Essays on Gains, Losses and Focality

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Abstract

Decision makers face gains and losses decisions on an everyday basis. Unlike conventional economic theories, the real decisions people make are influenced by various factors. Focality, for example, is an important payoff-irrelevant factor that significantly influences individual decision makings. In this thesis, we report three studies of decision makings influenced by focality from a behavioural perspective.

In the second chapter, we extend the analysis of a riskless choice experiment reported recently by Hochman et al. (2014). I run an experiment where participants select from among sets of standard playing cards valued by a simple formula. In some sessions, participants are given a prepayment associated with some of the cards, which need not be the earnings-maximizing ones. Hochman et al. (2014) find that participants choose an earnings-maximizing card less frequently when another card is prepaid. I find our experiment replicate this result under the original instructions, but not with instructions which explain the payment process more explicitly. Participants who state they do not consider themselves good at mathematics make earnings-maximizing choices much less frequently overall, but those who express self-confidence in mathematics drive the treatment effect. Our results suggest that even when comparisons among choices require only simple quantitative reasoning steps, market designers and regulators may need to pay close attention to how the terms of offers are expressed, explained, and implemented.

In the third chapter, inspired by a historical event–"the treaty of Hong Canal", I use experimental methods to test the effects of joint endowment on coordination success in tacit bargaining games. It has been well established that people use existing focal points to facilitate coordination and the power of such cues declines as payoff becomes increasingly unequal. I conduct an experiment in which two players jointly engaged in an interactive team building activity and together earned the stakes over which they bargain. In the team building exercise, two players jointly complete a shortest route task in a metaphor of a treasure hunt. After the two treasure hunters complete the journey, they independently decide how to divide their rewards using a tacit bargaining table. I find that when participants bargain over the fruits that result from joint activity, they are more likely to coordinate the focal point equilibrium. We contribute to the existing literature of team reasoning and focal point by direct testing the influence of increased group identity on tacit bargaining games.

In the fourth chapter, I run an experiment of a dynamic real-time bargaining and report the results. The experiment captures a situation where two players have the opportunity to cooperate and share economic surplus in continuous time (*peace*), however at any point of time, both players can turn the fruitful assets into battlefield at non-recoverable costs (*wars*). The objective of the game is to capture players' bargaining stances during dynamic interactions and examine the influence of personal traits on bargaining outcomes. The results show that majority of the participants exert costly efforts into "wars", which results substantial efficiency loss. Focality has little influence on the efficiency attribute of bargaining outcomes; however has significant influence on the distributive features of bargaining outcomes. Moreover, I find players who do not come into "wars" systematically use turn-taking strategies to achieve relatively equal and efficient outcomes; And finally, females incur higher costs of wars; pairs with opposite Locus of Control traits incur least costs of conflict.

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Chapter 1

Introduction

In conventional economic theories, individuals make decisions based on stable utility maximizing preferences. However, the rising experimental evidences have demonstrated that individuals can sometimes systematically deviate from economically optimal strategies; examples such as sunk cost fallacy (Thaler, 1999) and endowment effect (Thaler, 1980; Kahneman et al., 1990); and anchoring effect (Slovic and Lichtenstein, 1968; Johnson and Schkade, 1989; Furnham and Boo, 2011). While such behaviours are sometimes defined as decision-making "anomalies" or "irrationality", I want to have a closer look at these decisions for a better understanding of "real" individual choices. Which is important for market designer and regulators when they take into account of these anomalies before design, implement and execute policies.

