on the table, the actual bargaining process started. Each bargaining stage lasted 90 seconds. Within this frame, players could bargain with their co-participant by inputting the number of objects that they claimed. This choice could be changed continuously during the given time frame. Their choice as well as the choice of their co-participant was indicated immediately on the bargaining table by showing blue and red dots next to the number of objects that were chosen. If any of the two players agreed with the distribution of objects, they had the possibility to press an “agree” button. If the agree button was pressed by both players, the bargaining stage ended instantly.

The arrangement of the objects on the bargaining table, as well as the selection mechanism of the objects, was given exogenously in this experiment. After any given player stated the number of desired objects, the computer selected the objects on the table automatically. No specific object could be claimed by the players, as discussed above. In the horizontal frame, the computer selected the objects nearest to a player’s base, starting with the object nearest to that base, as discussed. In the vertical frame, the computer started to select objects starting at the top for the favoured player and starting from the bottom for the less favoured player. The subjects were informed about this selection-mechanism when the instructions were given out and prior to each game. Players were informed if the total number of objects claimed exceeded the number of objects on the bargaining table by a red, blinking message on the screen stating “double claim”. After the bargaining stage ended, either by agreement, or by time out, the game was completed. All players were playing a particular game at the same time. Two players at a time saw the same scenario, as they were directly bargaining with each other. Once all rounds were completed by all players, players saw the payoff screen right away and awaited their payment. The payoff screen showed players the investment and bargaining outcome. Players were asked to wait at their desks for payment. Once paid, subjects left the computer laboratory. This concluded the experiment.

4. Results

Overall, 1608 individual observations of investments and bargaining behaviour were made in my experiment. I first investigate players' investment behaviour, followed by the players' bargaining behaviour.

4.1 Investment results

Hypothesis 1a. I first tested whether players found an efficient investment level in all games (Hypothesis 1a). In all games, an investment rate of 61% for the favoured players and 64% for the less favoured players could be observed. This included investments in which the favoured players did not use their full endowment for investing. Table 3.4 gives an overview of the investment behaviour:

Game	E_a	E_b	I_a %	I_b %	$I_a = E_a$ %
Game 1	6	2	70.15%	71.64%	19.15%
Game 2	8	0	52.24%		25.71%
Game 3	9	3	68.66%	62.69%	30.43%
Game 4	6	0	55.22%		100.00%
Game 5	6	2	71.64%	62.69%	25.00%
Game 6	10	2.5	52.24%	68.66%	25.71%
Game 7	6	2	65.67%	59.70%	34.09%
Game 8	8	0	41.79%		39.29%
Game 9	9	3	70.15%	65.67%	29.79%
Game 10	6	0	59.70%		100.00%
Game 11	6	2	71.64%	55.22%	31.25%
Game 12	10	2.5	56.72%	73.13%	23.68%

Table 3.4: Investment results

In Table 3.4, the endowment levels of the favoured player are depicted by E_a and that for the less favoured player by E_b. The percentage of players who invested at least some of their endowment is shown in the next two columns (for the favoured player (I_a) and the less favoured player (I_b)). The last column shows the percentage of full investments made by favoured players counting only players that made non-zero investments. Generally, investment levels lie between 41.8% and 71.6% for the favoured player and between 55.2% and 73.1% for the less favoured player. The range in the $I_a = E_a$ category lies between 19.1% and 39.3% excluding the obvious 100% investments (in these games, players could only choose one investment option). On the aggregate level, it seems that the evidence does not support Hypothesis 1a (i.e., that players always invest their whole endowment) for the favoured player ($\chi^2 = 215.244$, $p < .001$) and the less favoured player ($\chi^2 = 67.161$, $p < .001$).

Hypothesis 1b. I next tested whether players were concerned with fairness in the investment stage and such higher differences in starting endowment lead to a lower investment rate (Hypothesis 1b). At first glance investment levels between the favoured and unflavoured player seem similar. Several conclusions that elucidate players' fairness preferences when making investment decisions can be drawn from the results in Table 3.4. It becomes apparent that the investment rate of the less favoured player seems at least as high as the investment rate of the favoured player, sometimes even higher. Specifically, in 3 games the less favoured player had a higher investment rate than the favoured player. However, overall investment rates between the player types were not significantly different ($\chi^2 = 0.202$, $p = 0.653$). All players perceived the same uncertainty of whether the other player invested, and whether a gain could be realized in the ensuing bargaining game.

However, it appears that the level of endowment differences had an effect on investment rates. It can be observed that favoured players invested at lower rates (i.e., lower %) than less favoured players in Games 6 and 12 ($\chi^2 = 7.721$, $p < .005$). Investment levels for the favoured player for these games were similar to games in which the less favoured player did not have any initial endowment. The explanation that the multiplier σ had a determining effect can be rules out (odds ratio =.624, $z = -.95$, $p = .344$ for the favoured player; odds ratio = .479, $z = -1.03$, $p = .304$ for the less favoured player).

The larger the difference in endowment, the less likely the favoured player is to invest. A logistic regression analysis showed that the difference in endowments did predict whether the favoured player invested, odds ratio = .803, z = -4.64, p < .001. This means that the likelihood of the favoured player investing decreases as endowment differences increases.

The odds that the less favoured player invests do not depend on the difference of endowment (odds ratio = 1.076, z = 1.27, p = .204). The fact that the absolute difference in endowments predicts investment behaviour lends some support to the notion that favoured players see a higher risk of exploitation as endowment differences increase. The above evidence partially supports Hypothesis 1b, that players are concerned with fairness and inequity already in the investment stage, and that investments for favoured players are lower in games with a large difference in starting endowments.

Hypothesis 1c. Next I investigate whether fairness concerns lead to suboptimal investment levels (Hypothesis 1c). As most games had the option for the favoured player to invest a fraction of the endowment, it is necessary to look at investment behaviour in more detail.

Table 3.4 shows that the investment rate of the favoured player is higher in games in which the less favoured player also had an endowment. The range of the investment rate for the favoured player lies between [52.2%, 71.6%] when the less favoured player also had an endowment. The investment rate for the favoured player is lower [41.8%, 59.7%] in cases where the less favoured player had no endowment. In order not to bias the results, only Games 1, 4, 7 and 10 were compared as the endowment level for the favoured player is the same. The results showed that investment rates of the favoured player were slightly higher when the less favoured player could also invest (χ^2= 3.127, p = .077).

The favoured player had up to 5 different investment choices. Each choice represented a fraction of the entire endowment. For Game 1, level 1 represents an investment of 2 tokens, level 2 represents an investment of 4 tokens and level 3 an investment of 6 tokens, the full investment. Level 0 represents that no investment was made. In most games in which both players could make an investment, a level 1 investment was the most common choice for players to choose. In games in which both players can invest, a level 1 investment always represents the maximum possible investment that the less favoured player is able to make.

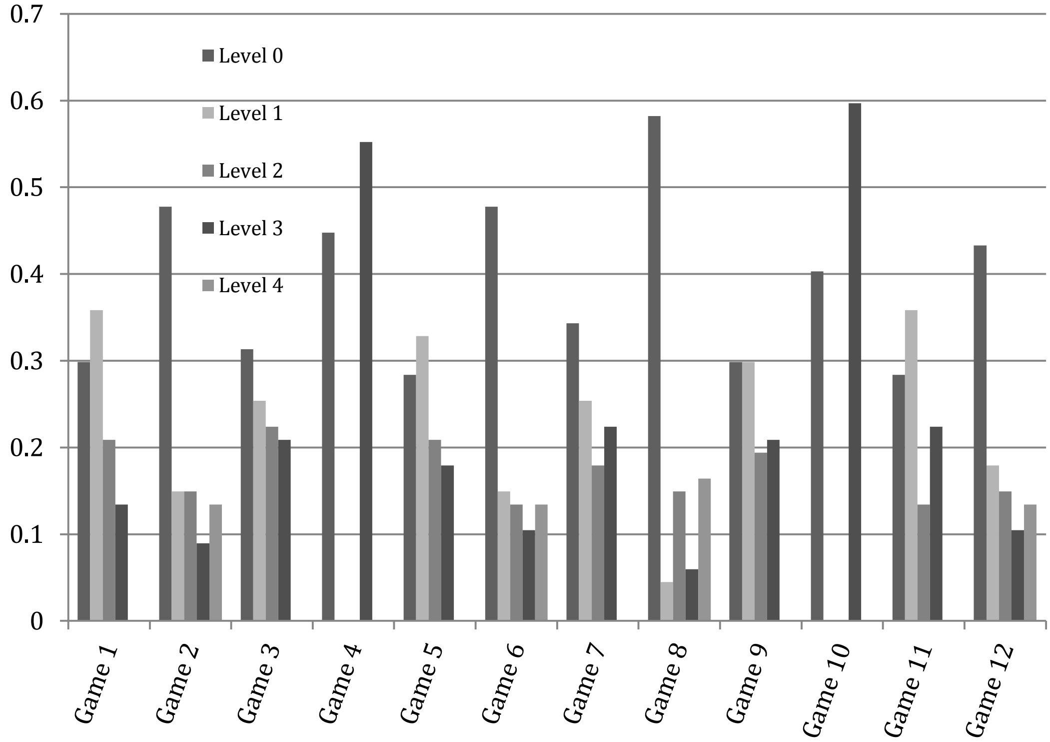


Figure 3.4: Detailed investment distribution of the favoured player.

Omitting the games in which there was no investment, the investment frequencies show that favoured players made level 1 investments in a frequency range between 10.71% and 51.06%. In Game 8, due to uncertainty, favoured players overwhelmingly chose not to invest (58.21%). Favoured players invested over 50% on level 1 in Game 1 and Game 11. In the rest of the games, level 1 investment typically lies in the range of approximately 30% - 40%. In comparison, investment on levels 3 and 4 occurred with a lower observed frequency range of 14.29% and 34.09%. When looking at investment behaviour of the favoured player in games with three investment levels and with an initial endowment for the less favoured player (Games 1, 3, 5, 7, 9, 11), investment at levels 1 is marginally different ($\chi^2 = 3.657$, $p = .055$), where investment at level 1 is at 44.29% (level 2 = 27.50%, level 3 = 28.21%). Thus, for games in which both players had an investment option the favoured player matches predominantly the maximum level of investment that the co-participant can make. Despite the hold-up problem, the favourite player invests, but on a sub-optimal level. This is an indication of fairness concerns and partially supports Hypothesis 1c.

Hypothesis 2. Next, I tested the effect on payoff-irrelevant cues on investment decisions. In case games with a vertical configuration, players could anticipate an equal split and not invest (Hypothesis 2). There was no apparent framing effect between games with a horizontal configuration of payoffs and games with a vertical configuration of payoffs (Games 1-6 in comparison with respective Games 7-12). Investment rates for the favoured player between strategically identical games appear similar (Game 1 (70.2%) and Game 7 (65.7%); Game 2 (51.2%) and Game 8 (41.8%); etc.). Investment rates between Games 1-6 and Games 7-12 for the favoured player (χ^2 = 0.047, p = .828) and the less favoured player (χ^2 = 0.524, p = .469) are not significantly different. This means that players do not consider non-payoff-relevant cues in order to make their investment decisions. Table 3.5 displays the comparison of the individual games:

Comparison of games		Favoured Player	Less Favoured Player
Game 1	Game 7	.579	.145
Game 2	Game 8	.226	
Game 3	Game 9	.852	.718
Game 4	Game 10	.600	
Game 5	Game 11	1.000	.380
Game 6	Game 12	.603	.568

Table 3.5: Comparison of individual games regarding investment activity of favoured players and less favoured players: *p*-values.

The first two columns of Table 3.5 show the games which are compared, while the third and fourth column shows the p-values of the χ^2-Tests. The Hypothesis that players do not invest in games with a "vertical" configuration cannot be supported. Overall, there is no evidence to support Hypothesis 2.

4.2 Bargaining

Hypothesis 3. Next I test whether players make claims according to efficiency criteria such that both players have a mutual gain. To shed light on players' bargaining behaviour as well as to test players' preferences for splitting the pie, I first look at average claim levels. The average claim of the favoured player is £4.75 and for the less favoured player it is £3.42 over all games. Table 3.6 presents a more detailed view on the games in terms of average claims, showing all games in which at least one player invested.

Game	Average Claim Favoured Player	Average Claim Less Favoured Player
Game 1	£3.69	£3.03
Game 2	£4.94	£2.34
Game 3	£5.59	£4.00
Game 4	£6.70	£3.65
Game 5	£3.60	£2.74
Game 6	£3.83	£3.36
Game 7	£4.00	£2.89
Game 8	£5.79	£3.14
Game 9	£5.15	£5.08
Game 10	£6.50	£3.93
Game 11	£3.14	£2.97
Game 12	£4.04	£3.93

Table 3.6: Average claims of both players per game.

The difference between the claims for favoured and less favoured players is higher in games in which the less favoured player could not invest anything. Favoured players claimed significantly more than less favoured players in Games 2 (z = 3.618, p < .01), 3 (z = 2.820, p = .004), 4 (z = 5.629, p < .01), 8 (z = 3.560, p < .01), and 10 (z = 4.838, p < .01).

In order to investigate inequity aversion tendencies a closer investigation on agreement structures (including Nash equilibrium conditions) is presented next. First, the agreement structure was investigated in terms of efficiency. Regarding the games in which there was investment, in 5% of the cases players reached sub-optimal agreements and objects remained on the table. In 16.5% of the games in which there was investment, players could not reach an agreement. However, in the rest of the games (78.5%) players reached an efficient outcome, meaning all objects on the table were allocated to the players. Table 3.7 presents the results per game including the games in which there was no investment.

Game	Frequency Not Invested	Frequency Efficient Agreement	Frequency Suboptimal Agreement	Frequency no Agreement
Game 1	13.43%	62.69%	5.97%	17.91%
Game 2	47.76%	41.79%	4.48%	5.97%
Game 3	13.43%	71.64%	1.49%	13.43%
Game 4	44.78%	44.78%	5.97%	4.48%
Game 5	14.93%	65.67%	5.97%	13.43%
Game 6	13.43%	73.13%	1.49%	11.94%
Game 7	14.93%	68.66%	1.49%	14.93%
Game 8	58.21%	37.31%	1.49%	2.99%
Game 9	11.94%	59.70%	2.99%	25.37%
Game 10	40.30%	38.81%	5.97%	14.93%
Game 11	13.43%	73.13%	2.99%	10.45%
Game 12	17.91%	65.67%	4.48%	11.94%

Table 3.7: Agreement distribution by game including games in which there was no investment.

In games where both players had an initial endowment, players found an efficient agreement in the frequency range of 59.7% and 73.13%. In these games, the frequency range of finding no agreement lies between 10.45% and 25.37%. This is a clear indication of occasional coordination failure by both players. Only in a very few cases did players reach a sub-optimal agreement (range: 1.49% - 5.97%). For games in which the less favoured player had no endowment, the agreement structure was slightly different. The frequency of no investment in these games was higher, thus the games in which there were efficient agreements much lower (41% and 68% for games without and with two-sided endowments, respectively, $\chi^2 = 53.148$, $p < .001$). On an aggregate level players were fairly efficient in dividing the amount to be split, finding an efficient distribution more often than not (78.5%; χ^2test, $p < .001$). On an aggregate level, players more often found mutually beneficial distributions (68.5%) than not (χ^2-Test, $p < .010$). This gives some support to Hypothesis 3, because players' claims were larger than their own investment and less than the pie minus the other player's investment[14].

[14] However, excluding agreements in which one player had a payoff of 0, the percentage of mutually beneficial agreements drops to 33%.

In support of this result, Figures 3.5a – 3.5l depict the distribution of the net gain for each player in each game in which a successful agreement was reached. Each figure consists of a coordination system in which units on each axis are equal to one. The position of each number shows the agreement reached between a pair of players. The number displays the frequency of a particular agreement. The line depicts the maximum possible net surplus, (i.e., both players fully invest their endowment and successfully agree on a distribution of the amount to be split). Agreements below the line can also be an efficient distribution, as players might not have invested their complete endowment. Any number located in the first quadrant depicts a mutually beneficial agreement in which both players realized a net gain. Any number in the fourth quadrant depicts agreements in which the player with the higher initial endowment received less than his investment. Any number in the second quadrant shows agreements in which the less favoured player realised a net loss. Any number in the third quadrant shows successful agreements in which both players received a net loss. The net gain is calculated as earnings from the bargaining minus the initial investment. Since investment was overwhelmingly at level 1, often the net surplus to be divided was fairly small. Hence, not making a loss for either player is a success and is viewed as mutually beneficial in this game. Any number on an axis, meaning that a player received 0 net gain, is therefore viewed to be part of quadrant 1.

Hypothesis 4. Next I investigated Hypothesis 4, which states that players reach more equal splits of the pie in games with a vertical configuration and reach proportional agreements in games with horizontal agreements. The results presented in Table 3.6 show that there does not appear to be a substantial difference on the average claims between Games 1-6 (games with horizontal alignment of objects) and Games 7-12 (games with vertical alignment of objects; z =-0.879, p = .379; Wilcoxon Rank Sum Test). Thus, on first glance no evidence was found that players used the spatial features of the bargaining table to coordinate their claims. However, the results in Table 3.6 do not show the claims relative to the investment levels and surplus generated.

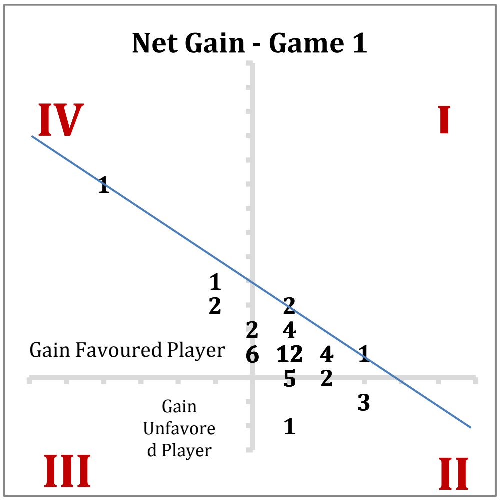


Figure 3.5a: Split of net surplus – Game 1

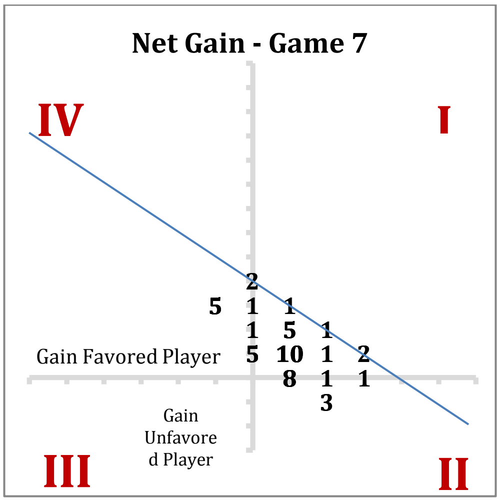


Figure 3.5b: Split of net surplus – Game 7

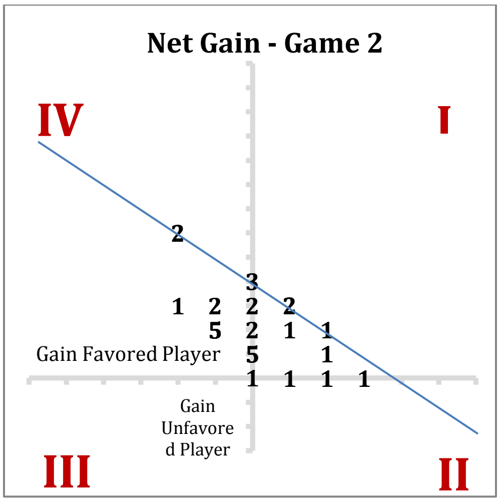


Figure 3.5c: Split of net surplus – Game 2

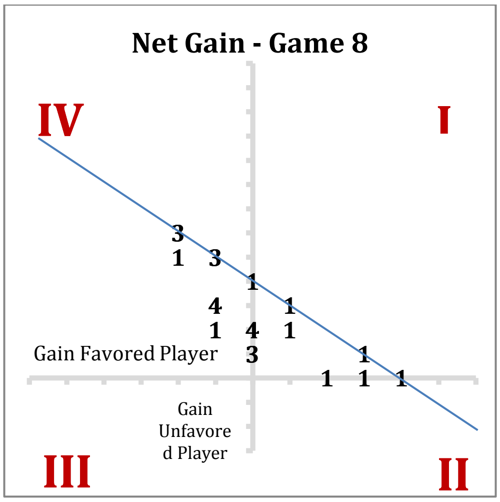


Figure 3.5d: Split of net surplus – Game 8

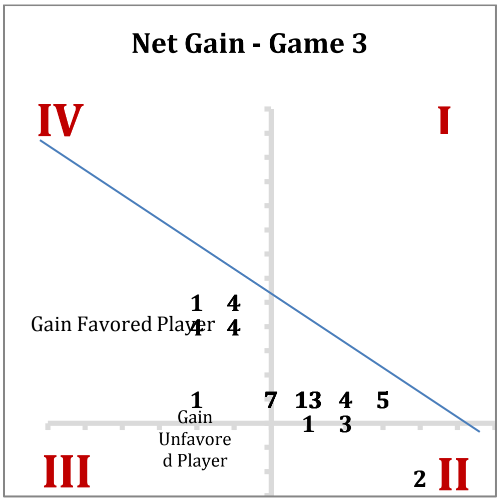


Figure 3.5e: Split of net surplus – Game 3

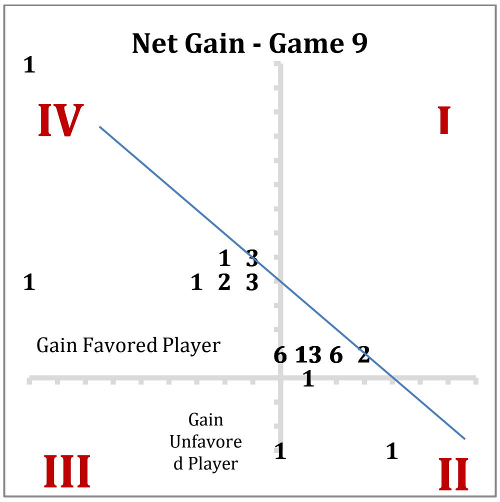


Figure 3.5f: Split of net surplus – Game 9

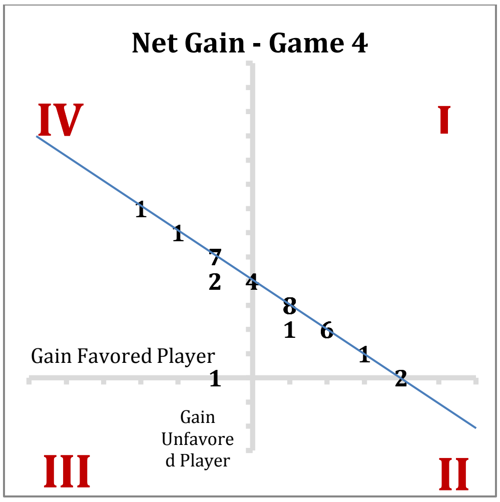


Figure 3.5g: Split of net surplus – Game 4

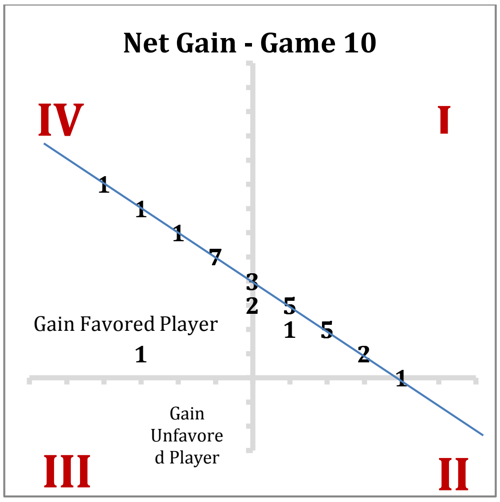


Figure 3.5h: Split of net surplus – Game 10

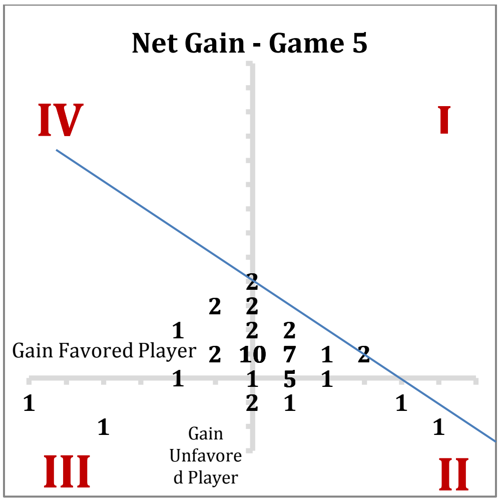


Figure 3.5i: Split of net surplus – Game 5

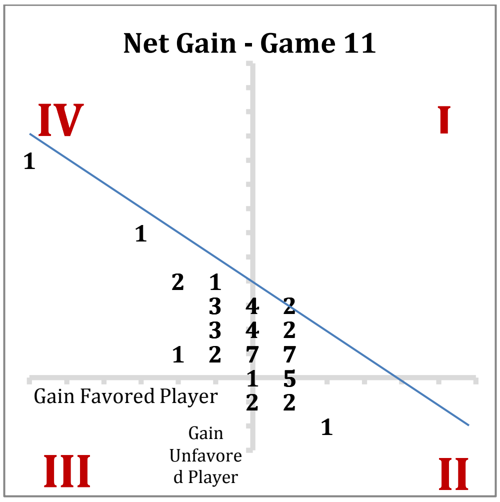


Figure 3.5j: Split of net surplus – Game 11

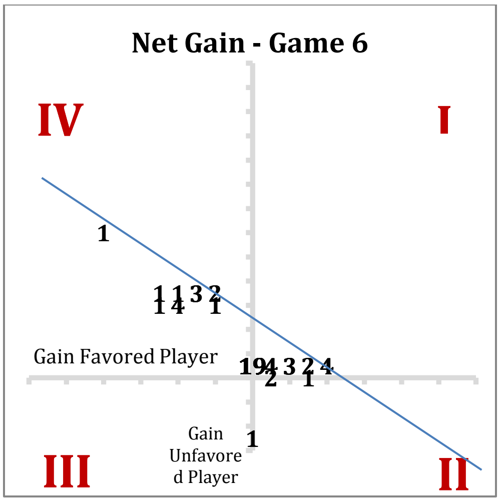


Figure 3.5k: Split of net surplus – Game 6

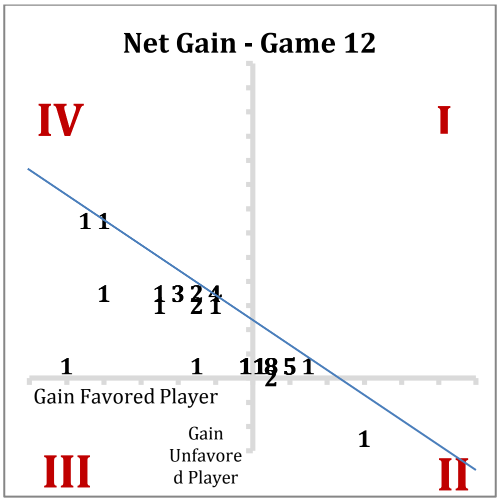


Figure 3.5l: Split of net surplus – Game 12

The frequency of favoured players dividing the pie equally in games in which there was an optimal agreement lies at approximately 62% (81% for less favoured players). As not all games allowed for equal splits, the stated frequency includes splits in which the amount to be distributed was split using the next best division (e.g., a split of a pie of size 3 where one player receives 2 and one player receives 1). Hence, the frequency might include other distribution rules. Testing this measure between Games 1-6 and 7-12 revealed no statistical difference between those group of games ($\chi^2 = 0.145$, $p = .703$). The less favoured player seeks equal splits with a 100% in Games 7-12 and with 81% in Games 1-6 ($\chi^2 = 38.035$, $p < .001$). However, in order to better test Hypothesis 4, games in which the pie size allows for an even split needs to be investigated only. In games with evenly divisible pies, players made claims to split the pie evenly with a frequency of 55%. For both players, no difference between games with horizontal configuration and vertical configuration could be detected ($\chi^2 = 0.324$, $p = .569$). Comparing games in which both players invested, results showed that players in Games 1-6 and in Games 7-12 did not split the pie proportionally with a different frequency (χ^2-Test, $p = .350$). Overall, there is not sufficient evidence for Hypothesis 4.

*Hypothesis 5*a. Next I investigate if players seek a distribution based on their contribution (Hypothesis 5a). Figures 3.6 and 3.7 show the distribution of claims versus the level of contribution to the pie made by the favoured and the less favoured player over all games. The horizontal x-axis measures the percentage contribution of the claim, while the vertical y-axis measures the percentage contribution to the pie.

Figure 3.6 and Figure 3.7 are mirror images of each other. The main bulk of the claims of favoured players seemed to be in the range of 50% and higher, meaning the favoured player contributed at least 50% to the amount to be split. The less favoured players contributed 50% and less to the total amount to be split. Any points on the equity line show instances in which a player claimed the same ratio of the amount to be split that was contributed by investment. The majority of points is located around the equity line, suggesting that players did not claim significantly more than what was contributed. While claims are related to contributions, not all divisions are proportional.

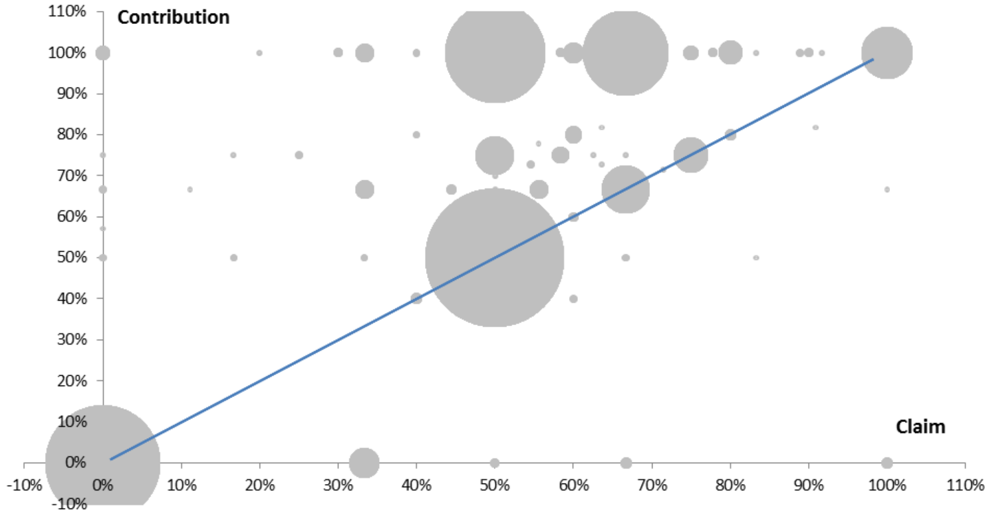


Figure 3.6: Favoured player claims versus contribution

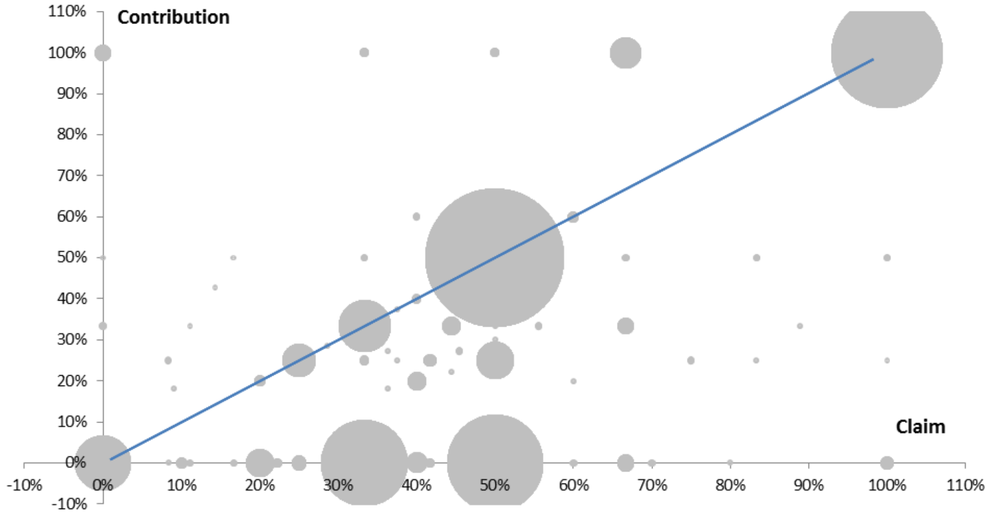


Figure 3.7: Less favoured player claims versus contribution

Favoured players have a tendency to make smaller claims in comparison to their contribution (above the equity line), while less favoured players have a tendency claim somewhat more than what they contributed. Next to some degree of proportionality, this suggests also some degree of inequity aversion. A linear regression reveals that contributions of all players (in percent) significantly predicts the players' claim (in percent), $b = .36$, $t = 16.1$, $p < .001$. This means that an increase in the contribution of one percent increases the final claim by 0.36%. The positive relationship between contributions and claims suggests that players are sensitive to their own contribution levels. However, claims do not match contributions in perfect proportion. To further elucidate the notion of proportional splits, equity ratios are investigated next.

The data in my experiment suggests that players were very concerned finding claims that matched the level of their contribution to the pie. In cases in which both players invested an amount greater than 0, in 50% of the cases the ratio $\frac{C}{I}$ was identical for the favoured and the less favoured player. Not all games provided the opportunity to achieve an exact identical ratio, as perhaps the pie was not perfectly divisible. If we consider games in which the proportionality ratios were within the range of ±0.5[15] of each other, approximately 63% of games in which both players invested fall into that category. Accordingly, in significantly more games, claims were made according to proportionality ($\chi^2 = 17.387$, $p < .001$). However, in games with two-sided investment possibilities in which some players did not invest despite having an endowment, in 43.0% of the cases the players matched their claims according to their contribution of the amount to be split.

However, there is also evidence for some degree of inequity aversion. Sometimes less favoured players did not claim anything, even if they did not have an initial endowment. Also, not all claims were on the equity line. Favoured players claimed somewhat less than what they contributed and less favoured players claimed more, hence some compensation for the less favoured player could be observed.

Further, as the above results from section 4.1 suggest, both players had a preference to invest on the level of $I_a = I_b = E_b$, followed by an even split of the pie. Coordination on this inefficient Nash equilibrium also suggests on one hand that players seek equity. On the other hand, this choice reduces the risk of players' failing to coordinate and choosing different distribution rules. This special case satisfies equity theory, inequity aversion as well as an even split of the pie, but it does not satisfy efficiency criteria. Overall, evidence suggests that players preferred a division of the pie according to equity principles (Hypothesis 5a).

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[15] A ratio difference includes a split in favour of the player with the higher endowment but excludes a split in favour of the less favoured player (e.g., a pie of £12 (full investment of both players in Game 1) is split such with playoff combinations for the favoured and less favoured player of (£10, £2) and (£9, £3) respectively would be measured. A split suggested by inequity aversion in which the net surplus is split evenly with payoffs of (£8, £4) would yield larger difference than 0.5 between the rations. Thus it is not measured. This is a way to distinguish between Equity Theory and inequity aversion in players' choice behaviour.

Hypothesis 5b: Now I test whether players are inequality averse regarding total payoffs (Hypothesis 5b), which leads to some degree of compensation in the bargaining stage. In games in which two-sided investment was possible, it appears that players had more difficulties finding mutually beneficial agreements when the surplus was low. However, logistic regression analysis shows that the surplus generated did not predict whether players achieved a net gain, odds ratio = .96, z = -0.76, p = .449. While most players found a mutually beneficial distribution, it appears from Figures 3.5a 3.5l that the less favoured player gained more than the favoured player.

In a number of games, the favoured player incurred a net loss, suggesting that players tended to compensate overall inequality of the starting endowments. This evidence gives some support towards inequity aversion. To further investigate inequity aversion, I conducted a gain and loss analysis of successful agreements which is presented in Table 3.8.

The first and second columns of Table 3.8 show the average net gains that the favoured and less favoured player incur. If added to the initial endowment this number shows the total payoff a player had on average. The favoured players had overall net earnings of £0.23, while the less favoured player gained £1.79 on average. This difference is significant (Mann-Whitney U test, z = -12.8, p <.001). The distribution of the net surplus shows that much of the surplus is allocated to the less favoured player.[16]

Taking a closer look at inequity aversion reveals that players only to some degree show signs of inequity aversion with regard to the whole amount of the money involved (i.e., surplus from the game plus not invested endowments). Favoured players made fewer claims (36%) regarding a split that divides the whole pie including the not invested endowments of both players than would be expected according to Hypothesis 5b (χ^2-Test, p < .001). Similarly, less favoured players also made fewer of these claims (18%) as would be expected (χ^2-Test, p < .001)[17]. Regarding all games, there seems little evidence to support Hypothesis 5b (i.e.,

[16] No framing effects could be found between games 1-6 and games 7-12 (Mann-Whitney U test, z = -0.05, p =.958)

[17] Only games in which there were agreements dividing the entire pie were included in this analysis.

players claim half of the pie plus the other player's not invested endowment). However, evidence from Figures 3.5a-3.5l as well as Table 3.8 suggests that there seems to be some compensation for the less favoured player for having a lower endowment.

Game	Avg Net Earnings Favoured Player	Avg Net Earnings Less Favoured Player	Favoured Players' Frequency of positive Earnings	Less Favoured Players' Frequency of positive Earnings
Game 1	£0.89	£1.17	91.30%	91.30%
Game 2	£0.00	£2.23	67.74%	100.00%
Game 3	£0.63	£1.65	71.43%	95.92%
Game 4	£0.50	£3.26	64.71%	100.00%
Game 5	£0.33	£1.23	83.33%	85.42%
Game 6	-£0.16	£1.24	72.00%	98.00%
Game 7	£0.85	£1.23	89.36%	93.62%
Game 8	-£0.08	£2.81	53.85%	100.00%
Game 9	£0.07	£1.95	71.43%	95.24%
Game 10	£0.23	£3.47	63.33%	100.00%
Game 11	-£0.08	£1.63	72.55%	90.20%
Game 12	-£0.56	£1.59	59.57%	97.87%

Table 3.8: Average net earnings and frequency of positive net earnings in games with agreements.

Although inequity aversion does not seem to matter with regard to the total payoff, the above results give some support towards a general inequity aversion as splits of the pie seemed to give the less favoured player larger gains. Some evidence suggests that favoured players incur net losses, hence compensating the less favoured player for a lower starting endowment.

Hypothesis 5c. Now I test whether players are inequity averse with regard to the payoffs in the game (Hypothesis 5c). In order to test players' preferences regarding this division rule, games in which the surplus is evenly divisible need to be investigated. Games in which the surplus is uneven are excluded, so inferences can be properly made. In games in which the net surplus is evenly divisible the favoured player claims half of the surplus with an observed frequency of only 26% (29% for the less favoured player; χ^2-Test, *p*s < .001). This evidence does not support Hypothesis 5c[18].

Hypothesis 6. Lastly, I tested Hypothesis 6 which states that the added noise (i.e., investing one token leads to the generation of an object with a chance of 90%) could lead to a higher use of the rule that splits the pie evenly. Comparing Game 11 (noise) compared with Game 7 (no noise) shows that players did not split the pie evenly with a higher frequency in either of the two games ($\chi^2 = 0.811$, $p = .367$). Hypothesis 6 cannot be supported. Extra noise does not seem to be a determinant in the current bargaining scenario.

5. Conclusion & discussion

Prior research has identified that pre-game communication as well as pre-investment determination of ownership structures provide a partial remedy for the common underinvestment problem in a hold-up scenario. Further, it was found that subjects had strong fairness and inequity aversion preferences. However, not all situations allowed for explicit or implicit pre-investment communication. In the current experiment, I provided insight on the influence of non-payoff-relevant cues in a hold-up scenario as well as on fairness concerns in investment and bargaining situations. My design improves players' investment rates in games without pre-investment communication, but it does not solve the problem of underinvestment entirely. Players seemed to make payoff-salient decisions without the use of payoff-irrelevant cues (i.e., spatial proximity). Further, players exhibited preferences for relational equity, some inequity aversion as well as reciprocity. Overall, fairness concerns in case of asymmetric starting endowments seem to cause inefficiencies. The following section reviews the results in more detail.

[18] However, this result does not include games in which the pie was not evenly divisible (i.e., a net surplus of 3), in which case players could have been inequity averse. Hence the measured frequency understates to some degree the preference of players for inequity aversion.)

5.1 Comparison with the experiment of E&Ja

The investment rates in my experiment were slightly lower than the investment rates in games with one-sided communication as featured in E&Ja (80.0%). Game 4 and Game 10 in my experiment gave players a similar investment option as in the experiments of E&Ja. Both of my experiments provided an endowment of 6 tokens (60 SEK respectively) and upon investment a surplus of £10 (100 SEK respectively) can be generated. Investment rates in Games 4 and 10 are at 55% and 60%. The design of E&Ja (investment rates of 80% in games with pre-investment communication) remedies underinvestment better than my design. However, a comparison with the investment rates in the no communication treatment of E&Ja (26.0%) shows that my design results in higher investment rates.

I conjecture that players are motivated by a combination of issues to make investments more often in my experiment. For one, the free-form bargaining game allowed players to coordinate by using cheap talk. This form of bargaining is less subject to coordination failure compared with one-shot ultimatum games. Second, the visual representation of the surplus on a bargaining table could help players to coordinate, even though players did not utilize the spatial proximity cues as focal points in their decisions. Both bargaining methods, one-shot ultimatum games and unrestricted, free-form bargaining as in my design, leave a degree of uncertainty regarding possible agreements. Since the ultimatum game is only one round, deviating from a pre-game agreement can cause coordination failure and lead to sub-optimal outcomes or break down of bargaining (both players receiving nothing). A free form bargaining session, with unlimited opportunities to change one’s decision within a certain time frame, leaves aggressive players with the possibility to wait until the last seconds before adjusting their claim downward. This results in a game of chicken and can also cause coordination failure.

5.2 Investment behaviour

Players did not tend to invest their full endowment at all times and efficiency criteria were mostly not fulfilled. Generally players did not fulfil the efficiency criteria investing at a level of 100%. Players invested with a frequency of 61% for the favoured player and with a frequency of 64% for the less favoured player. Out of all the investments made, only between 19% and 39% of the investments comprised the full endowment of the favoured player. Thus, there is little evidence to support Hypothesis 1a.

Players did not seem to make choices with regard to efficiency but there is evidence that players' choice behaviour seems to be guided by fairness concerns as their choices were influenced by the difference in starting endowment (Hypothesis 1b). Investigating participants' responses in more detail, it came to light that players invested less as the difference in starting endowments between the two players got larger. I conjecture that favoured players are inequality averse and they do not believe that a fair division of the pie was likely with high starting endowment differences, fearing exploitation.

Favoured players had the option to invest less than full endowment but at the maximum level of the less favoured player. Overall, approximately 44% of two-sided investments made were at that level, giving some support to Hypothesis 1c. This suggests that favoured players formulated the belief that the less favoured player would invest (i.e., the less favoured player only could invest all or nothing) and reciprocate by investing exactly on that level. I conjecture that favoured players presume that reciprocating the investment level is the best strategy to avoid exploitation next to not investing at all. Players are collectively missing out on an opportunity to achieve a larger mutual gain because of their attitudes to equality and their beliefs about the co-players' attitudes. In that sense, fairness concerns in combination with asymmetric starting endowments cause inefficiency.

Overall, players invested positive amounts in games with a vertical configuration, and did not anticipate an equal split of the pie as a result of missing special cues. Investment behaviour did not differ between games with horizontal configuration and games with vertical configuration. Thus, a notion of ownership due to the presence of spatial proximity does not seem to induce a higher investment for the favoured player. This evidence does not support Hypothesis 2.

5.3 Bargaining behaviour

Players tend to claim more than their own investment and less than the pie minus the other players investment, satisfying efficiency and Nash equilibrium conditions. Regarding bargaining behaviour it can be observed that players usually found efficient splits of the pie (78.5%), such that no objects remained on the table. Overall, the less favoured player tends to have higher net earnings, which suggests some degree of compensation for a lower initial starting endowment. Players could generate non-negative net earnings with a frequency of 68.5%. In total, there exists some supporting evidence to confirm Hypothesis 3.

However, results from my experiment do not support the notion that the closeness cues of the spatial grid have an impact on players' claims. No difference in investment behaviour between games with horizontal alignment and vertical alignment was found. Similarly, claim levels do not significantly differ between the two frames. At the margin, in games in which the net surplus was not equally divisible, the player that invested more received the larger share of the net surplus. However, this result was similar for games with horizontal alignment and vertical alignment. Hence, also in these situations, players did not utilize spatial cues, but used the level of investment as a determinant for making claims. In the experiment of Isoni et al. (2013), spatial cues were used as decision criterion in non-cooperative bargaining games. In my experiment, spatial proximity ("rule of closeness") was not a salient focal point, as players were more concerned with fairness and payoffs. Further, players used equal splits of the pie as well as proportional divisions with the same frequency in games with horizontal configuration and games with vertical configuration. Overall, there exists no support for Hypothesis 4. Players do not utilize spatial cues of the horizontal configuration of the bargaining table to split pies more according to proportion. Also, players do not use equal splits of the pie more in games with a vertical configuration.

5.3.1 Fairness considerations

I considered two models of fairness, inequity aversion (Fehr & Schmidt, 1999) and the Equity theory (Adams, 1965) as salient subgame perfect Nash equilibria choices. While my experiment was not designed to select explicitly among the population distributions (i.e., preferences defined by different levels of α and β; cf. Fehr & Schmidt, 1999), inferences can be made and it is possible to investigate players' preferences towards certain splits of the pie. Results of my experiment showed that players were not predominantly choosing according to the particular subgame perfect Nash equilibrium that distributes the entire surplus (including the remaining endowments) evenly. Also, players did not predominantly make choices as defined in the subgame perfect Nash equilibrium that divides the net surplus (i.e., pie size minus the investments of both players). Hence, there is only some support for Hypotheses 5b and 5c. Players do not favour an exact split of the total surplus of the game to a great majority (Hypothesis 5b). Additionally, players do not favour an exact split of the net surplus of the game (Hypothesis 5c) wherever possible.

However, Fehr & Schmidt (1999) argued that players had preferences to some degree that allowed for agreements other than perfect splits of either the entire sum or the net surplus (different levels of α and β; cf. Fehr & Schmidt,1999). Further, Figures 3.5a- 3.5l as well as Table 3.8 show that there is some compensation for players with a lower starting endowment. Hence players are to some degree inequity averse. Thus, given the evidence above, the model of Fehr & Schmidt (1999) can to some extent explain the choice behaviour of the players. However, the model of Fehr & Schmidt (1999) does not explicitly explain choice behaviour regarding the different investment levels. In order to elucidate the strategy choices better, the idea of proportionality needs to be introduced, as players start on different endowment levels.

In terms of fairness, some data provides evidence to support the equity theory as proposed by Adams (1963, 1965). A salient split of the amount to be distributed is to take the proportion of contribution to the cake of each player into account. To conduct this analysis, it is necessary to consider games with asymmetric, two-sided investment possibilities. In my experiment, players matched their claims to their contributions to the pie with a frequency of 75% in games in which agreements were reached, which provides evidence for Hypothesis 5a. Players tend to focus on proportionality regarding claims and their contribution of the pie, such that relational equity is reached with the other player. Further, players chose to split the pie evenly with a percentage of 68.5%. At first glance, this would suggest a preference of players for this outcome. However, as players also had a preference for investing on the level of $I_a = I_b = E_b$, this result also suggests some sense of proportionality.

I conjecture that players perceive this outcome as the safest strategy next to not investing. Players seem to have some egalitarian preferences as to the risk of exploitation, which is the same for both players. This result suggests that the starting endowment level was not taken into consideration when the pie was split and that players had a preference for risk equality. The fact that not all pies were split equal in case of equal investment might imply coordination failure due to players playing aggressively. In this case, players mutually forgo higher gains to achieve equity. Fairness concerns in combination with asymmetric starting endowments cause inefficiency.

During the experiment extra noise was added in Game 5 and Game 11 in that every token invested generated an object only with a chance 90%. In games with a vertical configuration, players thus do not know how much of the investment was generated by their own investment and how much by the other player. Hence, no proportional division could be calculated and also no split of the net surplus. In this situation, it was anticipated that players would choose an equal division of the surplus. Games 7 and 11 had identical parameters with the exception of the extra noise. Comparing these two games, evidence did not support Hypothesis 6. Bargaining behaviour did not differ depending on noise and players used the same frequency of an even split of the surplus.

5.4 Conclusion

Taken together, the design of my experiment improved the underinvestment problem in games without pre-investment communication. Perhaps it is not surprising that players in this experiment invested more compared with players in the no-communication treatment in the experiment of E&Ja. The bargaining procedure in this experiment allows for some implicit communication between players by continuously sending claim preferences to the other player. There are several possible explanations why the underinvestment problem in games without pre-investment communication could not be solved. Players did not include the associated ownership by spatial proximity into their decision-making. Further, the bargaining procedure allows in the final stages of the bargaining process for coordination failure. Also, players were sensitive to the difference in endowment levels, where investment decreased with an increasing endowment difference. The degree of endowment difference is associated with the degree of the risk of exploitation. Players showed a preference to achieve risk equilibrium by investing on the same level, mutually forgoing higher possible payoffs. In this sense, fairness concerns do cause inefficiencies in the hold-up problem. Players forgoing payoffs in order to play a, to them, safe strategy could already be observed in Chapter 1, where players chose the lower payoff when losses loomed.

Most strikingly, players clearly showed a preference for relational equity, matching their claims to their contribution to the pie. The principle of relational equity as stated by the Equity theory (Adams, 1965) extends mostly to games in which both players had an initial endowment. In games with one-sided investment possibilities, players who invested did not claim the entire pie. This suggests that players were concerned with inequity aversion to some degree, where compensation for lower starting endowments was observable.

However, several questions remain unanswered, such as whether a more salient non-payoff-related focal point would have allowed players to better coordinate their claims and remedy the underinvestment problem. Further, several different explanations of players' bargaining behaviour are possible, such as the model of inequity aversion according to Fehr & Schmidt (1999) or the model of equity theory as by Adams (1965). Probably introducing treatments without a minimum monetary unit of £1 and a treatment in which players both have the same starting endowment could have shed even more light on the nature of players' fairness concerns. Further research should extend the investigation of proportional equity and different compensation mechanisms for starting endowment asymmetries. The hold-up problem could be remedied by providing players with a better possibility to level risk (e.g., by adding rounds to renegotiate bargaining outcomes) as people seem to be somewhat egalitarian with regards to levels of risk incurred.