To examine individuals' "real" decisions in economic environment and to what extent do these decisions influenced by focality (salient focal point cues), we unfold the research question in two dimensions: individual decision makings versus group interactions; static versus dynamic (continuous) decision makings. Chapter 2 revisit an individual decision making anomaly– the "prepayment effect" (Hochman et al., 2014). We find that the framing of tasks, especially the saliency, can have significant influence on individual decisions. In Chapter 3, we look at the role of salient focal point in static group-interactive decision making environment. In this chapter, we use an interactive team building activity to induce group identity in one treatment. And the results show that participants' tendency to follow salient focal point cues is also influenced by the feelings of group membership. Finally, in Chapter 4, we extend the interaction between participants from static to dynamic. In an attempt to examine the evolution of participants' tendency to follow focal points. Our results reveal that although various focal point cues can influence the dynamic interaction process, but they have little influence on the payoffs. Interactions of individual characteristics, on the other hand, have significant influence the results (payoffs) of the dynamic interactions.

In conventional economic theory, timing of payment should not have an influence on individual's choice of task, especially when time interval is no longer than 1 hour. In the second chapter, we re-visited an individual decision making anomaly influenced by the timing of payment– the "prepayment effect" (Hochman et al., 2014). [1] Hochman et al. find that when participants are given opportunity to choose from prepaid task and post-paid task without any risk or uncertainty, there is a systematic tendency that participants choose prepaid ones at sub-optimal situations. The experiment is designed as follows: participants are given sets of four standard playing cards, and are instructed to select one card from each set. Each card has a monetary value, which depends on the card's suit and rank.[2] In post-payment

[1]There is extensive literature on inter-temporal decision making anomalies (Loewenstein and Prelec, 1992; O'Donoghue and Rabin, 1999; Malhotra et al., 2002; Glimcher and Fehr, 2013; Morrison et al., 2016; Cohen et al., 2016); however the game we examined cannot be counted as one of them, since the time-interval difference between prepayment and post-payment is as short as half an hour, moreover even the half an hour is not free time to spend. In the game we examined, prepayment is more of a framing.

[2]The value of the card depends on its suit and rank only in distant representation framing treatments. In other two framings, value of the card are given by specific number or a combination of both. For our study, we only examined the distant representation treatment, because it is the only treatment that found to have significant prepayment effect.

treatment, participants are paid based on the cards they have selected in all sets. In prepayment treatment treatment, participants receive an advance payment, which corresponds to all spades cards in the sets. Each set has up to one spade card, in some of these sets spades choices are optimal (earnings-maximizing), while in some of other sets spades choices are not optimal. If participants choose spades cards, then they can keep the advance payment; otherwise, if they choose other cards, they need to payback the value of spades in the sets but they will be paid for what they have chosen instead. They find that participants in the prepayment treatment are more likely to carry-out the prepaid-choice (choosing spades cards) than the post-payment treatment, even when the spades choices are not optimal choices.

One possible reason for participants' preference for the prepaid cards is "loss aversion". Participants perceive potential losses higher than expected gains. Another possible reason, we propose, is the saliency of spades cards in the task. Specifically, the spades cards differ from other cards in three aspects, first in the protocol of prepayment: spades cards are prepaid; second in different in value of the suits: spades cards worth 25p per rank while other cards worth 10p per rank; and third in the instructions the total value of spades are given but not the other suits, which makes the spades cards even more salient than other suits cards. In Chapter 2, we first attempt to examine the robustness of prepayment effect, conditional on successful replication, we then unravel each possible explanations of the prepayment effect.

First, we replicate the "prepayment effect" in two treatments, the baseline treatment **Post** and the prepayment treatment **Pre+Amount**. In addition, we conduct two additional treatments **Post+Amount** and **Pre+Amount+Instr** to examine the influence of the choice environment. In **Post+Amount**, we keep the essential features in the baseline treatment **Post** but including the saliency of spades by mentioning the total value of spades cards in the instructions. In **Pre+Amount+Instr** we used the same experimental protocol with the prepayment treatment **Pre+Amount**, but explaining the prepayment protocol in an alternative way by listing all possible scenarios explicitly. The purpose of **Pre+Amount+Instr** is to examine the robustness of the prepayment effect in a different framing.