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APPENDIX

1. APPENDIX: CHAPTER 1

APPENDIX 1.1: Theoretical Model

Let us denote the expected payoff for choosing "Near" E(N) and choosing "Far" E(F), where q denotes the probability of player 2 to choose "Near", and 1-q the probability of player 2 choosing the "Far". Then player 2's expected payoff can be denoted by

$$E(N) = E(F) = \alpha q + (1-q)(-c) = -qc + (1-q)\beta = 0$$

Solving this expression with respect to q yields a probability q for choosing the "near" location for player 2

$$\Leftrightarrow \alpha q - c + qc + qc - \beta + \beta q = 0$$
$$\Leftrightarrow \alpha q + 2qc + \beta q = \beta + c$$
$$\Leftrightarrow q = \frac{\beta + c}{\alpha + \beta + 2c}.$$

The probability of choosing the "far" location for player 2 (1-q) is then

.

$$1 - q = \frac{\alpha + \beta + 2c}{\alpha + \beta + 2c} - \frac{\beta + c}{\alpha + \beta + 2c} = \frac{\alpha + c}{\alpha + \beta + 2c}$$

Player 1's expected payoff choosing "Near" E(N) and choosing "Far" E(F) can be depicted by:

$$E(N) = E(F) = \beta p + (1-p)(-c) = -pc + (1-p)\alpha = 0$$

Solving this expression yields the probability p for picking the "Near" location:

$$\Leftrightarrow \beta p - c + pc + pc - \alpha + \alpha q = 0$$
$$\Leftrightarrow \alpha p + 2qc + \beta p = \alpha + c$$
$$\Leftrightarrow p = \frac{\alpha + c}{\alpha + \beta + 2c}.$$

The probability of choosing the "far" location for player 1 (1-p) is then

$$1-p=\frac{\alpha+\beta+2c}{\alpha+\beta+2c}-\frac{\alpha+c}{\alpha+\beta+2c}=\frac{\beta+c}{\alpha+\beta+2c}$$

So by symmetry:

$$q=1-p=\frac{\beta+c}{\alpha+\beta+2c}$$

and

$$p=1-q=\frac{\alpha+c}{\alpha+\beta+2c}$$

The probability of a successful coordination P(S) thus is expressed as

.

$$P(S)=\frac{\alpha+c}{\alpha+\beta+2c}*\frac{\beta+c}{\alpha+\beta+2c}+\frac{\alpha+c}{\alpha+\beta+2c}*\frac{\beta+c}{\alpha+\beta+2c}$$

Simplifying this yields probability of successful coordination of

$$P(S)=\frac{2(\alpha+c)(\beta+c)}{(\alpha+\beta+2c)^2}$$

Where the Probability of coordination on both the Near and the Far equilibrium is:

$$P(S_{N,F})=\frac{\alpha+c}{\alpha+\beta+2c}*\frac{\beta+c}{\alpha+\beta+2c}=\frac{(\alpha+c)(\beta+c)}{(\alpha+\beta+2c)^2}$$

Given that c > 0, all probabilities are strictly positive.

Formally: looking at the partial derivative ∂P(S) with respect to c it becomes apparent that with an increasing c the probability of coordination strictly increases. The derivative can be depicted as

$$\frac{\partial P(S)}{\partial c}=\frac{\partial[2(\alpha+c)(\beta+c)]}{\partial\left[(\alpha+\beta+2c)^2\right]}$$

Applying the quotient rule the expression becomes

$$\Leftrightarrow \frac{\partial[2(\alpha+c)(\beta+c)]*(\alpha+\beta+2c)^2-2(\alpha+c)(\beta+c)*\partial\left[(\alpha+\beta+2c)^2\right]}{\partial\left[(\alpha+\beta+2c)^2\right]}$$

With further simplification the derivative becomes

$$\Leftrightarrow \frac{2(\alpha+c)}{(\alpha+\beta+2c)^2}+\frac{2(\beta+c)}{(\alpha+\beta+2c)^2}-\frac{8(\alpha+c)(\beta+c)}{(\alpha+\beta+2c)^3}=P'(S)$$

.

Simplifying the terms

$$\Leftrightarrow \frac{2(\alpha-\beta)^2}{(\alpha+\beta+2c)^3}=P'(S)$$

The function is decreasing in c, as c >=0, the function is decreasing as c increases.

Looking at the effect of a change in c on the probabilities of coordinating on the near and far equilibria (as they are symmetric):

$$\frac{\partial P(S_{N,F})}{\partial c}=\frac{\partial[(\alpha+c)(\beta+c)]}{\partial\left[(\alpha+\beta+2c)^2\right]}$$

Applying the quotient rule the term becomes

$$\Leftrightarrow \frac{\partial[(\alpha+c)(\beta+c)]*(\alpha+\beta+2c)^2-(\alpha+c)(\beta+c)*\partial\left[(\alpha+\beta+2c)^2\right]}{\partial\left[(\alpha+\beta+2c)^2\right]}$$

Then through simplification we receive

$$\Leftrightarrow \frac{(\alpha+c)}{(\alpha+\beta+2c)^2}+\frac{(\beta+c)}{(\alpha+\beta+2c)^2}-\frac{4(\alpha+c)(\beta+c)}{(\alpha+\beta+2c)^3}=P'(S)$$

The derivative thus is

$$\Leftrightarrow \frac{2(\alpha-\beta)^2}{(\alpha+\beta+2c)^3}=P'(S)$$

The derivative of $P'(S_{N,F})$ is strictly positive as the expressions in the numerator and denominator are always positive.

Hence the probabilities for coordinating on the near and far equilibrium decrease in c as well.

Pure win and loss frames

Adding or subtracting a factor to the expected payoff functions will keep the game theoretic prediction of the game equivalent. This makes it possible to create a pure win or pure loss frame. Regarding the expected payoff functions for player 1 and 2 subject to an external factor Δ:

$$E(N) = E(F) = (\Delta + \alpha)q + (1-q)(\Delta - c) - (\Delta - c)q - (1-q)(\Delta + \beta) = 0$$

Solving this expression with respect to q yields a probability q for choosing the “near” location for player 2 yields as before

$$\Leftrightarrow \alpha q + \Delta q + \Delta - c - \Delta q + qc - \Delta q + cq - \Delta - \beta + \beta q + \Delta q = 0$$
$$\Leftrightarrow \alpha q + 2qc + \beta q = \beta + c$$
$$\Leftrightarrow q = \frac{\beta + c}{\alpha + \beta + 2c}.$$

The probability of choosing the “far” location for player 2 (1-q) is then

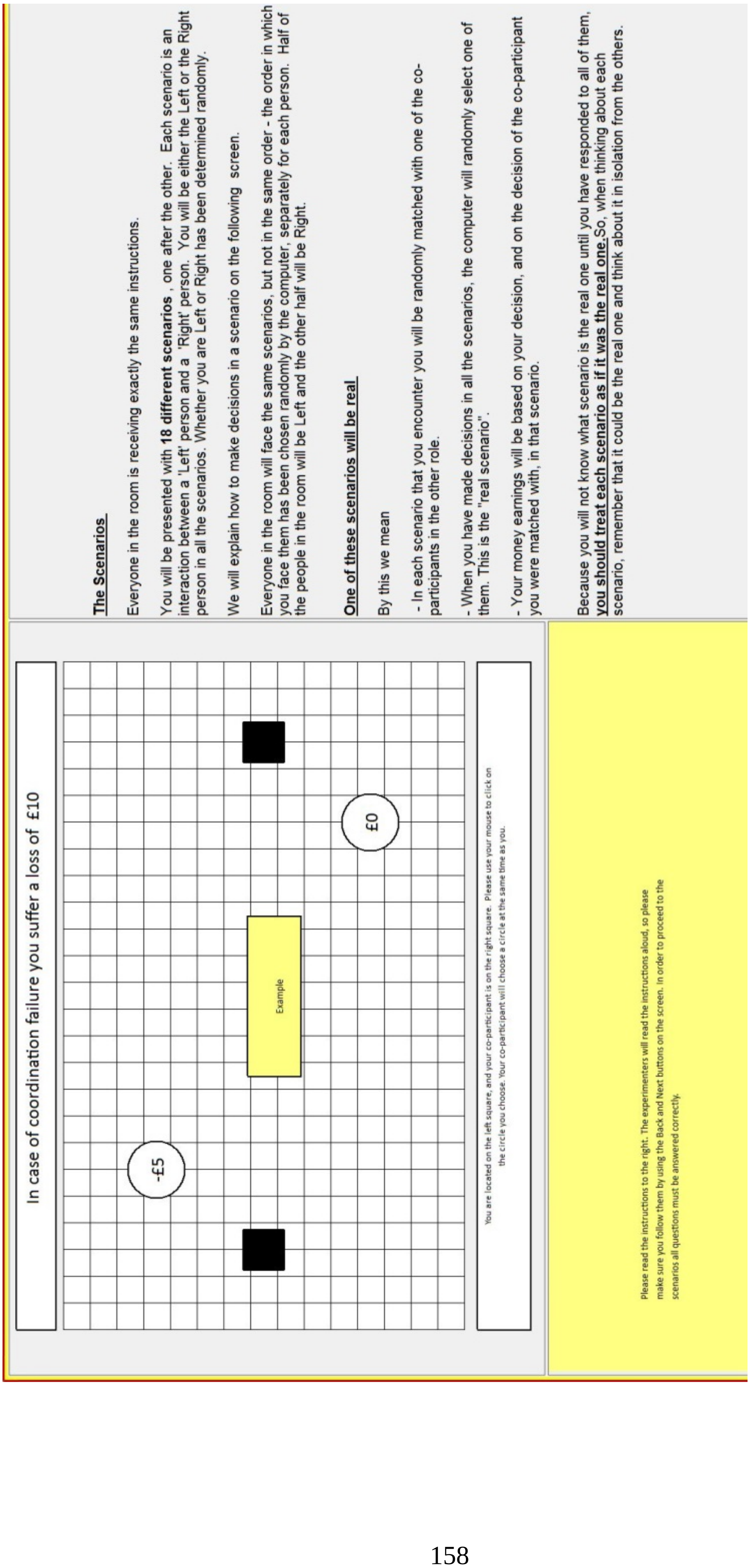
$$1 - q = \frac{\alpha + c}{\alpha + \beta + 2c}$$

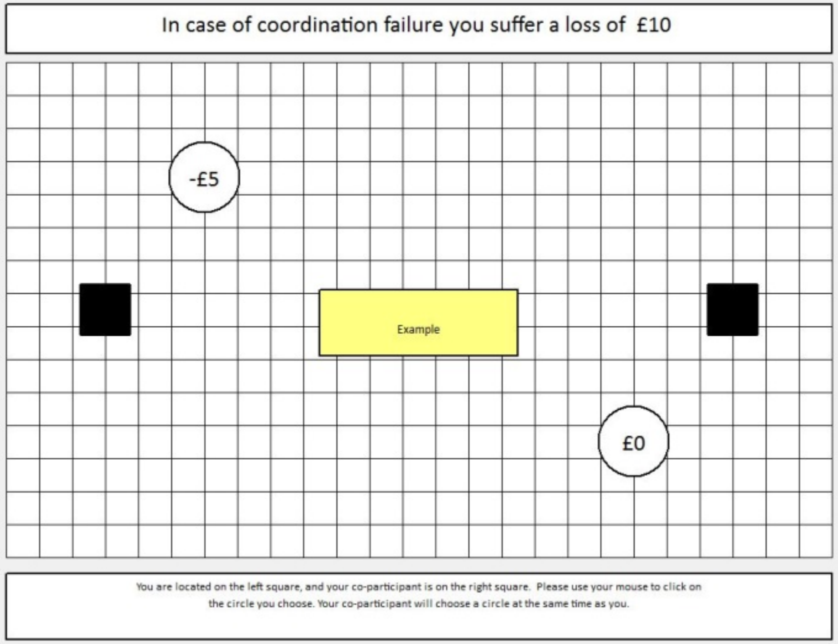
By symmetry this holds also for player 1

$$q = 1 - p = \frac{\beta + c}{\alpha + \beta + 2c}$$
$$1 - q = p = \frac{\alpha + c}{\alpha + \beta + 2c}$$

q.e.d.

APPENDIX 1.2: Sample Experiment Screen Shots





Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.

An example of a scenario

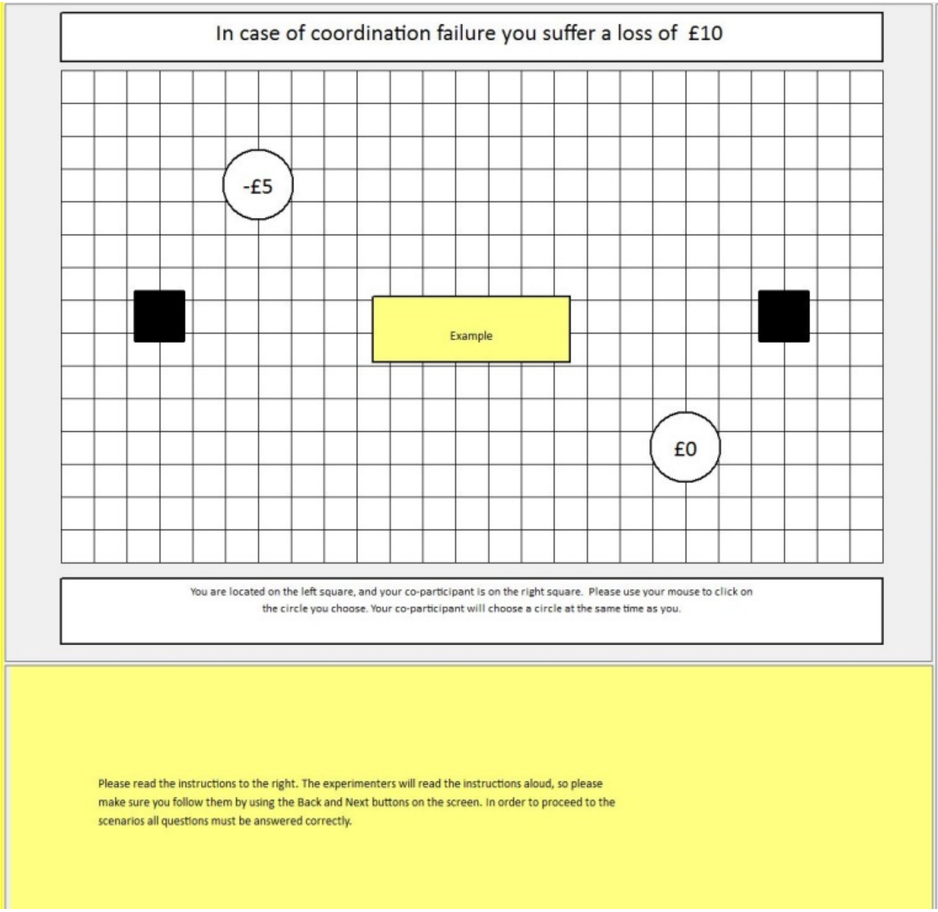
Each scenario is represented by a picture like the one displayed on the screen. We call this picture a 'table'.

Each scenario is an interaction between a Left person and a Right person. Each person has a 'base', represented by a square for the Left person and a square for the Right person. You will discover whether you are the Left or Right person when you see the first scenario. You will be either Left or Right in all the scenarios you will encounter.

Claiming Circles

- There are two circles on the table. Each circle has a money value, shown inside the circle. This value can be negative indicated by a minus sign. In this case this is a loss to you. Each of you must separately claim one circle. You claim a circle by clicking on it with your mouse.

- If you and your co-participant claim *different* circles (we call this "coordination"), then you get the circle you claimed, and your co-participant gets the circle that he or she claimed. If you claim the *same* circle (we call this "coordination failure") then both of you suffer a loss. This loss is shown above the table.



Your Money Earnings

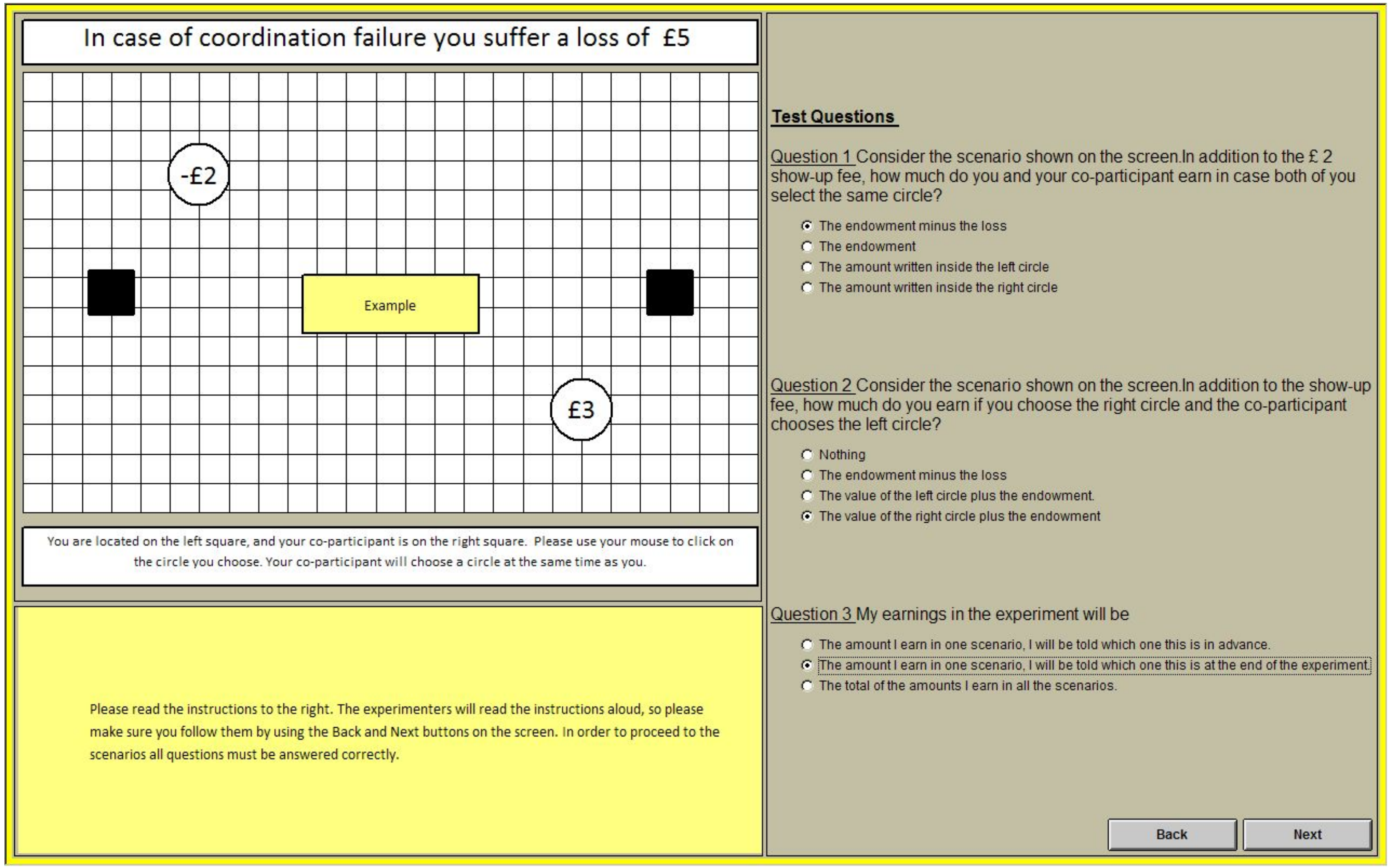
You will get a show-up fee of £ 2. You will also get a £ 15 endowment. In addition to this, you get the money earnings from the real scenario. The earnings from the real scenario are as follows:

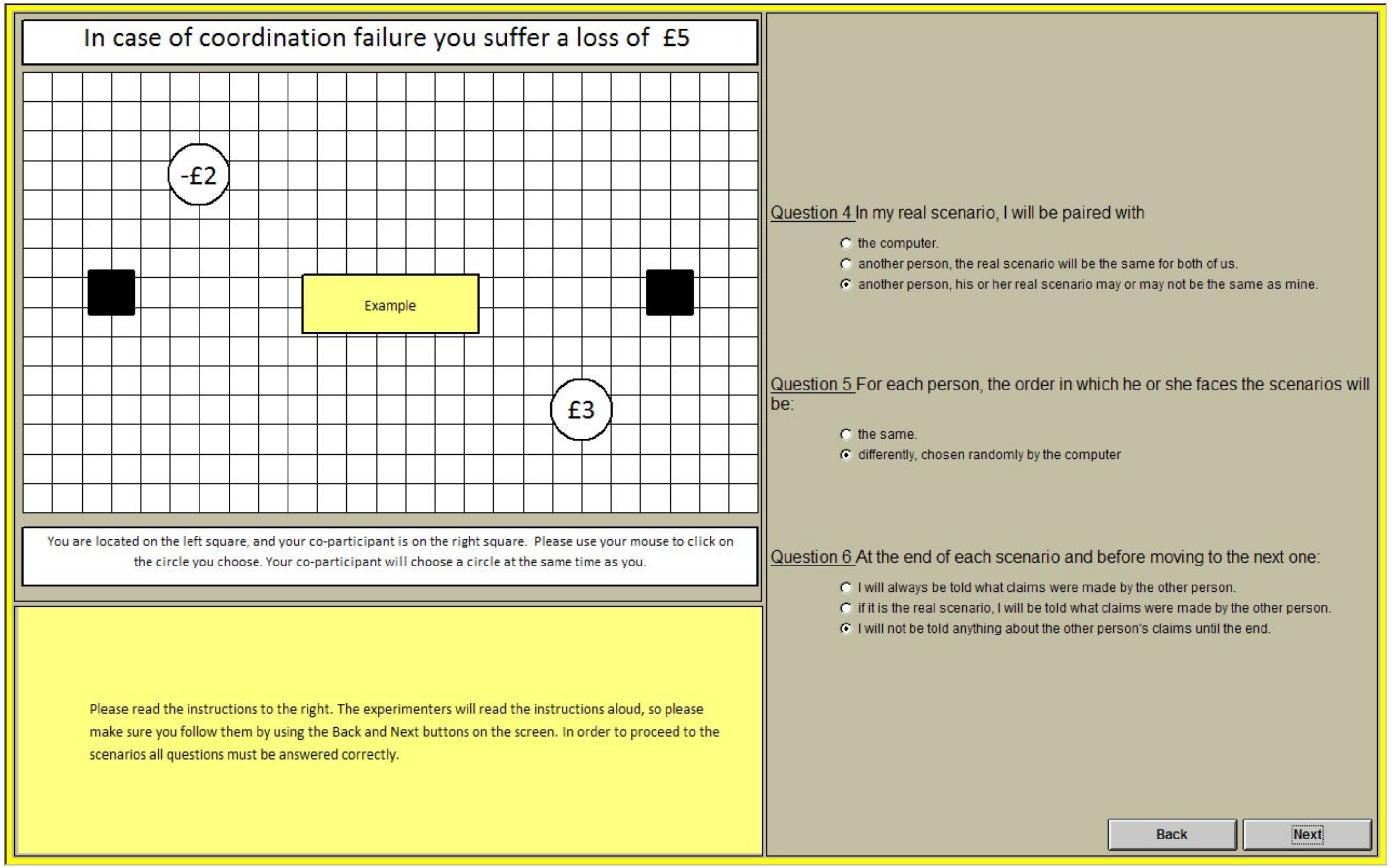
- If you and your co-participant chose different circles, you get the money value of the circle you chose. The amount is added to your endowment. If the amount is negative, then this is a loss to you. The amount is deducted from your endowment.

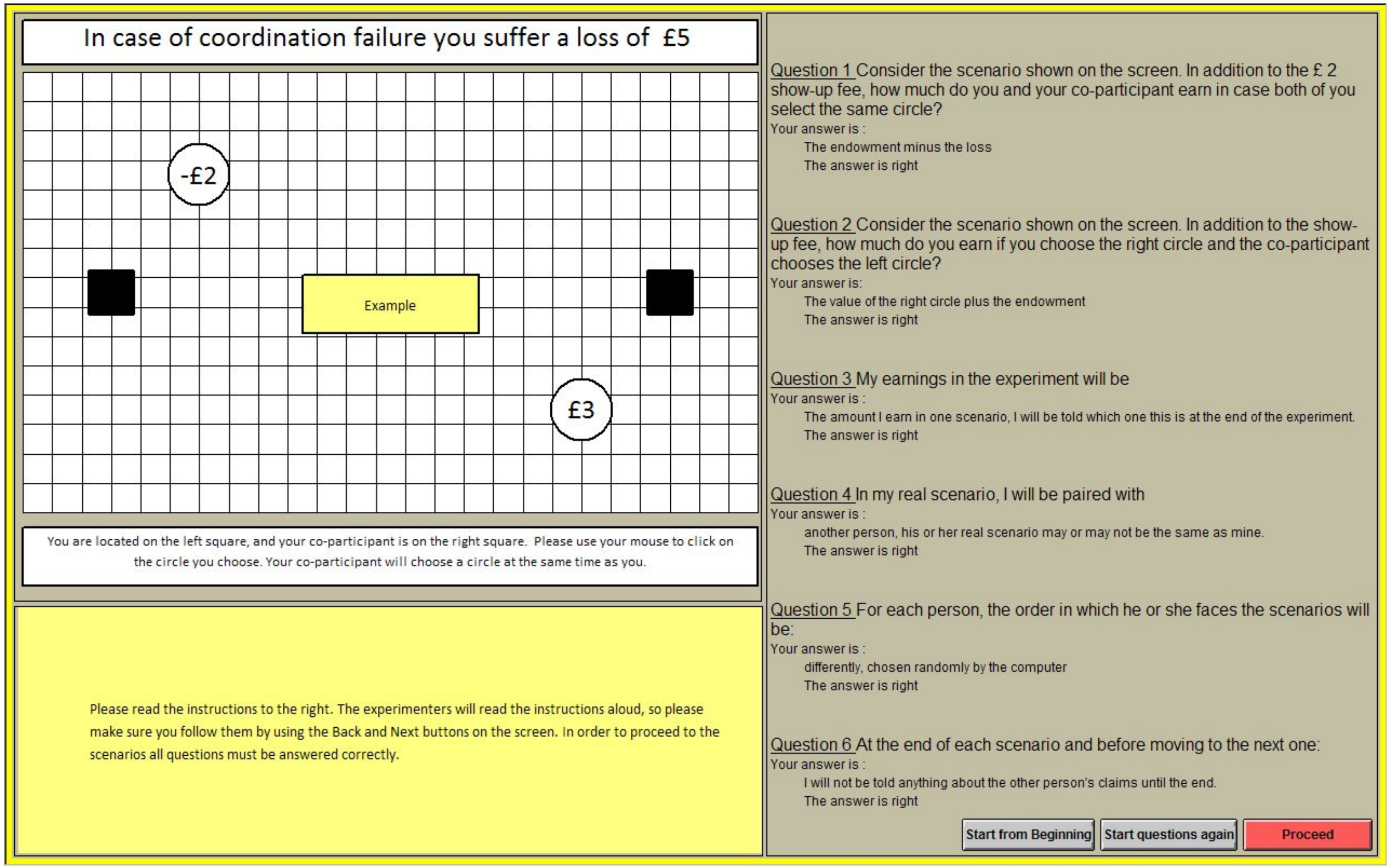
- If you and your co-participant chose the same circle, you suffer a loss. This loss is taken from your endowment. The loss will never exceed your endowment.

Example: consider the table on the left:

If you and your co-participant both choose the circle on the left or the circle on the right, you will suffer a loss of £ 10. This is deducted from your endowment of £ 15.So in total you get £ 2 (show-up fee) + £ 15 (endowment) - £ 10 (loss) = £ 7.Suppose then you and your co-participant chose different circles. For example, suppose you chose the circle on the right and that your co-participant chose the circle on the left. Then you get £ 2 (show-up fee) + £ 15 (endowment) + £ 0 (value from the circle) = £ 17.


In case of coordination failure you suffer a loss of £5
-£2
Example
£3
You are located on the left square, and your co-participant is on the right square. Please use your mouse to click on the circle you choose. Your co-participant will choose a circle at the same time as you.
Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.
Test Questions
Question 1 Consider the scenario shown on the screen.In addition to the £ 2 show-up fee, how much do you and your co-participant earn in case both of you select the same circle?
The endowment minus the loss
The endowment
The amount written inside the left circle
The amount written inside the right circle
Question 2 Consider the scenario shown on the screen.In addition to the show-up fee, how much do you earn if you choose the right circle and the co-participant chooses the left circle?
Nothing
The endowment minus the loss
The value of the left circle plus the endowment.
The value of the right circle plus the endowment
Question 3 My earnings in the experiment will be
The amount I earn in one scenario, I will be told which one this is in advance.
The amount I earn in one scenario, I will be told which one this is at the end of the experiment.
The total of the amounts I earn in all the scenarios.
Back
Next


In case of coordination failure you suffer a loss of £5
-£2
Example
£3
You are located on the left square, and your co-participant is on the right square. Please use your mouse to click on the circle you choose. Your co-participant will choose a circle at the same time as you.
Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.
Question 4 In my real scenario, I will be paired with
the computer.
another person, the real scenario will be the same for both of us.
another person, his or her real scenario may or may not be the same as mine.
Question 5 For each person, the order in which he or she faces the scenarios will be:
the same.
differently, chosen randomly by the computer
Question 6 At the end of each scenario and before moving to the next one:
I will always be told what claims were made by the other person.
if it is the real scenario, I will be told what claims were made by the other person.
I will not be told anything about the other person's claims until the end.
Back
Next


In case of coordination failure you suffer a loss of £5
-£2
Example
£3
You are located on the left square, and your co-participant is on the right square. Please use your mouse to click on the circle you choose. Your co-participant will choose a circle at the same time as you.
Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.
Question 1 Consider the scenario shown on the screen. In addition to the £ 2 show-up fee, how much do you and your co-participant earn in case both of you select the same circle?
Your answer is :
The endowment minus the loss
The answer is right
Question 2 Consider the scenario shown on the screen. In addition to the show-up fee, how much do you earn if you choose the right circle and the co-participant chooses the left circle?
Your answer is:
The value of the right circle plus the endowment
The answer is right
Question 3 My earnings in the experiment will be
Your answer is :
The amount I earn in one scenario, I will be told which one this is at the end of the experiment.
The answer is right
Question 4 In my real scenario, I will be paired with
Your answer is :
another person, his or her real scenario may or may not be the same as mine.
The answer is right
Question 5 For each person, the order in which he or she faces the scenarios will be:
Your answer is :
differently, chosen randomly by the computer
The answer is right
Question 6 At the end of each scenario and before moving to the next one:
Your answer is :
I will not be told anything about the other person's claims until the end.
The answer is right
Start from Beginning
Start questions again
Proceed

We are now ready to begin the experiment. Please raise your hand if you have any questions before we start.

We ask you not to communicate with anyone in the room. If you have any problems with your computer, please raise your hand and we will come to your desk to assist you.

Making your decision

You will now be presented with the 18 scenarios. Each scenario is identified by a number between 1 and 18, shown in the top-right corner of your screen.

In each scenario, once you click on the circle, your decision cannot be changed. You then move to the next scenario.

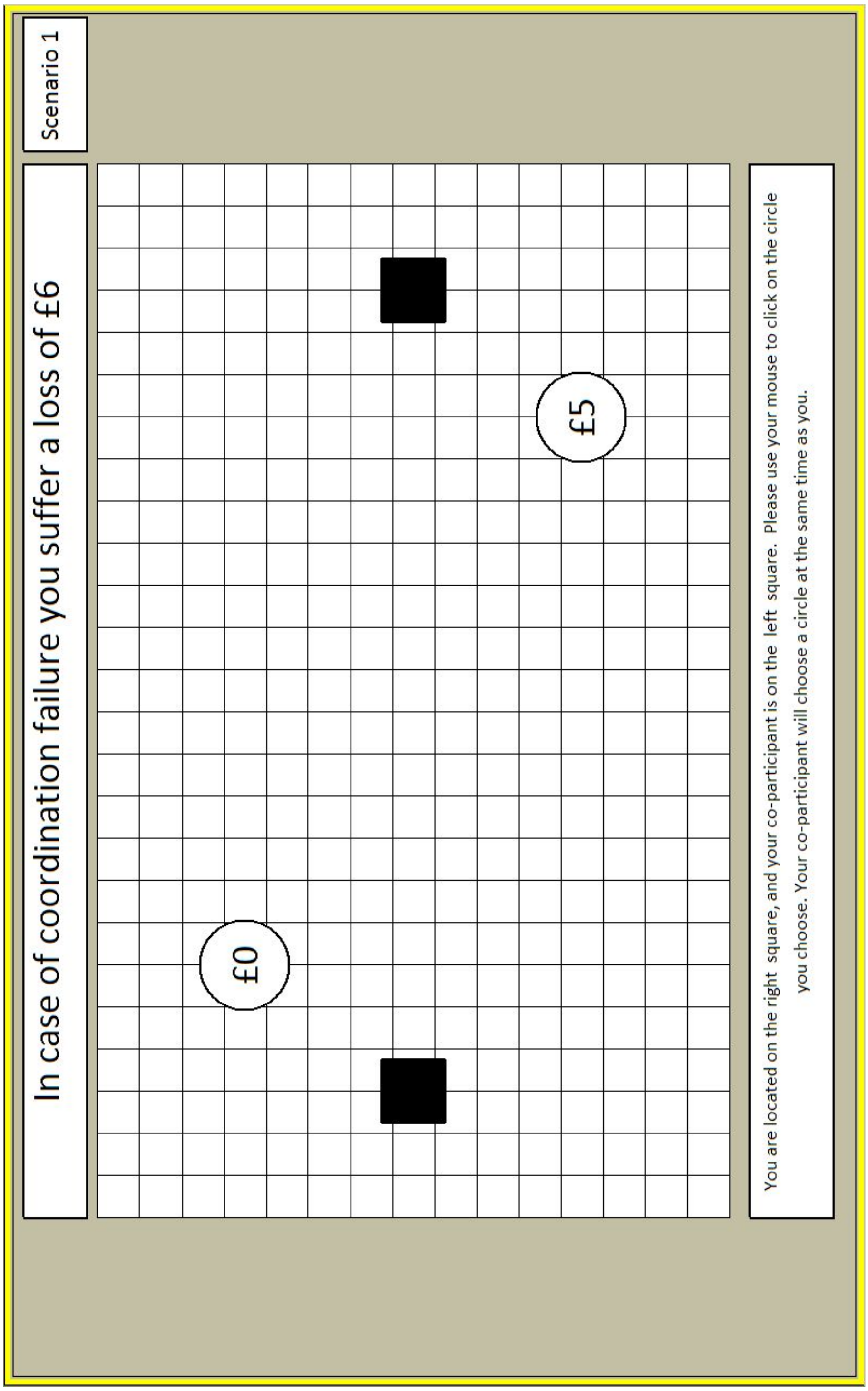
When you have finished the 18 scenarios, you will be told what scenario is the real one. The table for this scenario will appear on your screen again.

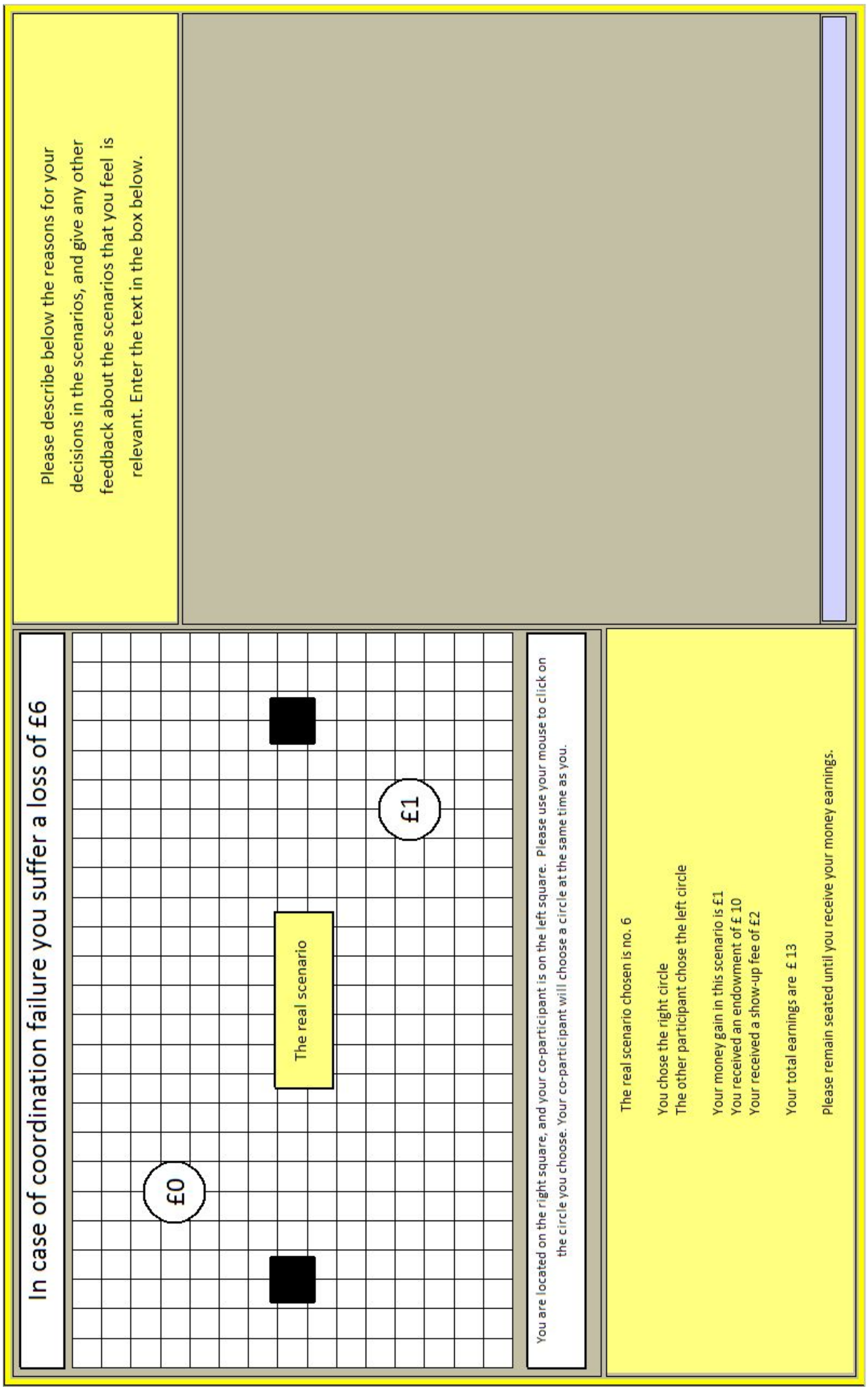
You will see if you and the other person coordinated or not. You will also see the amount of money that you earned.

While waiting to receive your payment you will be asked to describe the reasons for your decisions in the scenarios, and give any other feedback about the scenarios that you feel is relevant.

Please do not press the OK button until the experimenter has finished reading the instructions aloud.

OK


Scenario 1
In case of coordination failure you suffer a loss of £6
£0
£5
You are located on the right square, and your co-participant is on the left square. Please use your mouse to click on the circle you choose. Your co-participant will choose a circle at the same time as you.


In case of coordination failure you suffer a loss of £6
£0
The real scenario
£1
You are located on the right square, and your co-participant is on the left square. Please use your mouse to click on the circle you choose. Your co-participant will choose a circle at the same time as you.
The real scenario chosen is no. 6
You chose the right circle
The other participant chose the left circle
Your money gain in this scenario is £1
You received an endowment of £ 10
You received a show-up fee of £2
Your total earnings are £ 13
Please remain seated until you receive your money earnings.
Please describe below the reasons for your decisions in the scenarios, and give any other feedback about the scenarios that you feel is relevant. Enter the text in the box below.

2. APPENDIX: CHAPTER 2

APPENDIX 2.1: Alternating Offers Bargaining Theory

The standard alternating offer bargaining model [19] with a shrinking pie assumes two players, A and B, that engage in alternating offers over the division of a pie π, π > 0. Player A makes the first offer on how to divide the cake, player B either accepts or rejects the offer. If player B accepts then the game is over. If player B rejects the offer, player B will make a an offer at a time Δ = 2. Should player A reject the offer then player A will make anew an offer at time Δ = 3. The process continues until an offer is accepted or until the amount to be distributed becomes 0. An offer is a number between 0 and π. The payoffs of player i in this case are a share of the pie π depicted by $0 \le x_i \le \pi$ such that $x_i \exp(-r_i t\Delta)$ where $r_i > 0$ is the discount rate of player i. Time is discounted as [20] $\delta_i \equiv \exp(-r_i\Delta)$.

Two properties[21] necessary for the equilibrium are that whenever a player has to make an offer, and it is an equilibrium offer, it is accepted by the other player and also in equilibrium a player makes the same offer whenever she has to make an offer (Muthoo, 1999, pg.44). Given these properties the loss of player B rejecting an offer from A will be $\delta_b x_b^*$, since after rejecting player B will offer the equilibrium share of x_b^*. Hence, player B accepts any offer x_a such that $\pi - x_a > \delta_b x_b^*$. By the first property mentioned above $\pi - x_a^* \ge \delta_b x_b^*$. However, if $\pi - x_a^* > \delta_b x_b^*$, then player A could increase her payoff with an alternative offer that is higher. Hence we have the symmetric outcome of $\pi - x_a^* = \delta_b x_b^*$ and $\pi - x_b^* = \delta_a x_a^*$ which leads to the unique solution of $x_a^* = \mu_a \pi$ and $x_b^* = \mu_b \pi$, where $\mu_a = \frac{1-\delta_b}{1-\delta_a\delta_b}$ and $\mu_b = \frac{1-\delta_a}{1-\delta_a\delta_b}$ [22].

In a Subgame Perfect Equilibrium player A always offers x_a^* and accepts x_b if $\pi - x_b > \delta_a x_a^*$, thus player A always demands a share of $\frac{1-\delta_b}{1-\delta_a\delta_b}$ while accepting no

[19] The model as follows has been created by Rubinstein (1982).
[20] As presented in (Muthoo, 1999, pg. 42)
[21] Following: the Rubinstein alternate offer model as presented by Muthoo (1999).
[22] The properties mentioned as well as the presentation of the model stems from (Muthoo, 1999, pg 44).

offer smaller then $\frac{\delta_b(1-\delta_b)}{1-\delta_a\delta_b}$ [23]. The proof of optimality of this distribution is given considering that at any point in time $t\Delta$ player A makes an offer such that $x_a^t \le x_a^*$. In which case player B accepts immediately, so a deviation is not profitable (Muthoo, 1999, pg.45). In case of $x_a^t \ge x_a^*$ player B rejects any offer made. Hence x_a^* and x_b^* are equilibrium offers. The general idea of a sequential round alternating offer bargaining game is that players accept an offer in each round that is at least as high as the outcome they would get in the next round. Binmore et al. (2007) test the robustness of the Rubinstein bargaining solution and find that the solution holds up in experimental results[24].

In case of a fixed amount being deducted from an amount to be distributed π, players know the pie size in the next round Δ+1, where $\pi_\Delta > \pi_{\Delta+1}$ for $1 \le \Delta \le 14$. Offers can be made in each round by players within the range of $\Omega \in \{0, \pi_\Delta\}$ starting with player A in round 1. If an agreement is reached players will earn Ω_Δ for the proposer and π_Δ - Ω_Δ for the responder. Following the reasoning above there is a subgame perfect equilibrium in the sequential game using the on using the one step diviation principle (Fudenberg & Tirole, 1991). Suppose in any given period Δ player a offers player b the split of $\Omega_{\Delta a}$ such that player B receives $\Omega_{\Delta a}$ and player A receives π_Δ - $\Omega_{\Delta a}$ if player B accepts. Player a knows that if b rejects in the next round he will only obtain $\Omega_{\Delta b}$ where player b would earn π_Δ - 1 - $\Omega_{\Delta b.}$ Now player A knows that he has to offer at least $\Omega_{\Delta a} \ge \pi_\Delta$ - 1 - $\Omega_{\Delta b,}$ otherwise player b will reject the initial offer. If $\Omega_{\Delta a} > \pi_\Delta$ - 1 - $\Omega_{\Delta b}$ player a can improve by making a lower offer. Player B knows this and needs to accept $\Omega_{\Delta a}$ by player A. If player b rejects the maximum he can get is π_Δ - 1 - $\Omega_{\Delta b}$ in the next round. Player a will not offer more than π_Δ - 1 - $\Omega_{\Delta b}$ and accept no less than $\Omega_{\Delta b.}$ Due to the fact that $\pi_\Delta - 1 < \pi_\Delta$ and $\Omega^*_{\Delta b} = \pi_\Delta$ - 1 - $\Omega_{\Delta b}$ the only possible alternative for player B in period π_Δ + 1 player a will offer $\Omega^*_{\Delta a} = \Omega_{\Delta a}$ to player b and he accepts.

Looking at backward induction in the final round of the game (Δ = 14), if no agreement has been reached before, the amount to be distributed drops to 0, and both participants would thus receive 0. In round Δ = 13 the amount to be distributed is π_{13}

[23] cf. Fudenberg, 1991

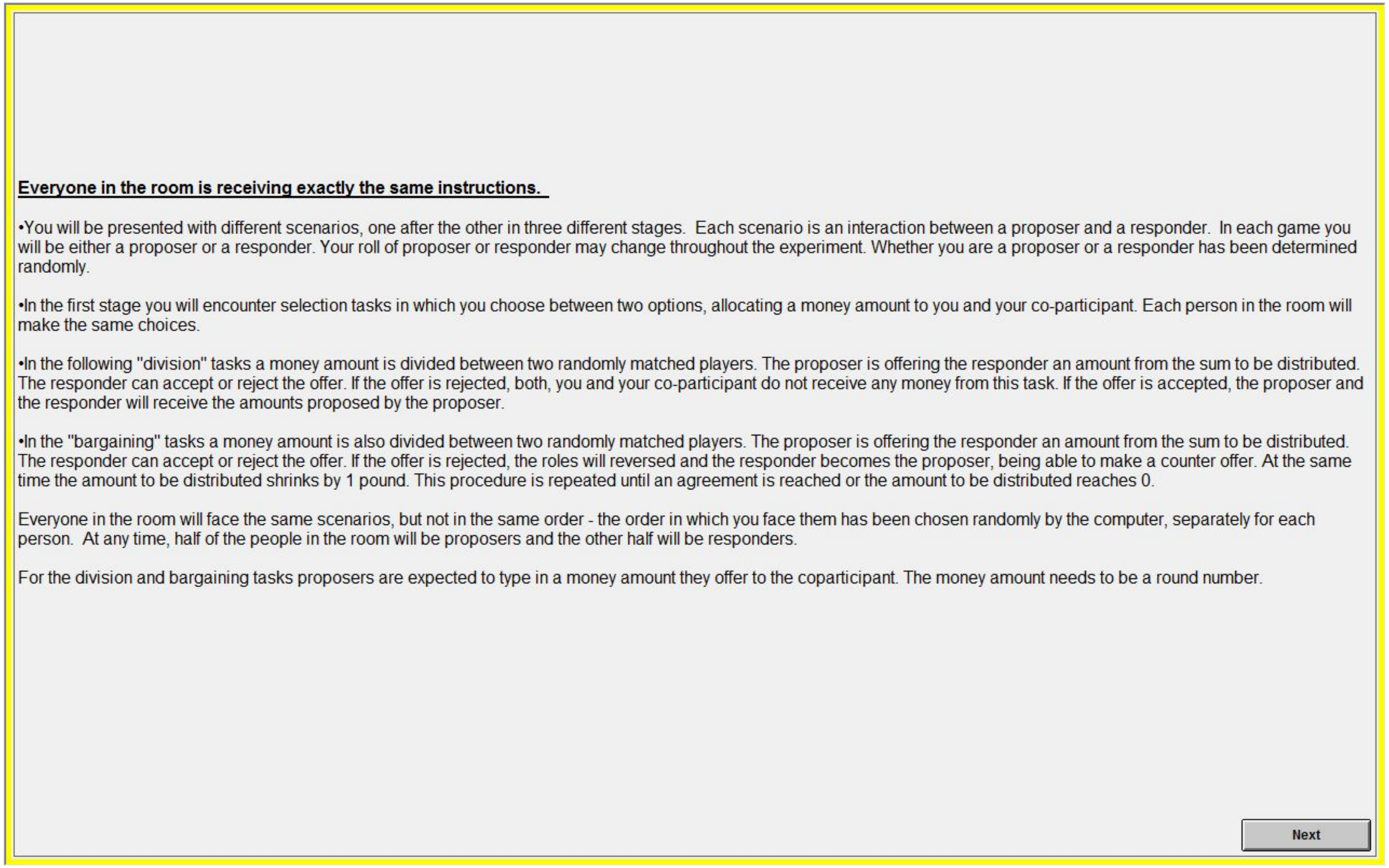
[24] Another option would have been to make offers retractable (Muthoo, 1995), however, the emphasis in this experiment was to observe first offers when offers are binding.

= 1. Player a can select from two possible distributions of the pie Ω_{13} = (1/0, 0/1). Player A will in this case allocate 1 for himself and 0 to player b (1/0). Player B accepts a payoff of 0 as he is indifferent to the payoffs in Δ = 13 and Δ = 14. In round Δ = 12 the amount to be distributed is 2 and player B knows that the maximum payoff for player A is 1 in round Δ = 13, thus offers him an amount that is at least as high. Given an offer range of Ω_{12} = (0/2, 1/1, 2/0), player B offers player A division of ½ / ½ of the pie so £ 1 each. This offer makes player A indifferent and thus accept the offer of player B. Following that logic in round Δ = 12 player A proposes a split that yields £ 2 and £ 1 for player B, as this is the maximum amount he can obtain in the next round. Following the backward induction the initial offer of player A is £ 7 for himself and £ 6 to player B and player B accepts.

APPENDIX 2.2: Ultimatum Game Bargaining Theory

Suppose two players engage in an Ultimatum Game to divide up a pie P. Player A makes a proposal to keep amount Ω in the range of [0, P] and to give to player B (P – Ω). Player B can then accept or reject the offer subject the function his f(0, P), choosing which offer to accept and which to reject. If player B accepts player A receives Ω and player B receives P – Ω. The strategy pair is thus (Ω, f(Ω)). The subgame perfect Nash equilibrium of the game is reached if f(Ω) is accepted and if there is no other offer θ , with $\theta > \Omega$ where f(θ) = accept. Players do not increase their demands, as they would get 0. Thus player A gives player B the minimum possible amount and player B accepts (SPNE).

APPENDIX 2.3: Instructions



Everyone in the room is receiving exactly the same instructions.

•You will be presented with different scenarios, one after the other in three different stages. Each scenario is an interaction between a proposer and a responder. In each game you will be either a proposer or a responder. Your roll of proposer or responder may change throughout the experiment. Whether you are a proposer or a responder has been determined randomly.