Our results shown that prepayment effect is robust in Hochman et al.'s original instructions in **Post** and **Pre+Amount** treatments. However, not in the alternate instructions treatment **Pre+Amount+Instr**. Merely mentioning the total value of spades do not have significant influence overall, but strongly affects the non-native speakers to maximize less often even in post-payment protocols. In addition, we find that participants' maximizing behavior is strongly affected by individual characteristics, which I will explain in more detail in Chapter 2.

In Chapter 2, we showed that the saliency of spades cards can play an important role in individuals' preference of spades over other earning-maximizing cards. In Chapter 3, we looked at the influence of salient focal point cues in tacit interactions.

In Chapter 3, we look at a type of coordination game– the tacit bargaining game. The game is often used as a device to examine players' cooperativeness in bargaining. The coordination game is a type of game first introduced by Schelling, in which two players can sometimes coordinate with each other without any communication by using salient focal point cues in the game. In case of pure coordination games, both players in the game get the same positive payoff if they successfully coordinate. In this circumstance, two players have common interests. Focal point cue can serve as an equilibrium selection device. Tacit bargaining games have the same feature as pure coordinate game, two players can coordinate to get the economic surplus, however, there is a conflict of interest in who will get the larger surplus. Schelling argued that in this circumstances, players should set aside the issue of payoff asymmetry in the outcomes and focus on coordination. If focal point cue suggested an unequal distribution, then the player who get lower payoff should accept it.

Schelling's intuition has been further developed into a family of theories of *team reasoning* (Hodgson, 1967; Sugden, 1993, 2000, 2005; Bacharach, 1995, 1997). In team reasoning theories, players' perception of salient labels and cues are included in the formal structure of the game, as a result the equilibrium suggested by the focal point becomes dominant strategy. In Bacharach's theory, a player is said to conduct "team reasoning" if she works out the best strategy profile for the team as a whole, and then carries out her component of it.

In existing experimental studies, it has been well-established that focal point cues can be an effective tool to facilitate participants' coordination in pure coordinate games (Mehta et al., 1994; Bacharach and Bernasconi, 1997); and in tacit bargaining games (Bardsley et al., 2010b; Isoni et al., 2013). However, as payoff allocations become increasing unequal, the effectiveness of focal point cues will be decreased (see Crawford et al., 2008; Isoni et al., 2014, for example).

In Chapter 3, we examined two candidate factors that could enhance participants' team reasoning so that participants are more willing to use focal point cues to coordinate, especially in asymmetric cases (conflict of interests). One factor is the induced group identity. It has been well-established in social identity theories (Tajfel et al., 1971) that enhanced group membership either by minimal group paradigm (Yamagishi and Kiyonari, 2000; Chen and Li, 2009) or though priming a common ethnic or community identity (Shih et al., 1999; Benjamin et al., 2007; Attanasi et al., 2016) could increase players' cooperativeness in social dilemma games. Another commonly used mechanism to enhance group membership in operational research and also recently in experimental economics is through team-building activities (Eckel and Grossman, 2005; Charness et al., 2014). In Chapter 3, in order to induce group identity without confounding the tacit coordination game, we use a interactive joint activity (team-building activity) without face to face communication. The game we used is based on the traveling salesman problem (TSP) and to our knowledge it is the first time this problem has been implemented in economic experiment.

The second factor is the origin of the potential economic surplus. In specific, whether the opportunity to bargain over an economic surplus is jointly earned by the two players or is given to them by default. Similar studies including the house money effect in individual risk taking and cooperativeness preference (Thaler and Johnson, 1990; Clark, 2002; Weber and Zuchel, 2005) and the influence of endowment origins in bargaining environment (Karagözoğlu and Riedl, 2014).

We conducted 3 treatments in Chapter 3 to examine the two factors. And our main result is that joint endowment (prior jointly activity and earn the opportunity to bargain) can significantly increase participants tendency to coordinate using focal point in asymmetric games; while merely joint activity has limited effects.

In Chapter 3, we look at the influence of focal point in a tacit bargaining environment and the possible influence factors to enhance the effectiveness of focal point. In Chapter 4, we further extend the bargaining environment into dynamic interactions.