•In the first stage you will encounter selection tasks in which you choose between two options, allocating a money amount to you and your co-participant. Each person in the room will make the same choices.

•In the following "division" tasks a money amount is divided between two randomly matched players. The proposer is offering the responder an amount from the sum to be distributed. The responder can accept or reject the offer. If the offer is rejected, both, you and your co-participant do not receive any money from this task. If the offer is accepted, the proposer and the responder will receive the amounts proposed by the proposer.

•In the "bargaining" tasks a money amount is also divided between two randomly matched players. The proposer is offering the responder an amount from the sum to be distributed. The responder can accept or reject the offer. If the offer is rejected, the roles will reversed and the responder becomes the proposer, being able to make a counter offer. At the same time the amount to be distributed shrinks by 1 pound. This procedure is repeated until an agreement is reached or the amount to be distributed reaches 0.

Everyone in the room will face the same scenarios, but not in the same order - the order in which you face them has been chosen randomly by the computer, separately for each person. At any time, half of the people in the room will be proposers and the other half will be responders.

For the division and bargaining tasks proposers are expected to type in a money amount they offer to the coparticipant. The money amount needs to be a round number.

Payoffs

•In each scenario that you encounter you will be randomly matched with one of the co-participants in the other role.

•When you have made decisions in all the scenarios, the computer will randomly select one of them. This is the "real scenario".

•Your money earnings will be based on your decision, and on the decision of the co-participant you were matched with if the "real scenario" chosen is a **division or bargaining** task. If the "real scenario" is a **selection** task proposer and responder receive the amount that was chosen by the proposer. Because you will not know what scenario is the real one until you have responded to all of them, **you should treat each scenario as if it was the real one.** So, when thinking about each scenario, remember that it could be the real one and think about it in isolation from the others.

Your Money Earnings

•You will get a show-up fee of £ 5.00. In addition to this, you get the money earnings from the real scenario.

Back Next

Example: Selection Task

This is a simple distribution task. Please select one of the choices below and then press the "OK" -button. Once you hit the "OK" button, you can not change your choice.

•Select choice **A** to allocate **£ 1.50** to yourself and **£ 2.00** to your co-participant.

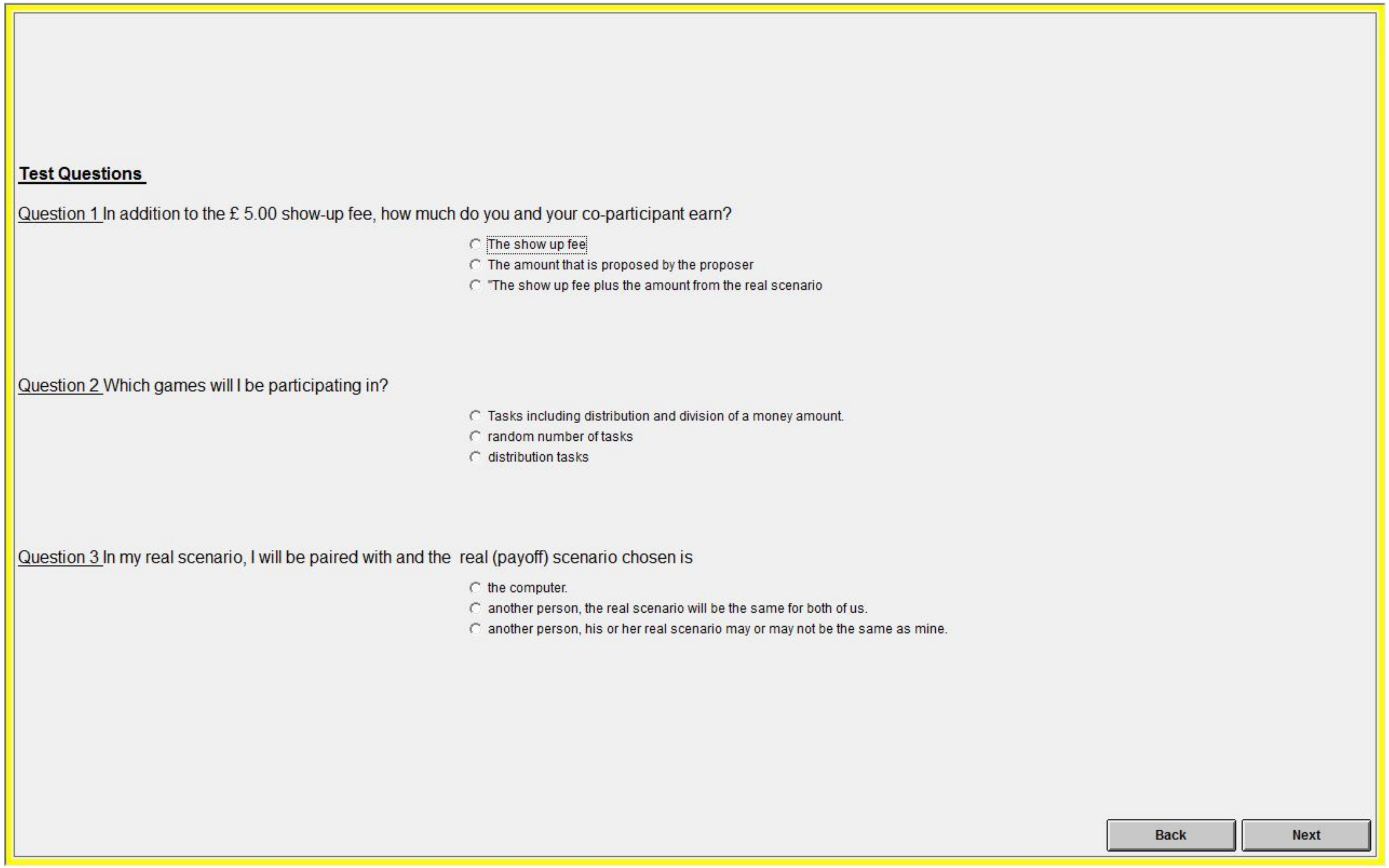
•Select choice **B** to allocate **£ 1.00** to yourself and **£ 0.00** to your co-participant.

•If you are the proposer and you chose option A, you will receive £ 5.00 (show-up fee) + £ 1.50 gain from the "real scenario". Your co-participant receives £ 5.00 (show-up fee) + £ 2.00 gain from the "real scenario". If the amount from the "real scenario" is negative, this will be deducted from your show-up fee of £ 5.00. During the experiment you can not lose money.

Example: Division & Bargaining task.

The total amount to distribute: b £ 10.00 Please make your offer. Your offer needs to be made in round numbers. Suppose you offer your co-participant **£ 5.00** . If the offer is accepted both players receive £5.00+ £5.00=£ 10.00.

Back | Next



Test Questions

Question 1 In addition to the £ 5.00 show-up fee, how much do you and your co-participant earn?

- The show up fee
- The amount that is proposed by the proposer
- "The show up fee plus the amount from the real scenario

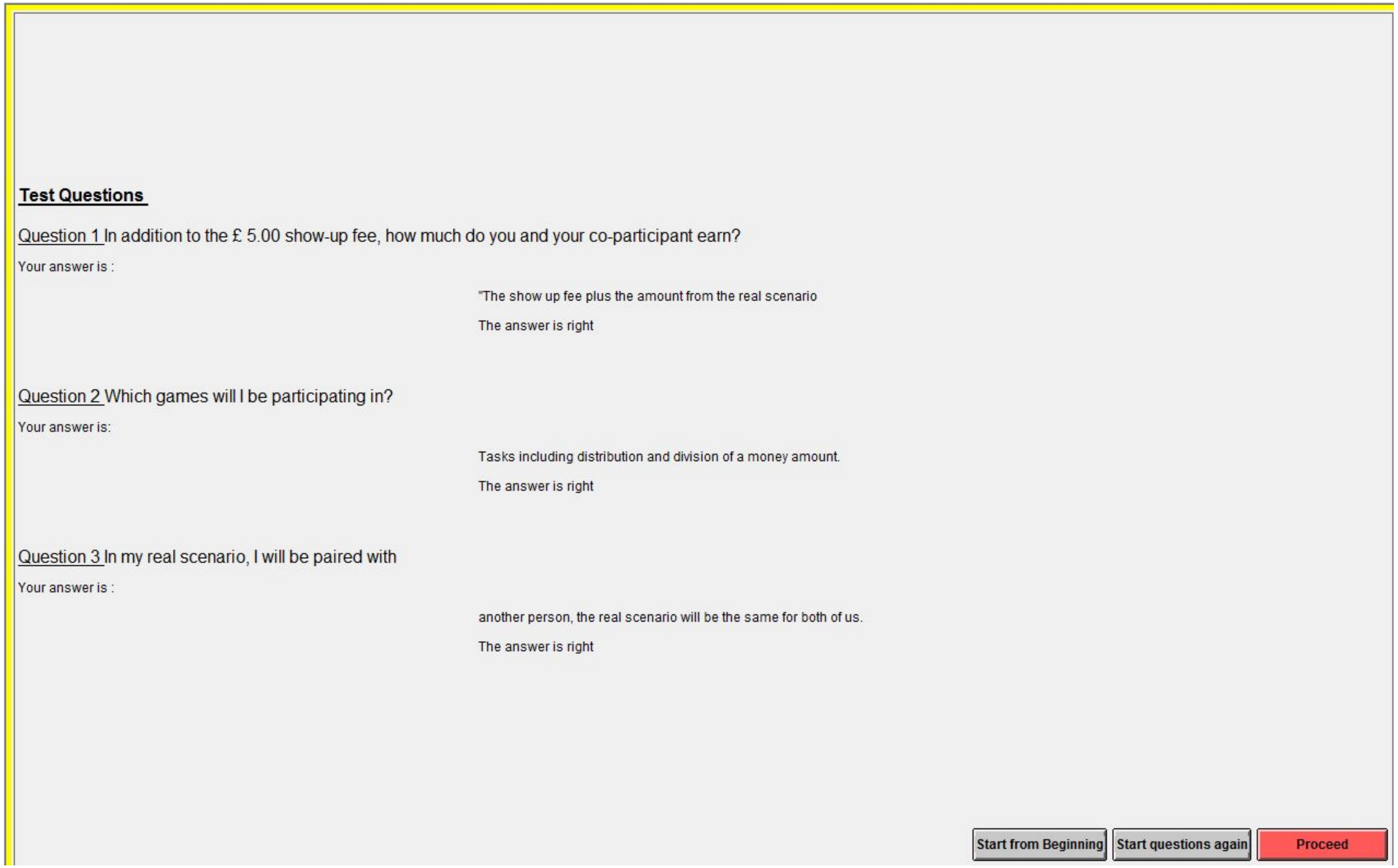
Question 2 Which games will I be participating in?

- Tasks including distribution and division of a money amount.
- random number of tasks
- distribution tasks

Question 3 In my real scenario, I will be paired with and the real (payoff) scenario chosen is

- the computer.
- another person, the real scenario will be the same for both of us.
- another person, his or her real scenario may or may not be the same as mine.

Back Next


Test Questions
Question 1 In addition to the £ 5.00 show-up fee, how much do you and your co-participant earn?
Your answer is :
"The show up fee plus the amount from the real scenario
The answer is right
Question 2 Which games will I be participating in?
Your answer is:
Tasks including distribution and division of a money amount.
The answer is right
Question 3 In my real scenario, I will be paired with
Your answer is :
another person, the real scenario will be the same for both of us.
The answer is right
Start from Beginning
Start questions again
Proceed

Everyone in the room has now answered the questions correctly. We are now ready to begin the experiment. Please raise your hand if you have any questions before we start.

We ask you not to communicate with anyone in the room. If you have any problems with your computer, please raise your hand and we will come to your desk to assist you.

Making your decision

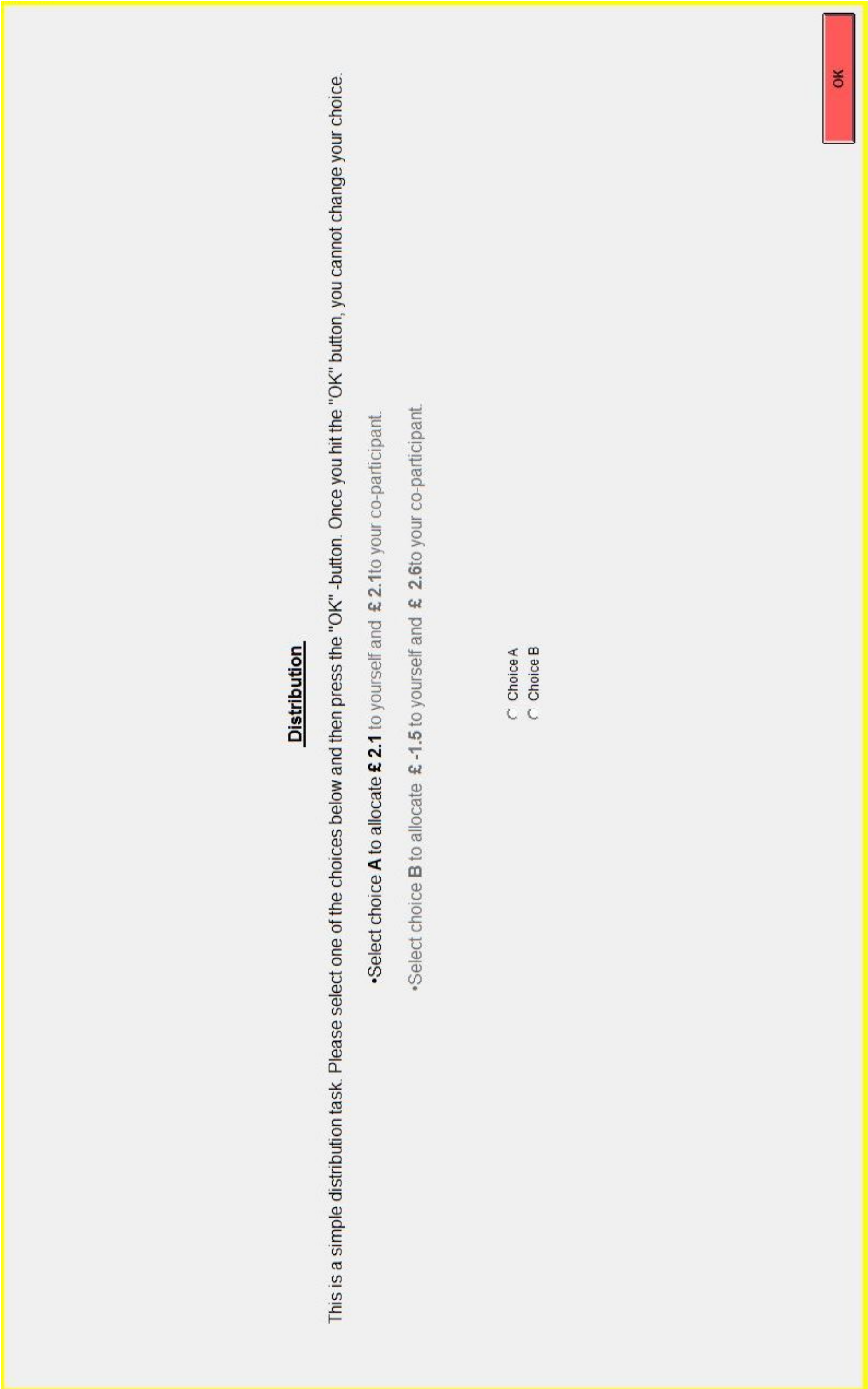
You will now be presented with the scenarios.

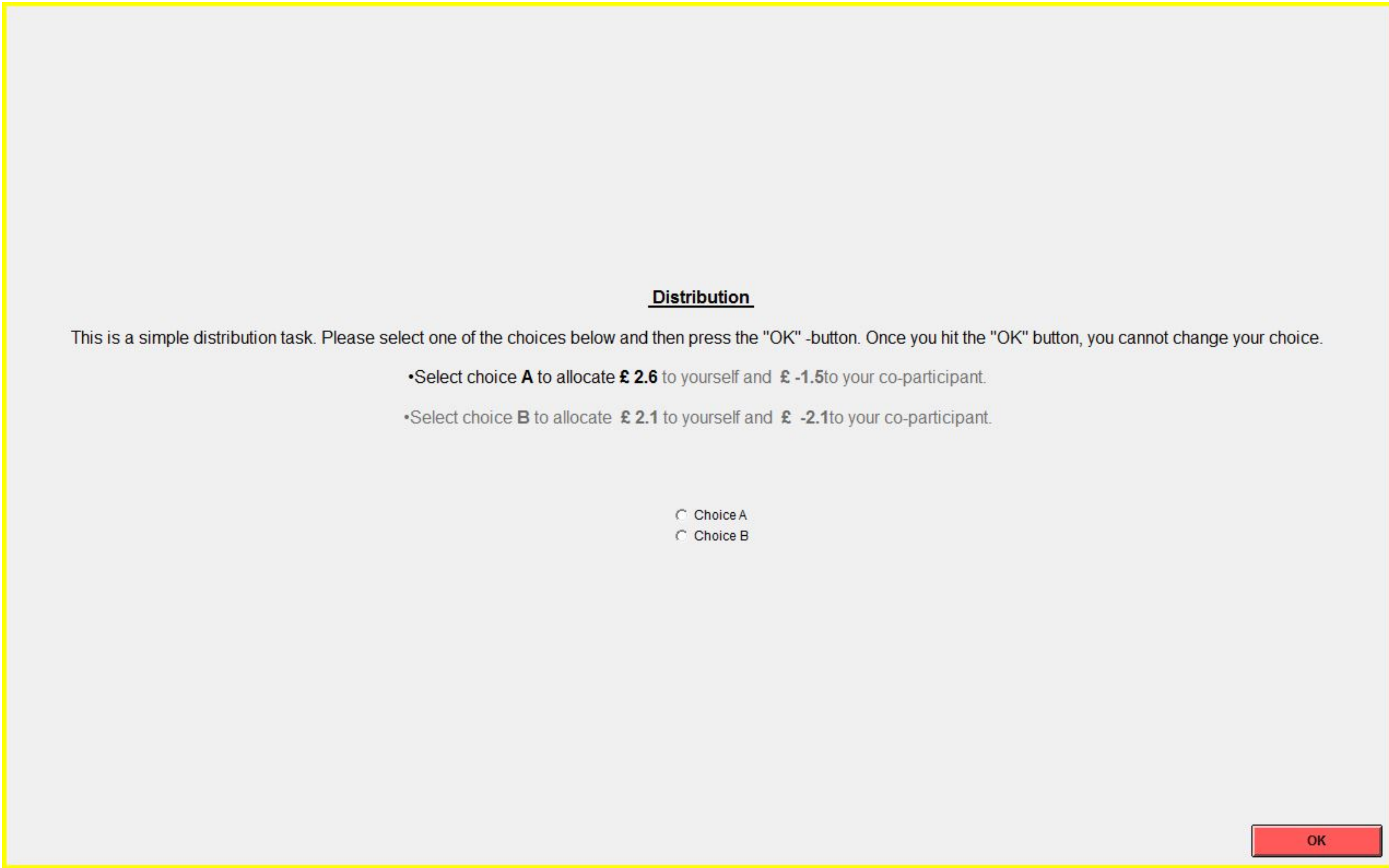
When you have finished the scenarios, you will be told what scenario is the real one. The game for this scenario will appear on your screen again.

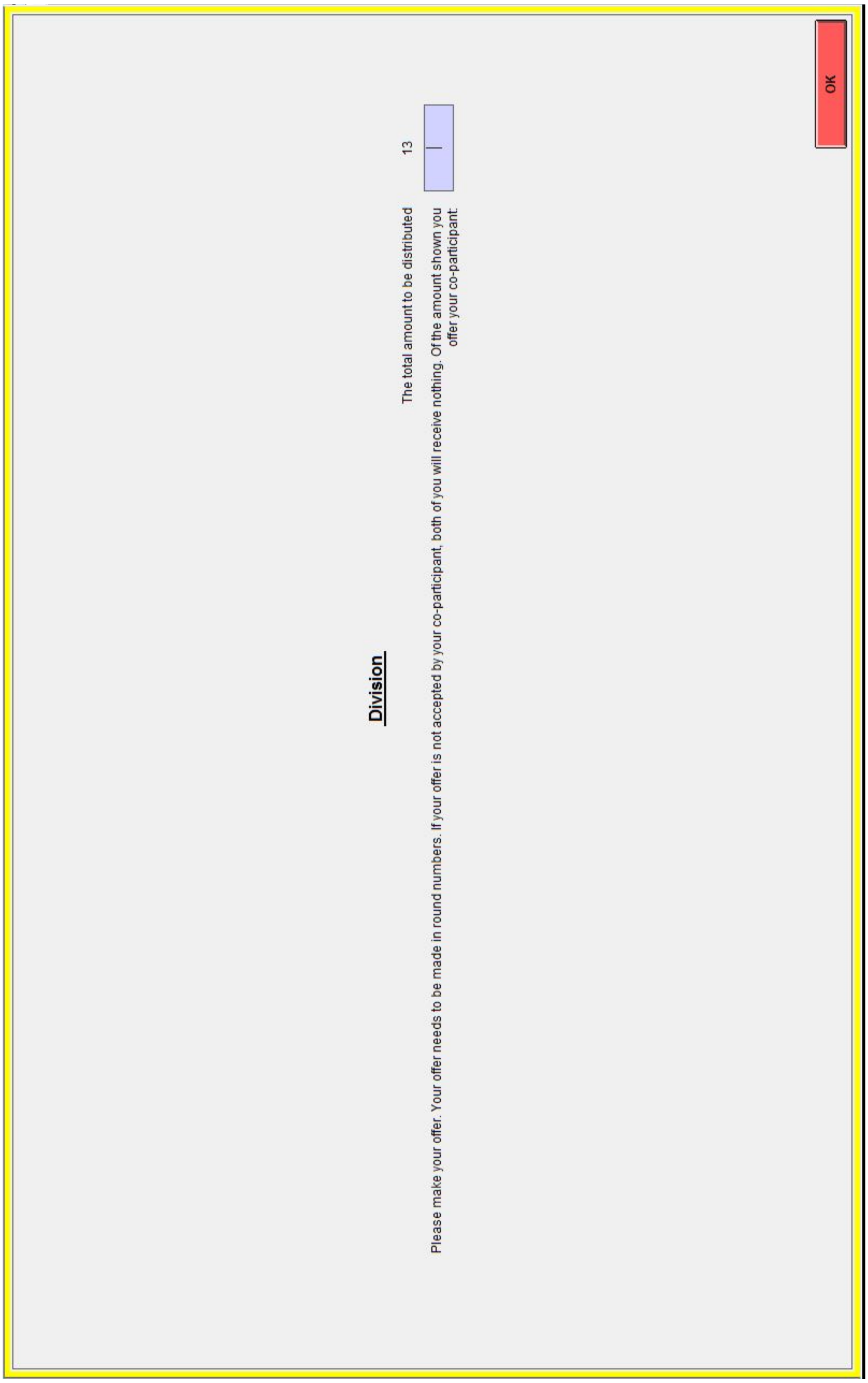
You will also see the amount of money that you earned.

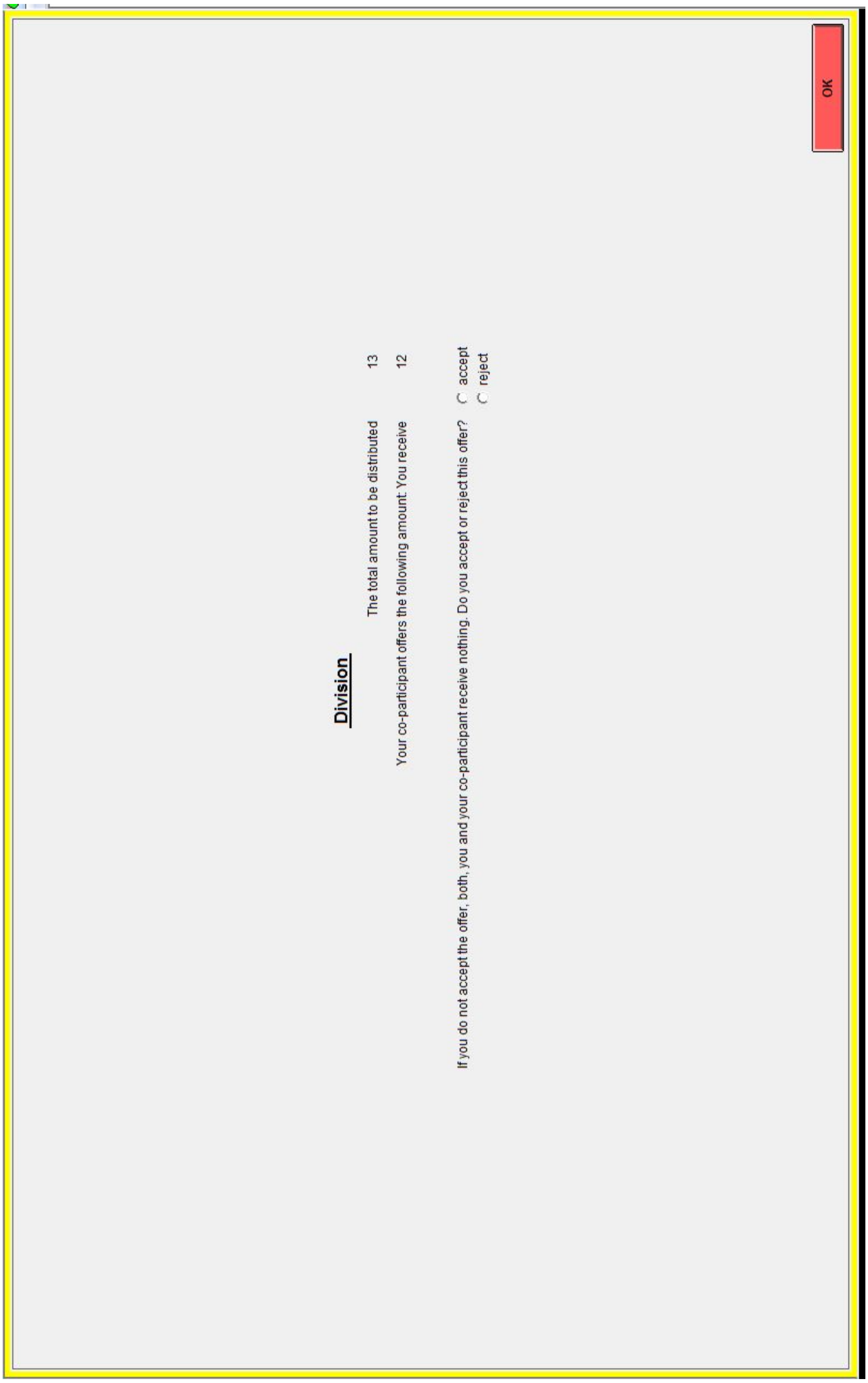
Please do not press the OK button until the experimenter has finished reading the instructions aloud.

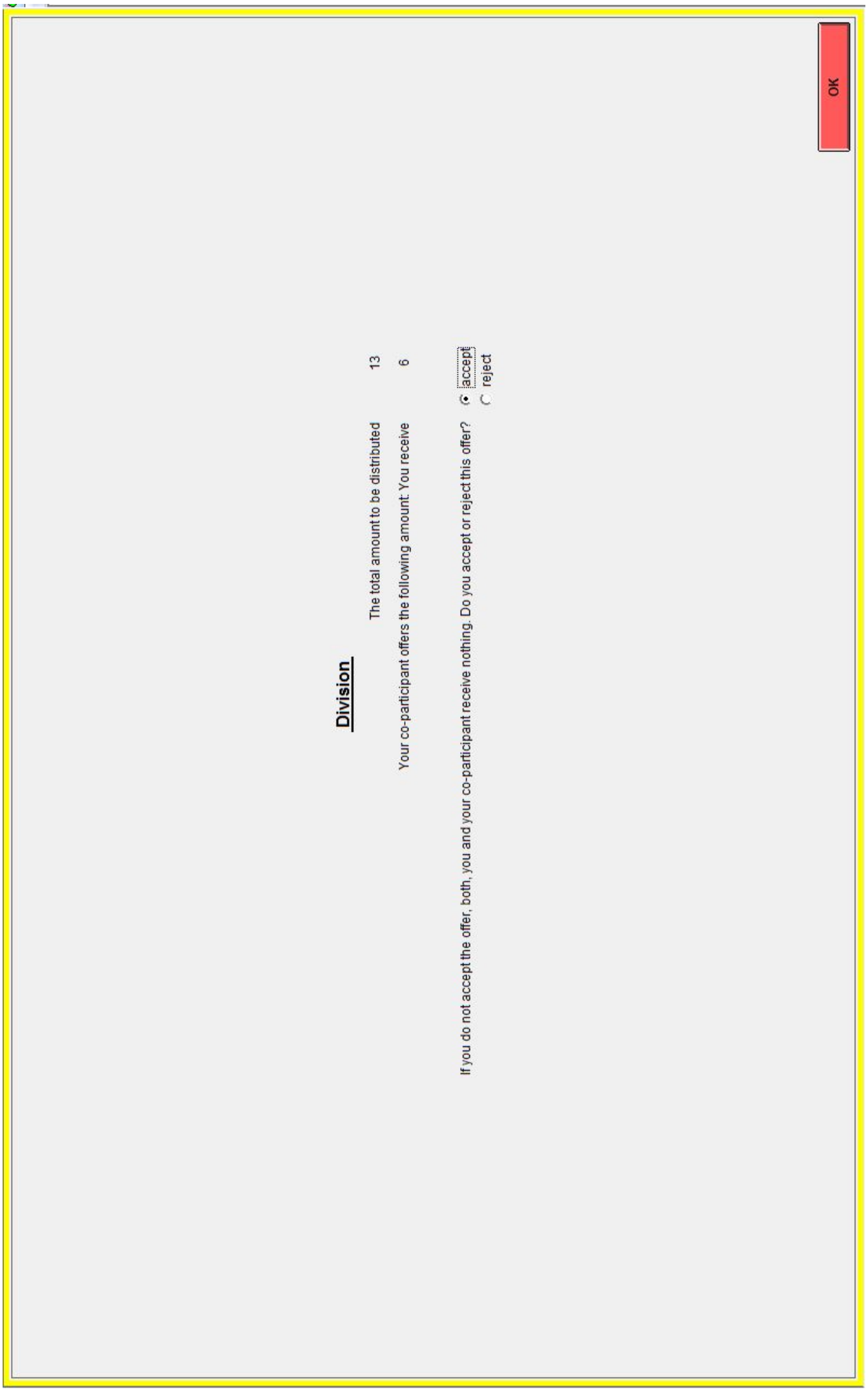
OK

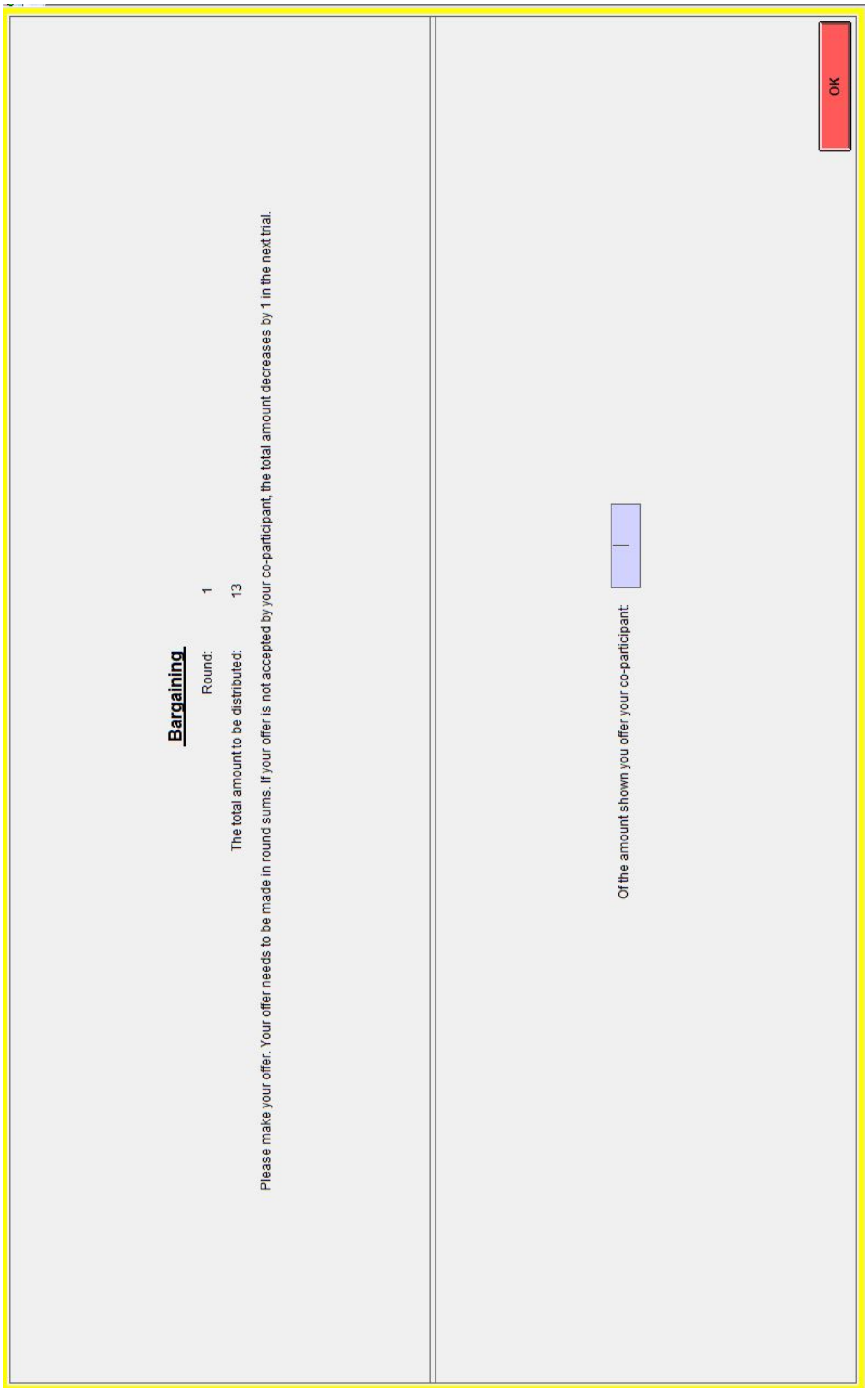

Distribution
This is a simple distribution task. Please select one of the choices below and then press the "OK" -button. Once you hit the "OK" button, you cannot change your choice.
•Select choice A to allocate £ 2.1 to yourself and £ 2.1to your co-participant.
•Select choice B to allocate £ -1.5 to yourself and £ 2.6to your co-participant.
Choice A
Choice B
OK


Distribution
This is a simple distribution task. Please select one of the choices below and then press the "OK" -button. Once you hit the "OK" button, you cannot change your choice.
•Select choice A to allocate £ 2.6 to yourself and £ -1.5to your co-participant.
•Select choice B to allocate £ 2.1 to yourself and £ -2.1to your co-participant.
Choice A
Choice B
OK


Division
The total amount to be distributed
13
Please make your offer. Your offer needs to be made in round numbers. If your offer is not accepted by your co-participant, both of you will receive nothing. Of the amount shown you offer your co-participant
OK


Division
The total amount to be distributed 13
Your co-participant offers the following amount: You receive 12
If you do not accept the offer, both, you and your co-participant receive nothing. Do you accept or reject this offer?
accept
reject
OK


Division
The total amount to be distributed 13
Your co-participant offers the following amount: You receive 6
If you do not accept the offer, both, you and your co-participant receive nothing. Do you accept or reject this offer?
accept
reject
OK



Bargaining
Round: 1
The total amount to be distributed: 13
Please make your offer. Your offer needs to be made in round sums. If your offer is not accepted by your co-participant, the total amount decreases by 1 in the next trial.
Of the amount shown you offer your co-participant:
OK

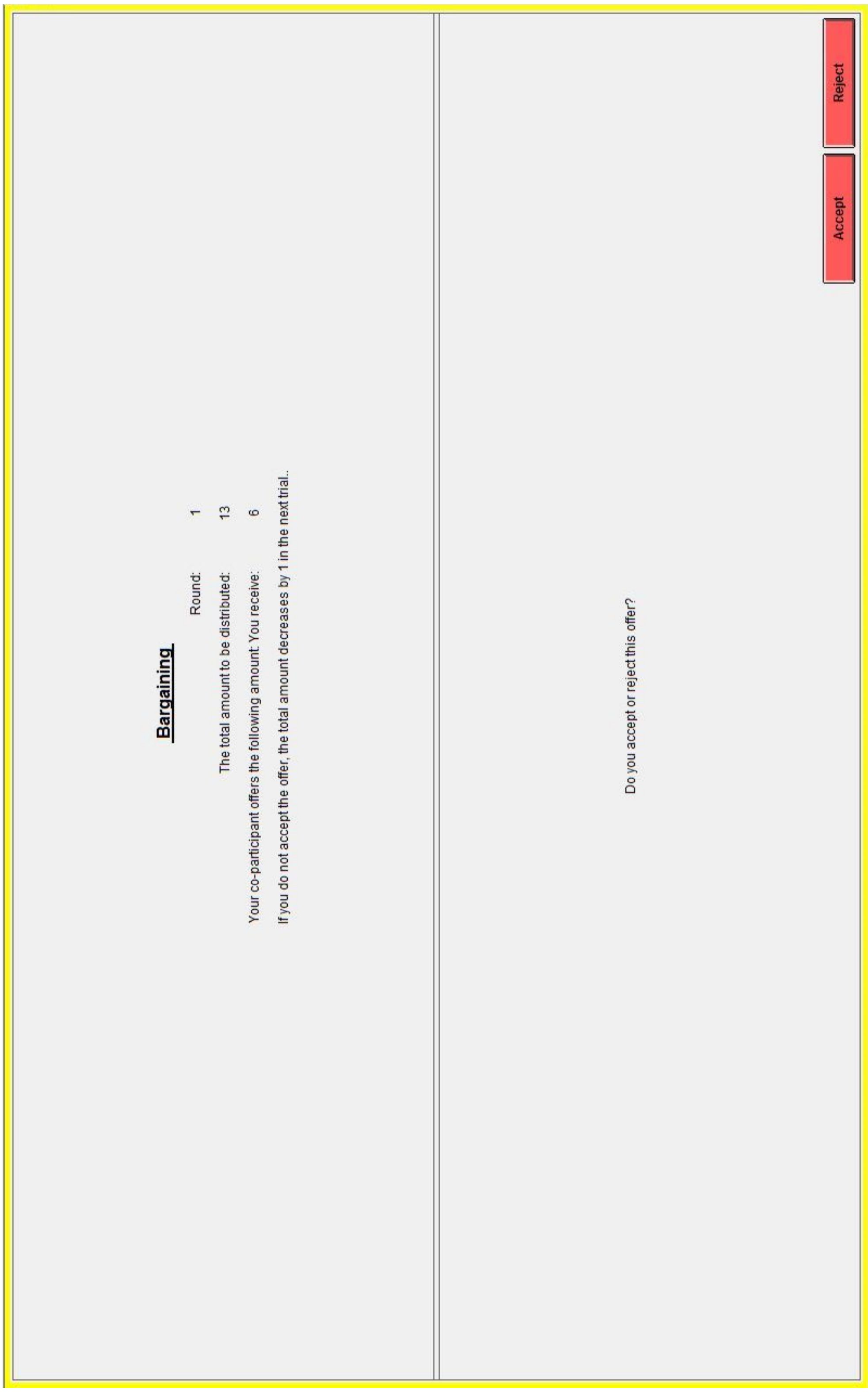
Bargaining

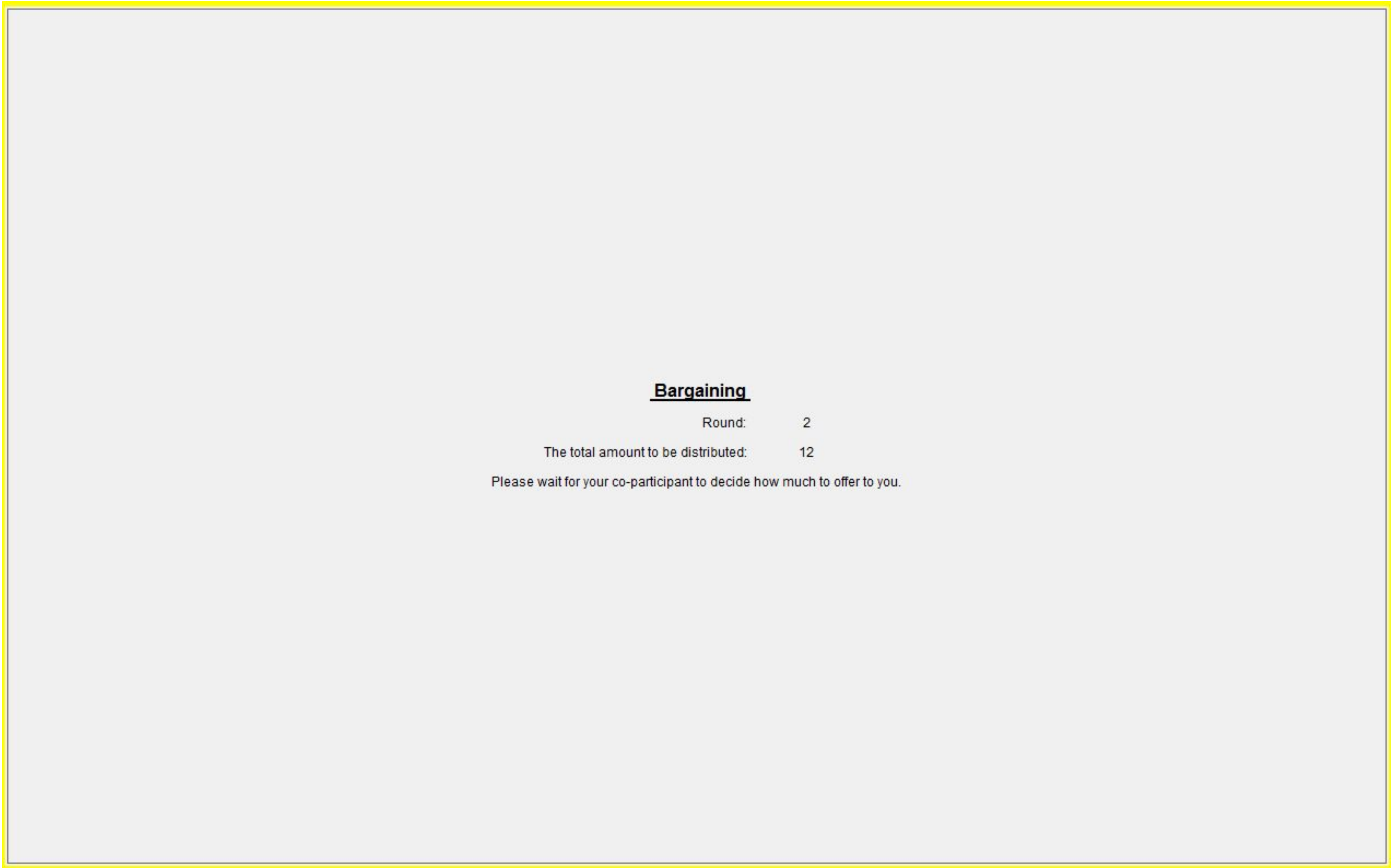
Round: 1

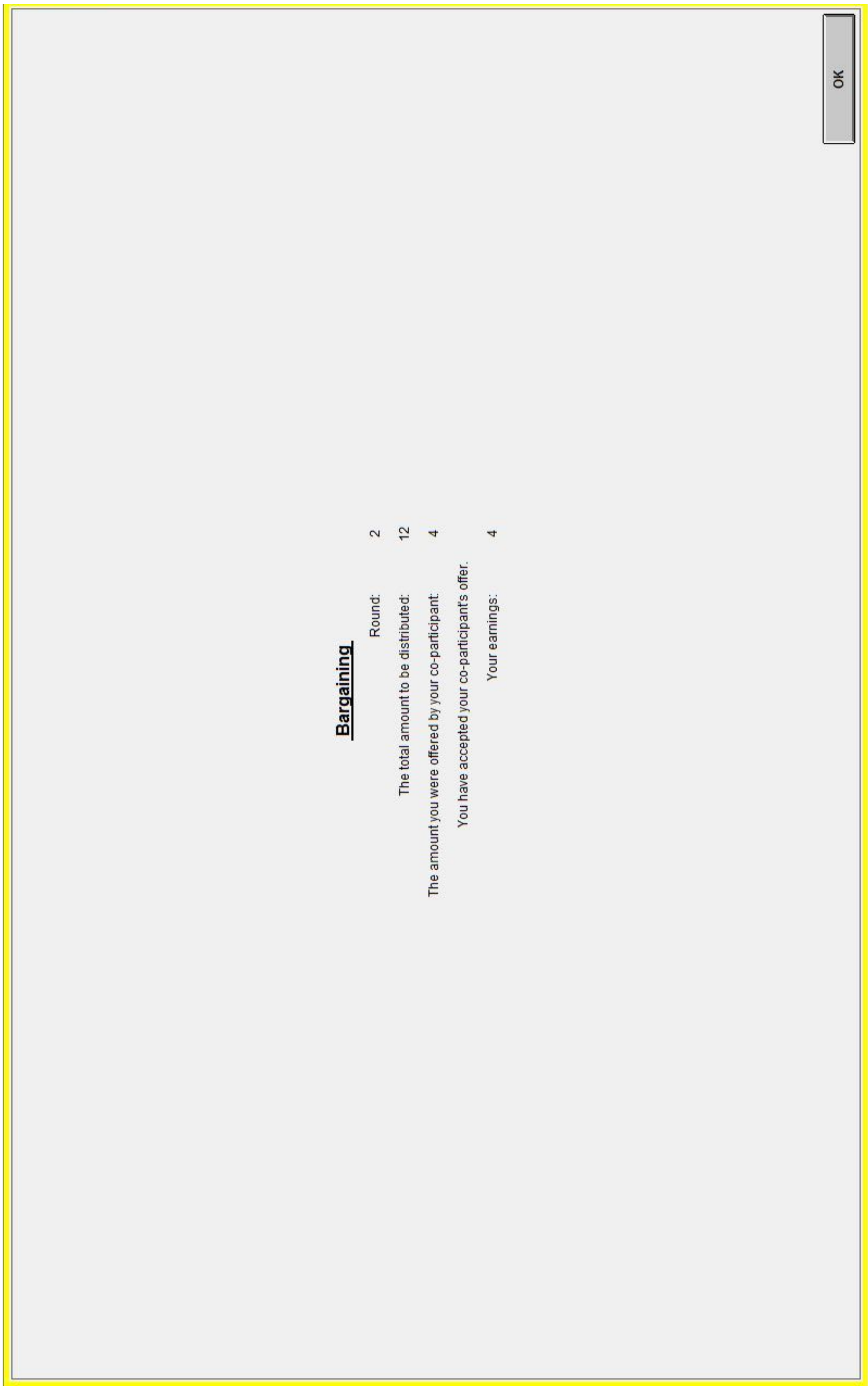
The total amount to be distributed: 13

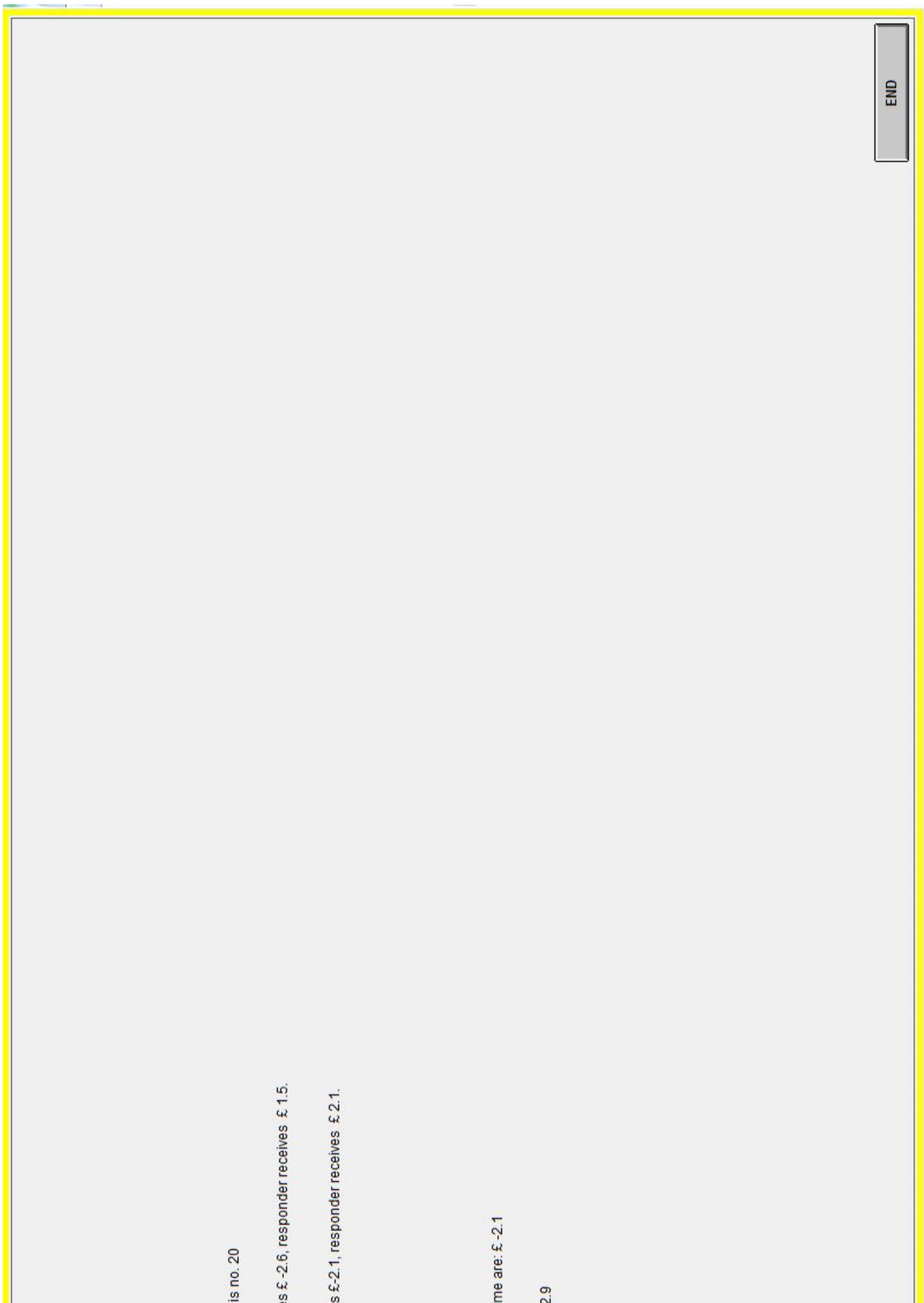
The amount you offered to your co-participant: 6

Please wait for your co-participant to decide whether to accept or reject your offer.