In Chapter 4, we report results from a laboratory experiments on dynamic repeated bargaining game in real time. The game design combines elements of tacit bargaining with focal point cues (Isoni et al., 2013, 2014; Crawford et al., 2008; Bardsley et al., 2010a) and war of attrition (Fudenberg and Tirole, 1986; Bulow and Klemperer, 1997). In the game, players, as a pair, have the opportunity to share a continuous economic surplus; however both players can start costly wars with regarding the possession of the assets. Costs of conflict in possession come from two sources: 1. the forgone opportunity from not gaining from assets in conflict; 2. The resources exerted in fighting.

Our game can be compared with war of attrition games (Fudenberg and Tirole, 1986; Bulow and Klemperer, 1997; Oprea et al., 2014) and other contests games (Nitzan, 1994;

Phillips et al., 2010; Dechenaux et al., 2015; Sheremeta, 2013) in general, where players exert non-recoverable costs to 'win' the additional resources. Empirical evidences have shown that people tend to over-spend in fighting which leads to inefficient outcomes (Chowdhury et al., 2016; Cadsby et al., 2013); However our game has fundamental differences with existing games from several aspects: First, Most of the contest games are conducted in strictly discrete time, while in our game every action is synchronized. This, we argue, can facilitate players sending signals (without incurring costs) and when conflict happens, players can resolve more timely. Moreover, Unlike single prize auction or contests, our experiment has 9 independent assets to be bargained with at each period; which dramatically increased the numbers of possible outcomes.

We analyze participants' competitive behaviour in the experiment from 2 perspectives: game structure and individual traits. We vary the structure of the bargaining table in two dimensions: *Imbalance* and *Central* based on the spatial layout of the discs. The predictions are based on existing theories and experimental evidences on focal point theories (Sugden, 1993, 2000, 1995; Bacharach, 1997, 2006; Mehta et al., 1994; Isoni et al., 2013). Our results show that costs of conflict do not significant differ across different game structures; however, where the conflict arises, or the allocation of conflicts in the table, is found to be significantly influenced by *Imbalance* and *Central*. Conflicts are more likely to happen in *Central*district where focal point cues are absent; and when the allocation of discs is asymmetric ($Imbalance > 0$), conflicts are more likely to happen in Zones that has more discs, showing a preference for equity.

For personal traits, our results showed that pairs with opposite Locus of Control (Rotter, 1966) types incur lowest costs of conflict. Pairs with female participants incur higher costs of conflict in general.

In addition to competitive behaviour, we found systematic cooperation in the experiments. In specific, pairs who never incur costs during the time horizon of the experiment have high probability to adopt turn-taking strategies to facilitate cooperation. This finding is consistent with repeated coordinations games in the literature (Lau and Mui, 2008, 2012; Silby et al., 2015; Cason et al., 2013).

Our findings in Chapter 4 can contribute to the repeated game literatures. Although there are many experimental studies on repeated games in public goods game (Oprea et al., 2014), prisons dilemma games (Bigoni et al., 2015) and battle of sex games (Silby et al., 2015; Lau and Mui, 2008, 2012), most of the experiments are conducted in strictly discretely time. Our game provides a device to capture real-time interactions between players and examine the interaction effects of individual traits. In addition, our results can contribute the existing studies of contests games. There are extensive literatures examining gender differences in contests games (Eagly and Crowley, 1986), our results confirmed the competitiveness among females in anonymous settings; moreover, our paper, to our best knowledge, is the first to reveal the effects of LOC on competitive bargaining stances.

We believe there are much scope for future research. Although we found that opposite LOC types have the most efficient bargaining outcomes, the underlying reasons are still not clear. Moreover, as with most of the contests games, we find substantial efficiency losses in bargaining outcomes. It showed that with real-time interactions, efficiency losses are still difficult to prevent. It is worth exploring whether the results will remain robust if the real-time interaction is undertake with mutually known identities.