Bargaining
Round: 1
The total amount to be distributed: 13
Your co-participant offers the following amount: You receive: 6
If you do not accept the offer, the total amount decreases by 1 in the next trial..
Do you accept or reject this offer?
Accept
Reject


Bargaining
Round: 2
The total amount to be distributed: 12
Please wait for your co-participant to decide how much to offer to you.


Bargaining
Round: 2
The total amount to be distributed: 12
The amount you were offered by your co-participant: 4
You have accepted your co-participant's offer.
Your earnings: 4
OK


The real scenario chosen is no. 20
Option A: proposer receives £ -2.6, responder receives £ 1.5.
Option B: proposer receives £-2.1, responder receives £ 2.1.
You were a Proposer
Option B was chosen.
Your earnings from the game are: £ -2.1
Your total earnings are £ 2.9
END

3. APPENDIX: CHAPTER 3

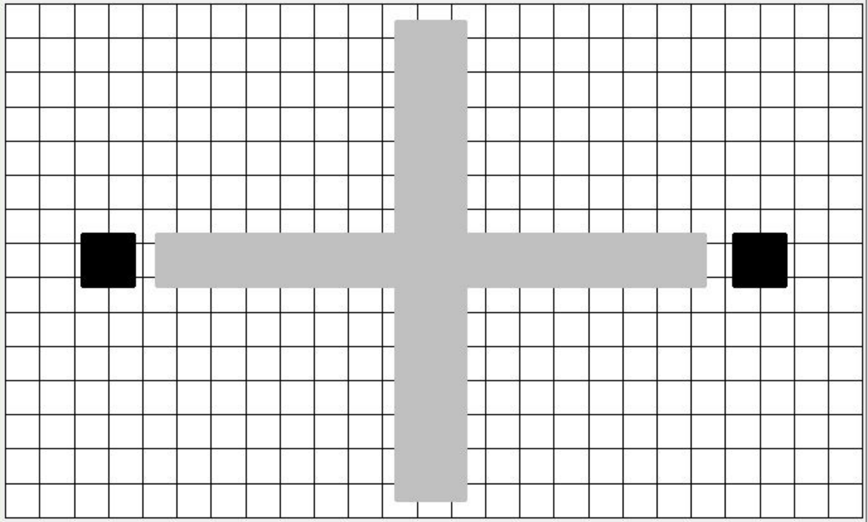
Appendix 3.1: Random sequence of games

GAME SEQUENCE	1	2	3	4	5	6	7	8	9	10	11	12
Game No. / Session 1	11	8	1	7	5	4	6	9	10	3	2	12
Game No. / Session 2	9	1	12	2	6	4	7	3	8	10	5	11
Game No. / Session 3	4	5	12	11	8	1	2	10	7	3	9	6
Game No. / Session 4	1	2	9	7	4	12	5	11	3	10	6	8
Game No. / Session 5	9	4	8	12	6	2	1	11	5	7	10	3
Game No. / Session 6	9	4	10	2	3	7	8	1	6	5	12	11
Game No. / Session 7	12	2	7	6	8	9	10	5	1	3	4	11
Game No. / Session 8	5	11	3	6	1	9	7	2	8	10	12	4

Table 3.9: Random Sequence of Games

Appendix 3.2: Instructions

Picture of Bargaining table



Objects will be placed either horizontally or vertically on the bargaining table. The grey areas show where the objects will be placed.

Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.

The Tasks

Everyone in the room is receiving exactly the same instructions.

You will be presented with **12 different scenarios** , one after each other. In each scenario you will be paired randomly with another person in this room. For each scenario you will be paired with a different person. Each scenario consists of two stages. In the first stage of each scenario you will receive an initial endowment, with which you can buy objects having a certain money value. In the second stage you will bargain with your co-participant about the total sum of purchased objects.

Bargaining will take part on a bargaining table as shown to the left. The bargaining table has two black squares on the left and on the right side. These black squares represent bases for you and your co-participant. You will be told which one of the bases is yours, placing you either to the left or to the right on the bargaining table.

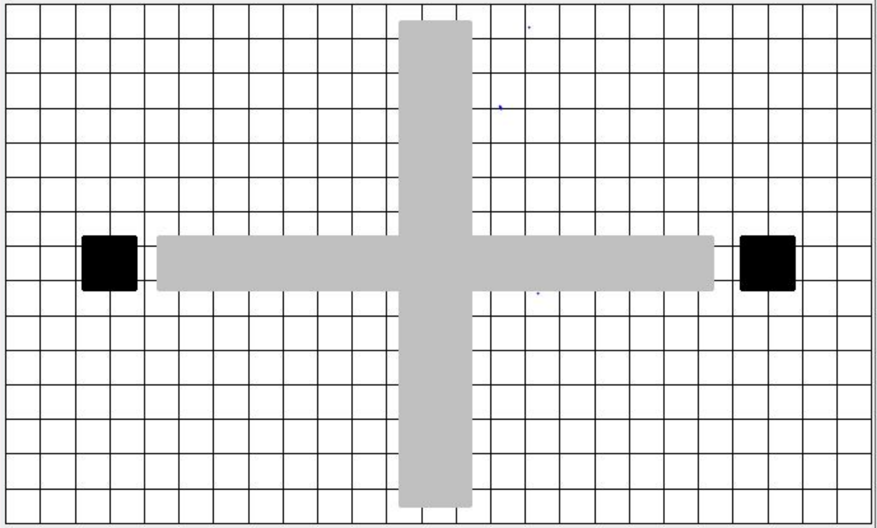
In each scenario you will receive a different endowment of Tokens. The endowment you receive will be either more or less than that of your co-participant. Prior to each scenario you will be told your endowment and the endowment of your co-participant. Your role is determined randomly for each scenario.

Everyone in the room will face the same scenarios. A player with higher endowment is always paired with a player with lower endowment. Half of the players will have a higher endowment and half of the players will have a lower endowment in each scenario.

Determining your payment

In order to determine your payment the computer randomly selects one of the 12 scenarios. This will be the real scenario. You will not know which scenario is the real one until you have responded to all of them. **So you should treat each scenario as if it is the real one.** So when thinking about each scenario, remember that it could be the real one and treat it isolation from the others. Your money earnings will be based on your decision and the decision the co-participant you were matched with in the winning scenario.

Picture of Bargaining table



Objects will be placed either horizontally or vertically on the bargaining table. The grey areas show where the objects will be placed.

Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.

Investing

In each task you will be asked to make a decision about investing your initial endowment. Investing means you use your available Tokens to buy objects with a certain money value. Objects have the same price for both players in a scenario. In a scenario all objects will always have the same money value. The money value of the objects varies in between scenarios. The available investment options will be shown on your screen. Any Tokens you do not invest will be converted to £ 1 and belong to you. Any objects you purchase will be placed on the bargaining table.

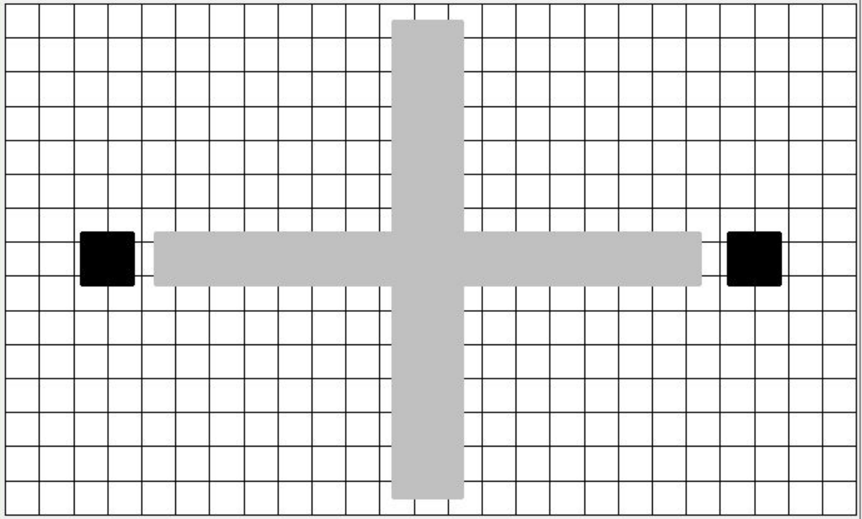
The objects you purchase will be either aligned horizontally next to the black squares or vertically in the middle of the bargaining table. The grey areas mark the space where objects will be placed. If the objects are placed horizontally any objects you purchase will be placed next to your base in a straight line between your base and the base of your co-participant. If the objects are placed horizontally they will be placed at an equal distance between your base and your co-participants base. You will be told prior to investing how the objects you purchase will be placed on the bargaining table.

Bargaining - Claiming Objects

Following the investment decision of you and your co-participant the objects on the bargaining table need to be split up. You and your co-participant simultaneously indicate how many of the objects on the bargaining table you want to claim by inputting your choice on the screen pressing the input button. Both you and your co-participant can change your choice as often as you like in the given time frame. Your choice and the choice of your co-participant will determine whether there is an agreement. An agreement is reached if neither object is claimed by both players. In case of an agreement you and your co-participant receive the objects with the corresponding money values that you claimed. However, if by the end of the bargaining session there is no agreement and one or more objects are claimed by you and your co-participant neither player will receive any objects.

The bargaining ends automatically after 2 minutes or if you and your co-participant end the bargaining by both pressing the Agree-button. As you will not know whether your co-participant pressed the Agree-button, you can press it evertime you agree with the distribution that you see, also several times. However, once you leave the bargaining table, you can no longer change your choice.

Picture of Bargaining table

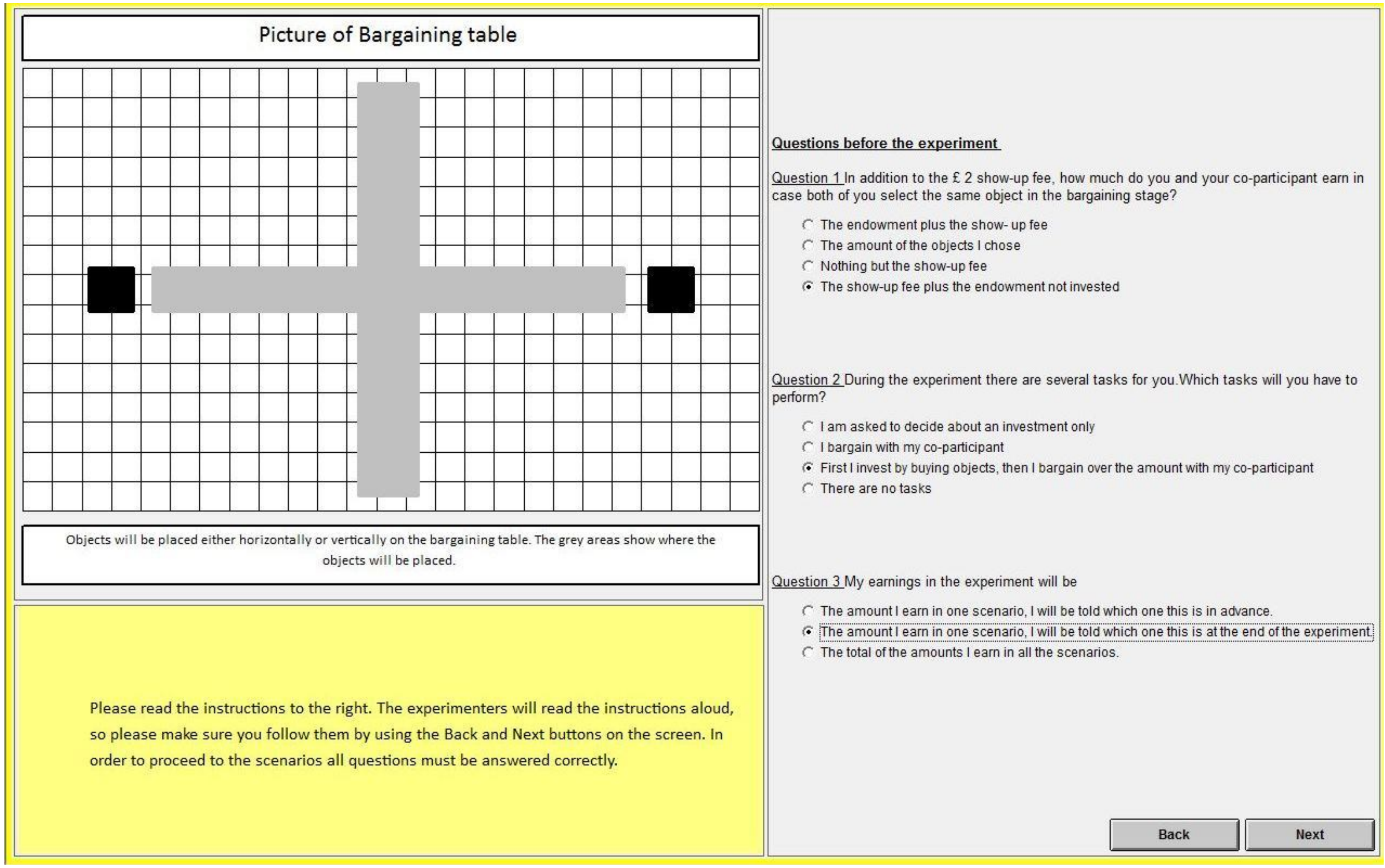


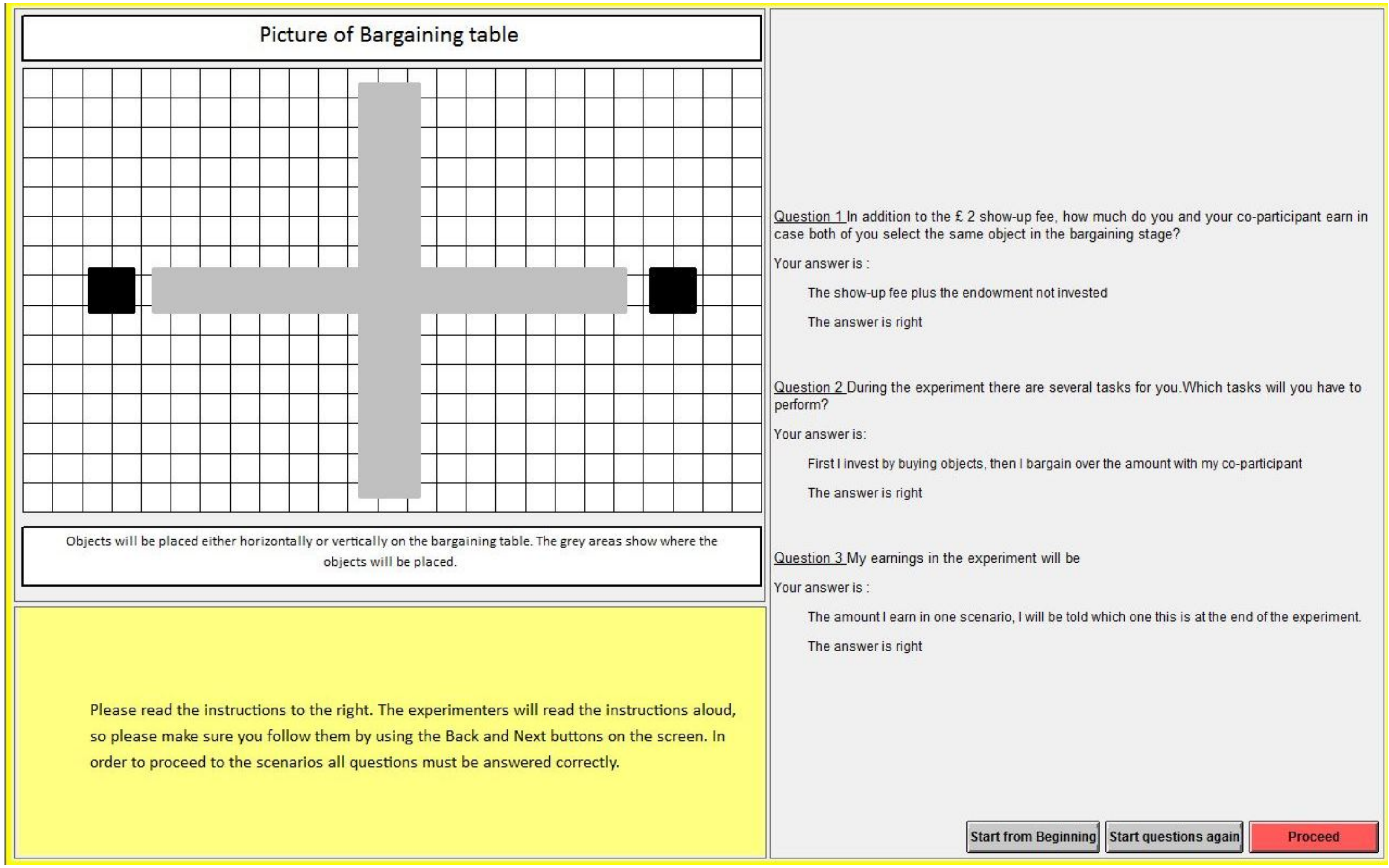
Objects will be placed either horizontally or vertically on the bargaining table. The grey areas show where the objects will be placed.

Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.

Your Money Earnings - Example

You will receive a show-up fee of £ 2. In addition you will receive £ 1 for each Token that you did not invest and your earnings from the bargaining scenario. Suppose you receive an endowment of 6 Tokens. If you do not invest any of the Tokens they will be converted to £ 1 each and you receive a total payment of £ 8. If you invest 4 Tokens purchasing 6 objects with a money value of £ 1 and retain two Tokens you will receive a £ 2 show-up fee, £ 2 from not investing and £ 6 from the objects if you reached an agreement and claimed all of them in the bargaining stage. This would leave you with a total of £ 10.


Picture of Bargaining table
Objects will be placed either horizontally or vertically on the bargaining table. The grey areas show where the objects will be placed.
Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.
Questions before the experiment
Question 1 In addition to the £ 2 show-up fee, how much do you and your co-participant earn in case both of you select the same object in the bargaining stage?
The endowment plus the show- up fee
The amount of the objects I chose
Nothing but the show-up fee
The show-up fee plus the endowment not invested
Question 2 During the experiment there are several tasks for you.Which tasks will you have to perform?
I am asked to decide about an investment only
I bargain with my co-participant
First I invest by buying objects, then I bargain over the amount with my co-participant
There are no tasks
Question 3 My earnings in the experiment will be
The amount I earn in one scenario, I will be told which one this is in advance.
The amount I earn in one scenario, I will be told which one this is at the end of the experiment.
The total of the amounts I earn in all the scenarios.
Back
Next



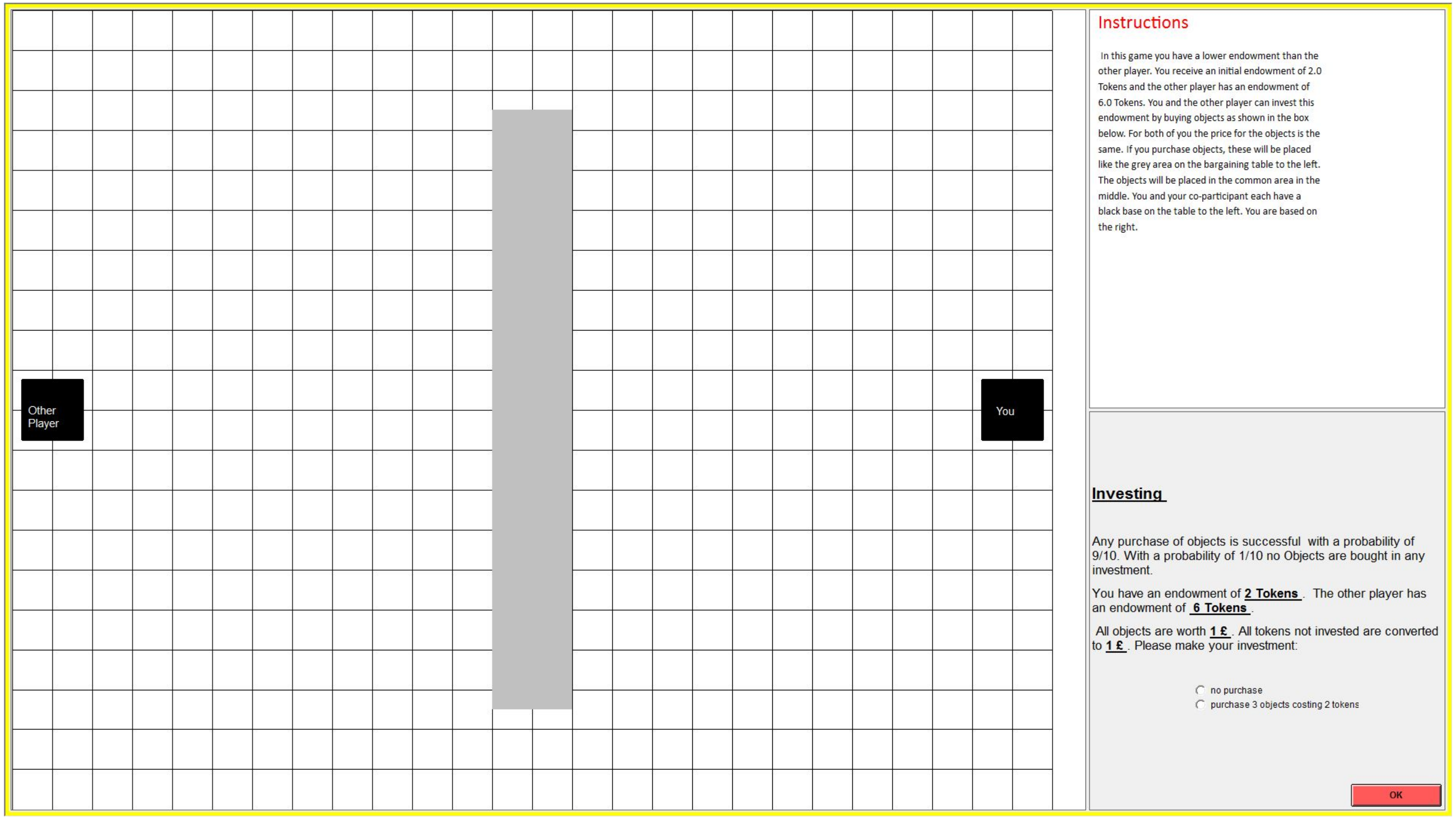
Picture of Bargaining table
Objects will be placed either horizontally or vertically on the bargaining table. The grey areas show where the objects will be placed.
Please read the instructions to the right. The experimenters will read the instructions aloud, so please make sure you follow them by using the Back and Next buttons on the screen. In order to proceed to the scenarios all questions must be answered correctly.
Question 1 In addition to the £ 2 show-up fee, how much do you and your co-participant earn in case both of you select the same object in the bargaining stage?
Your answer is :
The show-up fee plus the endowment not invested
The answer is right
Question 2 During the experiment there are several tasks for you. Which tasks will you have to perform?
Your answer is:
First I invest by buying objects, then I bargain over the amount with my co-participant
The answer is right
Question 3 My earnings in the experiment will be
Your answer is :
The amount I earn in one scenario, I will be told which one this is at the end of the experiment.
The answer is right
Start from Beginning
Start questions again
Proceed

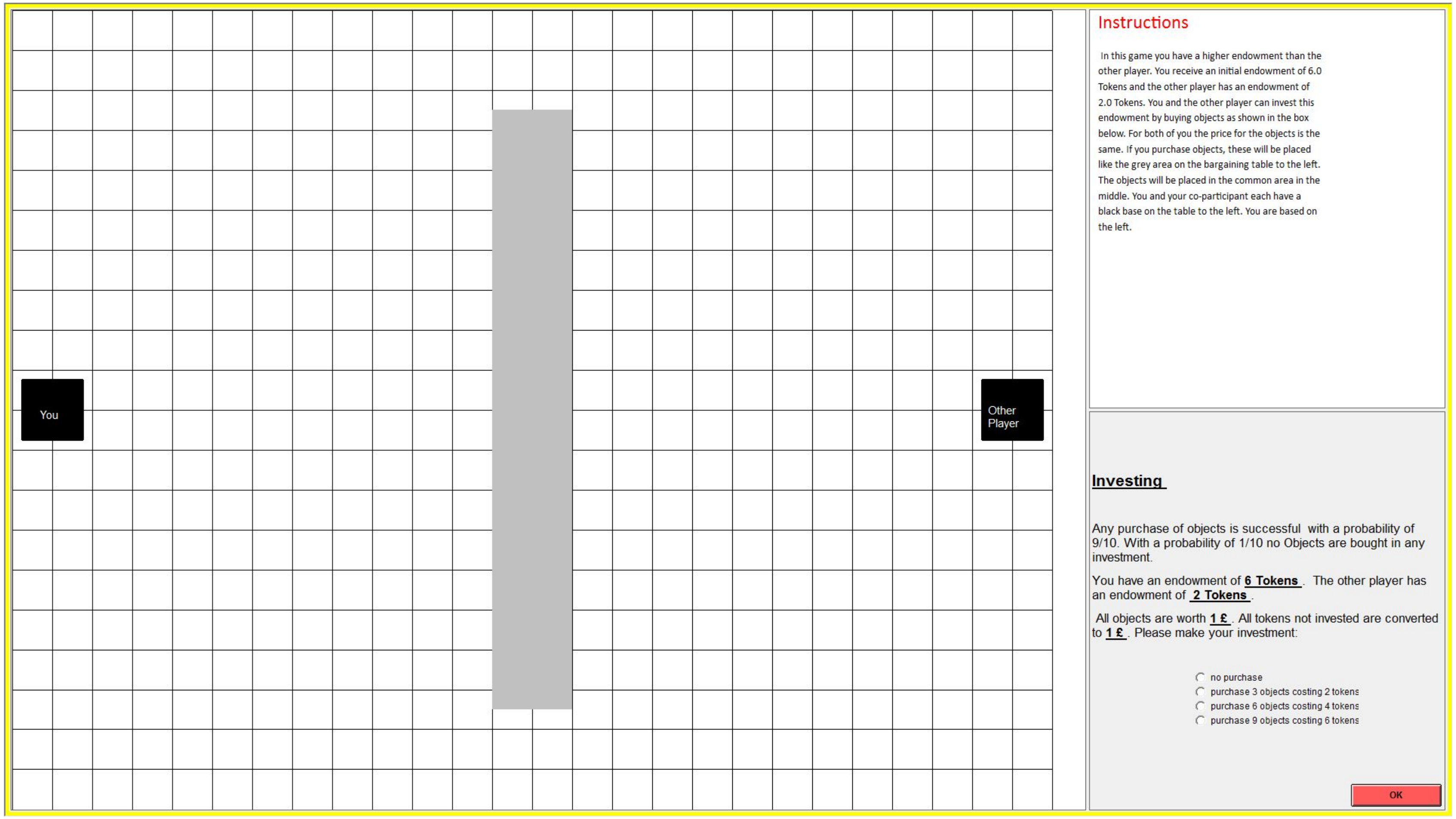
<u>Everyone in the room has now answered the questions correctly. We are now ready to begin the experiment. Please raise your hand if you have any questions before we start.</u>

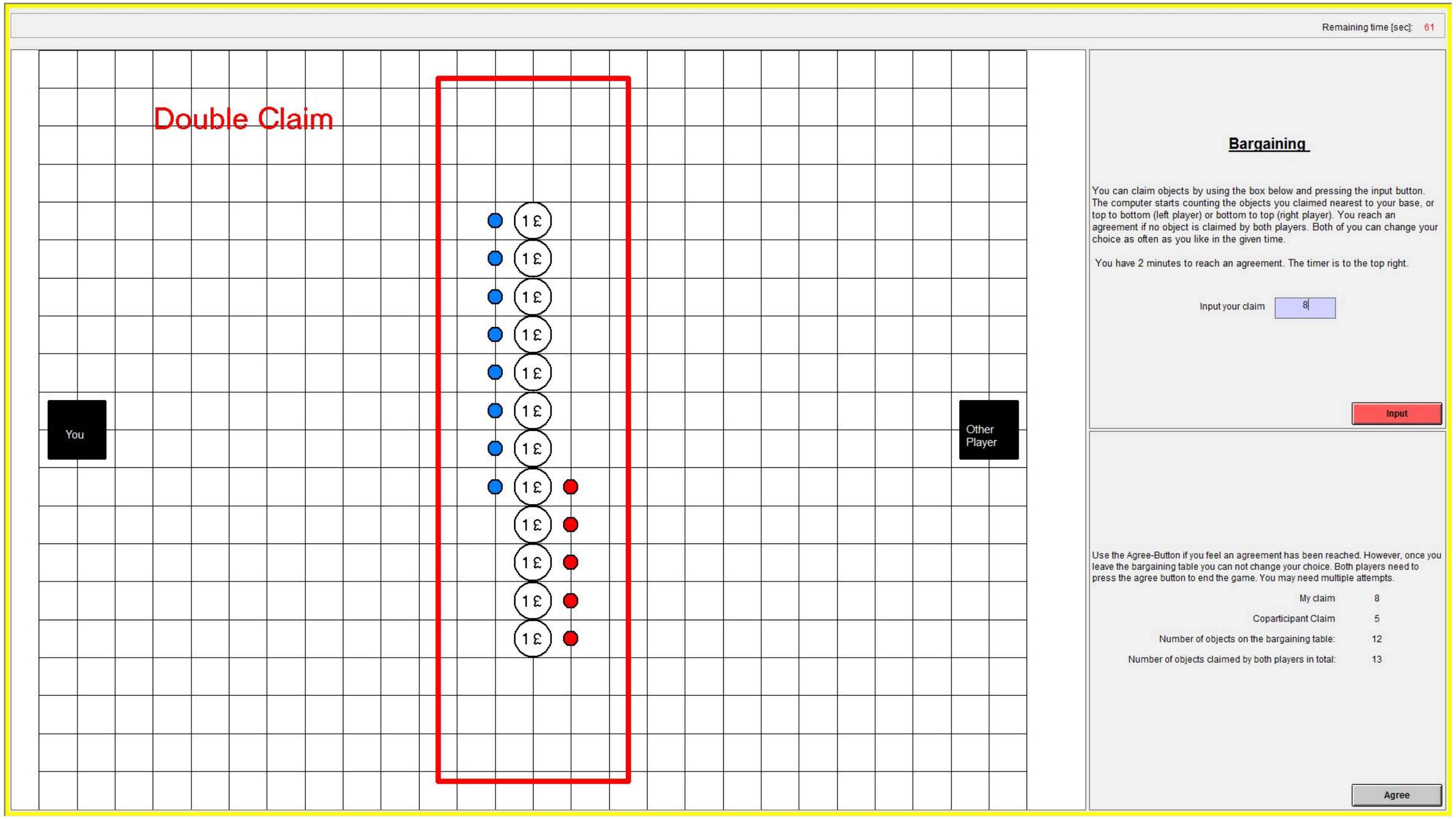
We ask you not to communicate with anyone in the room. If you have any problems with your computer, please raise your hand and we will come to your desk to assist you.

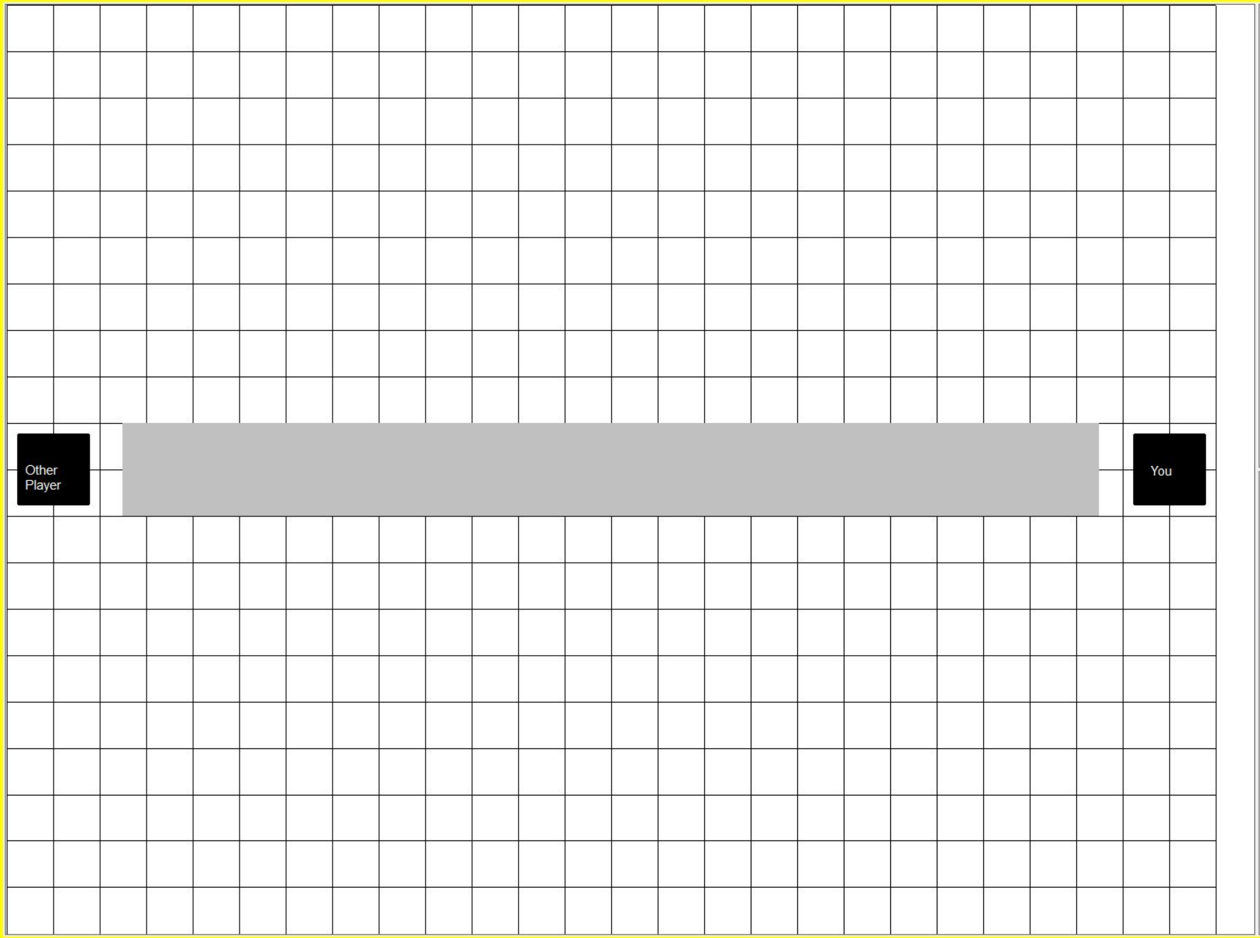
Please do not press the OK button until the experimenter has finished reading the instructions aloud.

OK


Other Player
You
Instructions
In this game you have a lower endowment than the other player. You receive an initial endowment of 2.0 Tokens and the other player has an endowment of 6.0 Tokens. You and the other player can invest this endowment by buying objects as shown in the box below. For both of you the price for the objects is the same. If you purchase objects, these will be placed like the grey area on the bargaining table to the left. The objects will be placed in the common area in the middle. You and your co-participant each have a black base on the table to the left. You are based on the right.
Investing
Any purchase of objects is successful with a probability of 9/10. With a probability of 1/10 no Objects are bought in any investment.
You have an endowment of 2 Tokens . The other player has an endowment of 6 Tokens .
All objects are worth 1 £ . All tokens not invested are converted to 1 £ . Please make your investment:
no purchase
purchase 3 objects costing 2 tokens
OK


You
Other Player
Instructions
In this game you have a higher endowment than the other player. You receive an initial endowment of 6.0 Tokens and the other player has an endowment of 2.0 Tokens. You and the other player can invest this endowment by buying objects as shown in the box below. For both of you the price for the objects is the same. If you purchase objects, these will be placed like the grey area on the bargaining table to the left. The objects will be placed in the common area in the middle. You and your co-participant each have a black base on the table to the left. You are based on the left.
Investing
Any purchase of objects is successful with a probability of 9/10. With a probability of 1/10 no Objects are bought in any investment.
You have an endowment of 6 Tokens . The other player has an endowment of 2 Tokens .
All objects are worth 1 £ . All tokens not invested are converted to 1 £ . Please make your investment:
no purchase
purchase 3 objects costing 2 tokens
purchase 6 objects costing 4 tokens
purchase 9 objects costing 6 tokens
OK


Remaining time [sec]: 61
Double Claim
You
Other Player
1 £
Bargaining
You can claim objects by using the box below and pressing the input button. The computer starts counting the objects you claimed nearest to your base, or top to bottom (left player) or bottom to top (right player). You reach an agreement if no object is claimed by both players. Both of you can change your choice as often as you like in the given time.
You have 2 minutes to reach an agreement. The timer is to the top right.
Input your claim 8
Input
Use the Agree-Button if you feel an agreement has been reached. However, once you leave the bargaining table you can not change your choice. Both players need to press the agree button to end the game. You may need multiple attempts.
My claim 8
Coparticipant Claim 5
Number of objects on the bargaining table: 12
Number of objects claimed by both players in total: 13
Agree



Instructions

In this game you have a lower endowment than the other player. You receive an initial endowment of 0.0 Tokens and the other player has an endowment of 6.0 Tokens. You and the other player can invest this endowment by buying objects as shown in the box below. For both of you the price for the objects is the same. If you purchase objects, these will be placed like the grey area on the bargaining table to the left. The objects will be placed next to your base. You and your co-participant each have a black base on the table to the left. You are based on the right.

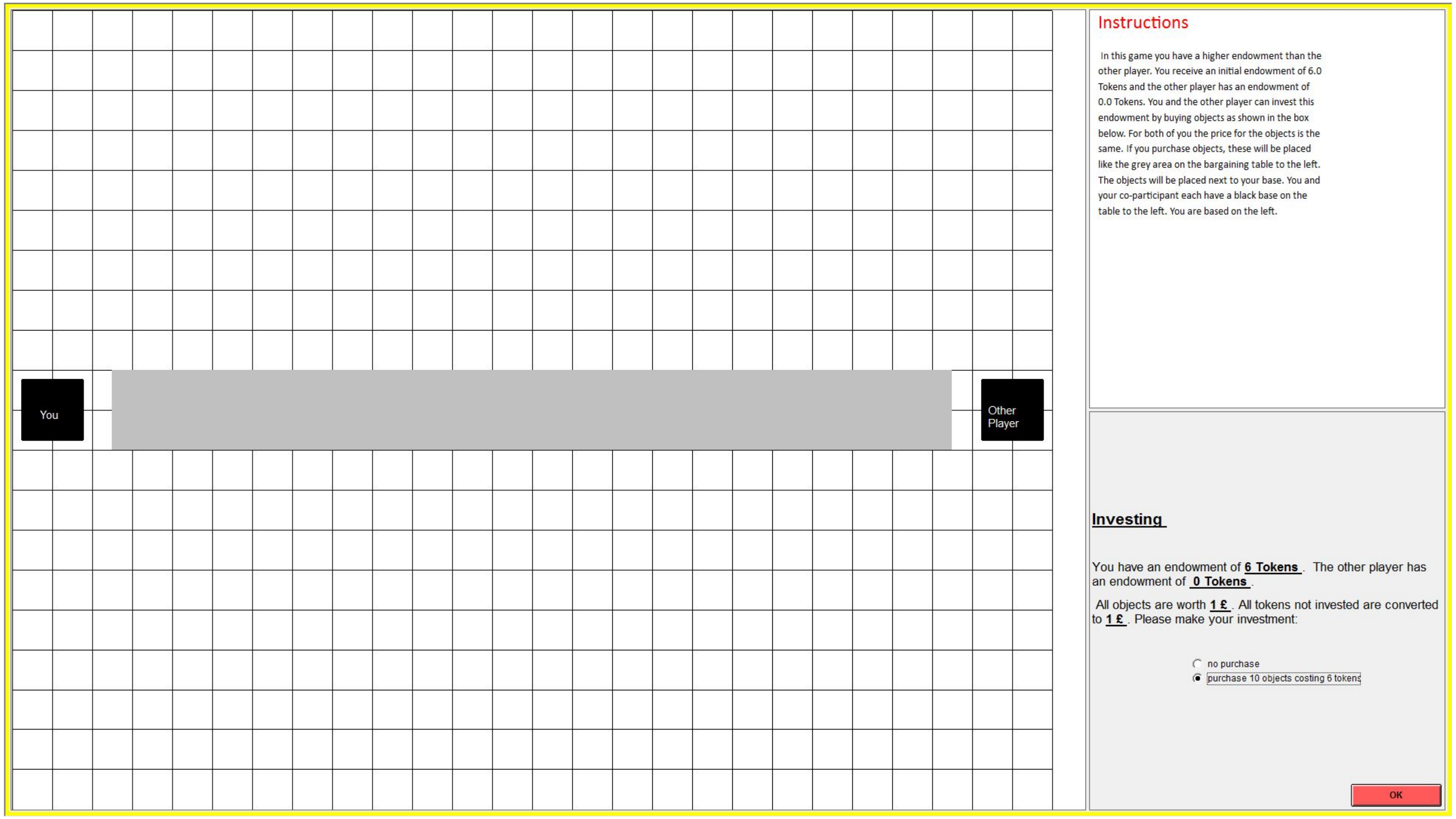
Investing

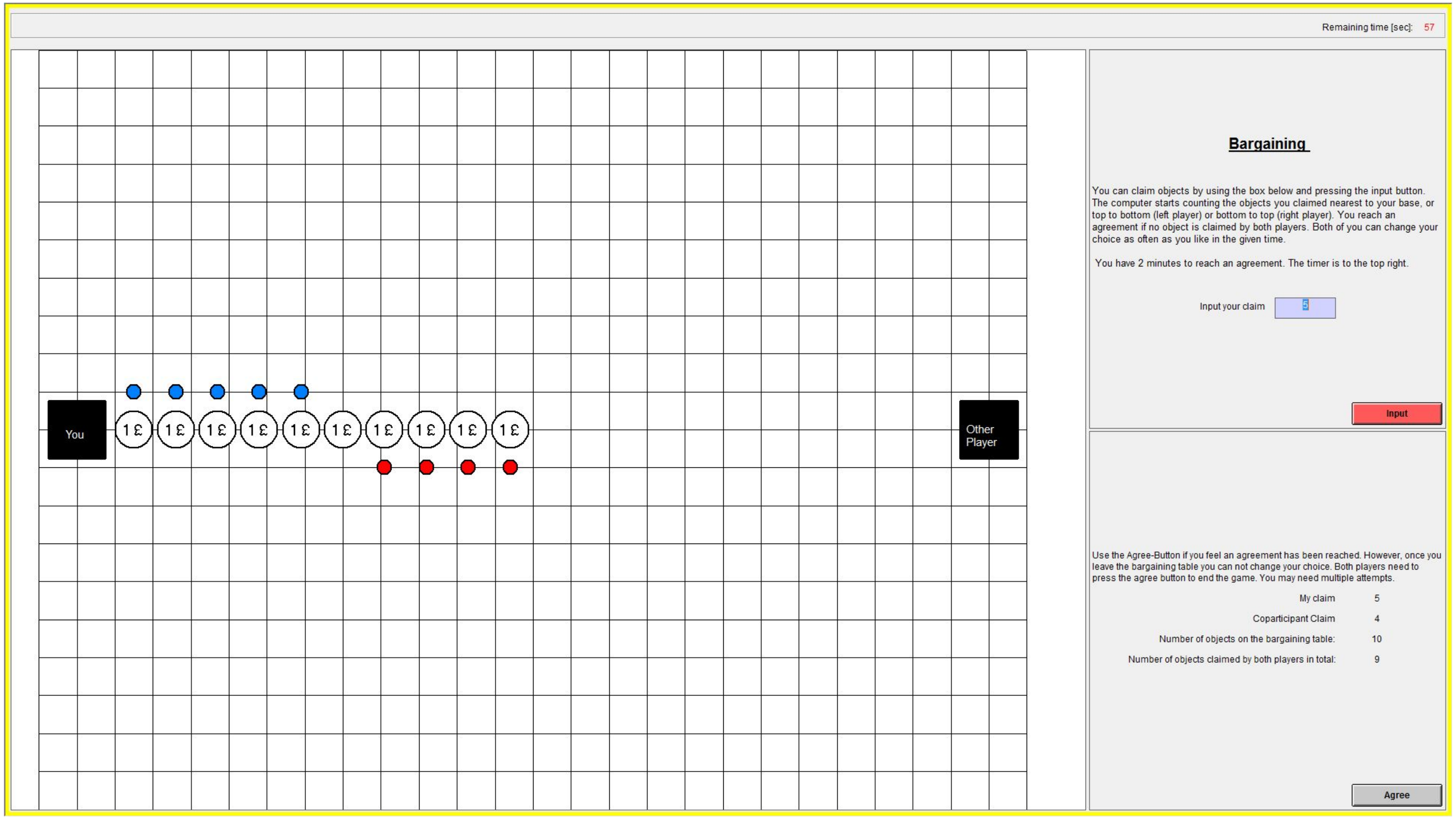
You have an endowment of **0 Tokens** . The other player has an endowment of **6 Tokens** .

All objects are worth **1 £** . All tokens not invested are converted to **1 £** . Please make your investment:

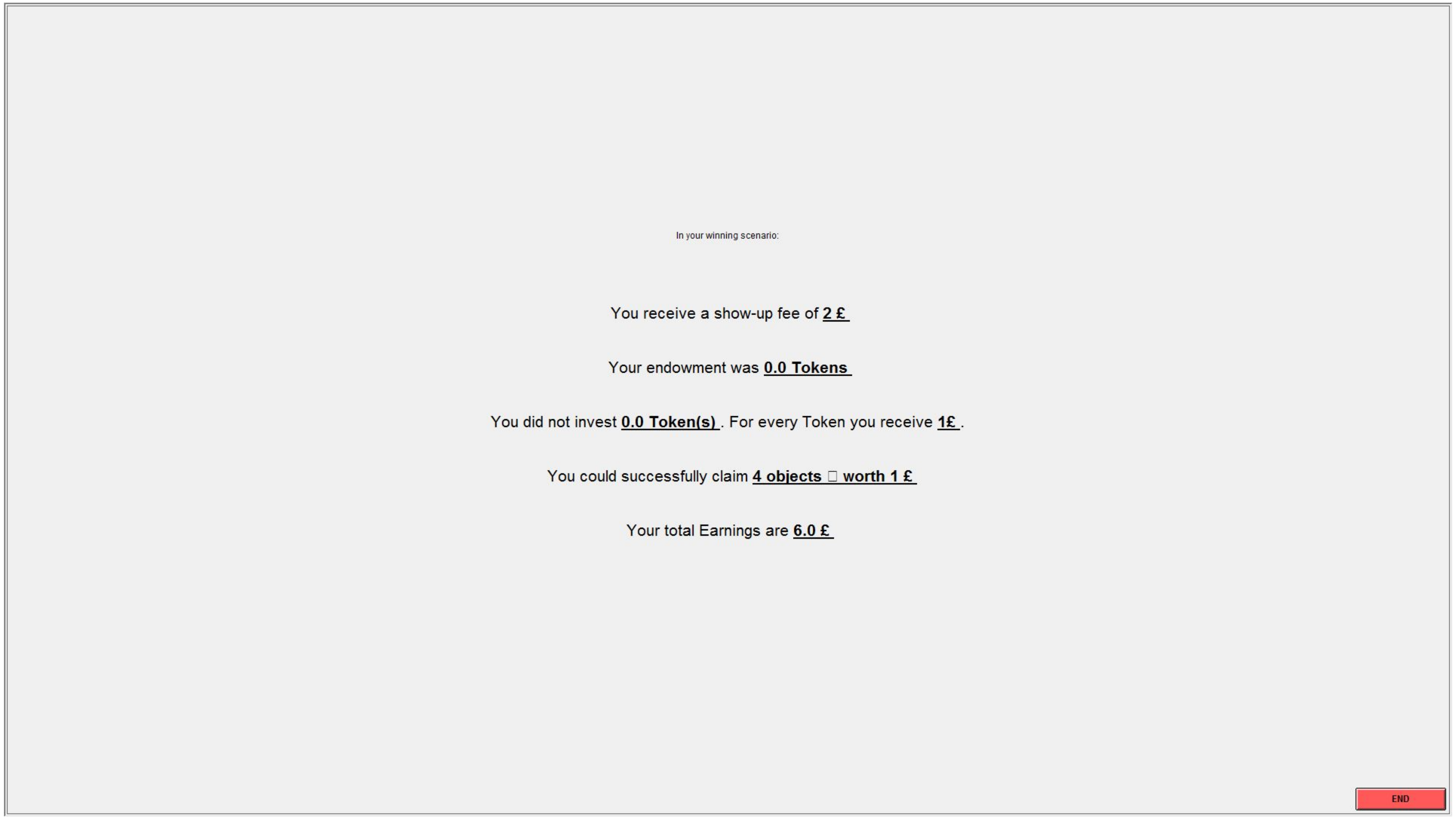
You can not make an investment

OK


You
Other Player
Instructions
In this game you have a higher endowment than the other player. You receive an initial endowment of 6.0 Tokens and the other player has an endowment of 0.0 Tokens. You and the other player can invest this endowment by buying objects as shown in the box below. For both of you the price for the objects is the same. If you purchase objects, these will be placed like the grey area on the bargaining table to the left. The objects will be placed next to your base. You and your co-participant each have a black base on the table to the left. You are based on the left.
Investing
You have an endowment of 6 Tokens . The other player has an endowment of 0 Tokens .
All objects are worth 1 £ . All tokens not invested are converted to 1 £ . Please make your investment:
no purchase
purchase 10 objects costing 6 tokens
OK



Remaining time [sec]: 57
You
1 £
Other Player
Bargaining
You can claim objects by using the box below and pressing the input button. The computer starts counting the objects you claimed nearest to your base, or top to bottom (left player) or bottom to top (right player). You reach an agreement if no object is claimed by both players. Both of you can change your choice as often as you like in the given time.
You have 2 minutes to reach an agreement. The timer is to the top right.
Input your claim 5
Input
Use the Agree-Button if you feel an agreement has been reached. However, once you leave the bargaining table you can not change your choice. Both players need to press the agree button to end the game. You may need multiple attempts.
My claim 5
Coparticipant Claim 4
Number of objects on the bargaining table: 10
Number of objects claimed by both players in total: 9
Agree


In your winning scenario:
You receive a show-up fee of 2 £
Your endowment was 0.0 Tokens
You did not invest 0.0 Token(s) . For every Token you receive 1£ .
You could successfully claim 4 objects □ worth 1 £
Your total Earnings are 6.0 £
END