Chapter 2

Mathematics self-confidence and prepayment effect in riskless choices

2.1 Introduction

A stylized fact of behavioural economics is that individuals dislike losses more than they like equivalent gains. The endowment effect (e.g. Thaler, 1980; Kahneman et al., 1990), status quo bias (e.g. Kahneman et al., 1991), and the sunk cost fallacy (e.g. Thaler, 1999) are well-established behavioral regularities which can be attributed to loss aversion. Some studies of these effects involve cross-modal comparisons involving different types of goods or assets. For example, Kahneman et al. (1990) observed that participants were reluctant to sell a mug given to them by the experimenter at the beginning of the experiment. Evidence is mixed on whether the endowment effect extends to money, as opposed to other goods.[1] Becker et al. (1974) found that participants in a non-incentivized experiment systematically treated outlay costs differently from opportunity costs. However, Kahneman et al. did not find evidence of

[1]For a lengthier discussion see Hochman et al. (2014).

the effect when they used tokens instead of mugs.

Hochman et al. (2014) (henceforth HAA) report an experiment in which participants perform a series of choice tasks with no objective risk. In each task, participants are presented with a set of four standard playing cards, from which they must choose one. To each card is attached a monetary value, which depends on both the suit and the rank of the card. In one treatment, participants receive an advance payment, which corresponds to a specific pattern of choices across five out of seven decision tasks. Some of these choices are not the optimal (earnings-maximizing) ones for their corresponding task. In a control treatment, participants receive no advance payment. They find that participants who receive prepayment are more likely to carry out the pre-paid choice even when it is not earnings-maximizing, while participants who do not receive prepayment are relatively more likely to make the earnings-maximizing choice. As the choice task involves no objective risk, HAA interpret this result as supporting loss aversion in money in a very strong form, and label this the "prepayment effect."

Such a strong result could have significant implications for the choice architectures firms use to interact with employees, contractors, and consumers. HAA give an example in which a firm pre-pays its downstream agents their commissions for selling their product, with the requirement that those agents pay back commissions should they fall short of their target; the prepayment effect would suggest these agents are more likely to stick with selling the firm's product (as opposed to a rival's) when they are paid in advance. The phenomenon of sticking to an apparently suboptimal decision has a parallel in consumer decision-making, in which it is argued that consumers fail to switch suppliers in markets such as banking, energy, and telecommunications, even though better plans are on offer (Wilson and Waddams-Price, 2010; Lunn, 2011; Grubb, 2015; Grubb and Osborne, 2015; Sitzia et al., 2015).

In those markets, complexity has been cited as one driver of stickiness in both empirical and laboratory studies (Larrick and Soll, 2008; Allcott, 2011; Kalayci and Potters, 2011; Sitzia and Zizzo, 2011; Grubb and Osborne, 2015). HAA's card-choice task has only one complicating feature: the rule to calculate the value of a card depends on its suit. Spades are worth USD 0.25 times the rank of the card, while all other suits are worth USD 0.10 times the rank of the card. The values of the cards are thus not determined by a single, common standard (Gaudeul and Sugden, 2012; Piccione and Spiegler, 2012) but depend on two dimensions, suit and rank. In two of the three conditions reported by HAA, participants are provided with the monetary value of the cards, either instead of or in addition to the card's suit and rank. In those conditions, in which the values of the cards have been in effect reduced to a common standard, HAA do not observe a prepayment effect. HAA's experiment demonstrates that the introduction of a minimally non-common standard can be enough to affect decision-making significantly.

In this paper, we take a closer look at HAA's card-choice task to understand more completely the drivers of the prepayment effect. In Section 2.2, we conduct an analysis of the experimental design, focusing on their "distant representation" treatment in which values of cards are not presented using a common standard. Based on previous literature, we identify a number of candidate factors which might affect a participant's propensity to choose a card which does not maximize their earnings. These include features of the choice architecture – specifically, the content and structure of the experimental instructions – as well as demographic factors including the participant's prior experience in experiments and their self-perception of their ability in mathematics.

Our results in Section 2.3 show that behavior in this simple task depends on these factors. First, we replicate the prepayment effect reported by HAA using their experimental protocol and instructions; prepayment can indeed lower the frequency of the earnings-maximizing choice. We show there are significant and substantial differences in the probability of earnings maximization as a function of individual characteristics. Participants who report they are good at mathematics maximize far more often than those who do not, while those who are having their first experience in an economics experiment are slightly less likely to maximize. We also find that the prepayment effect largely disappears under rewritten instructions which describe the transactions that will take place should the participant choose a card other than the one for which prepayment was made. We conclude in Section 2.4 by discussing how the results from this simple task, which turn out to be quite rich and interesting, might inform the applicability of the prepayment effect beyond the laboratory.

2.2 Experimental analysis and design

Our experiment replicates and extends the ”distant representation” condition of Experiment 1A in HAA. There are seven decision tasks. In each task, a participant sees a set of four playing cards, from which one much be chosen. Each card's monetary value depends both on its suit and its rank. For cards which are spades, the value of the card is GBP 0.25 times rank of the card. There are 5 spades cards in the deck, from ace to five. For all other suits, the value is GBP 0.10 times the rank of the card. Aces have rank one, so the ace of spades is worth GBP 0.25 and other aces are worth GBP 0.10. The ranks of jacks, queens, and kings are 11, 12, and 13, respectively. In HAA spades are valued at USD 0.25 per rank and other suits at USD 0.10 per rank; our stakes were 50 to 60 percent higher than HAA as measured by using the prevailing exchange rate at the time of the experiment.

The seven sets of cards, which are provided in Appendices A, are presented in the same order for each participant. In two sets, a spade is the earnings-maximizing card; these are called “high-spades” trials. In two other sets, a spade is present, but there is some other non-spade card in the set which is worth strictly more; these are called “low-spades” trials. HAA call the remaining three sets filler trials: of these, one set has a spade and a non-spade card which are tied as earnings-maximizing cards, and the remaining two sets do not contain any spade cards. Participants make their choices for all seven sets of cards without any feedback; a summary screen appears at the end of the session reporting the seven chosen cards, and calculating the participant's earnings for the session.[2]

The experiments were conducted in the laboratory of the Centre for Behavioural and Experimental Social Science (CBESS) at the University of East Anglia. Participants were recruited from the lab's standard subject pool, which is managed using the hRoot system (Bock et al., 2012). The choice task was computerized using zTree (Fischbacher, 2007). Sessions took place between November 2014 and October 2015, and lasted around 20 to 30 minutes, including all instructions and final payment.

2.2.1 Baseline and replication

Our first objective is to replicate the existence of the prepayment effect within the subject pool at out laboratory. We conduct two treatments, **Post** and **Pre+Amount**, which replicate the two payment conditions used by HAA. [3] Treatment **Post** is a stardard post-payment setup: participants make all seven choices, then see a summary screen which recaps the decisions and tabulates their earnings. They are then dismissed one-by-one to the payment station and receive their payments in private before departing the laboratory. Treatment **Pre+Amount** implements HAA's prepayment treatment. Each participant is given GBP 3.75 in cash at their station prior to making their choices. Participants are told this amount is the sum value of the five spades cards which will appear among the seven sets (hence the "Amount" in

[2]Full instructions and screenshots of the decision interface are available in Appendices A.

[3]We present treatment names in boldface type, choosing names intended to help recall the purpose of each treatment.

the treatment's label). After all seven choices are made, the summary screen appears; this screen tabulates separately the values of the cards chosen, as well as the value of any spade cards not chosen. Participants are then dismissed one-by-one to the payment station to settle payments in private. We carefully kept to the prepayment framing, in that, for any spades not chosen, we took back coins from the participant, and then gave them different coins for the cards actually chosen; that is, we did not integrate the two payments into a net payment.[4]

Hypothesis 1. *Participants will choose the earnings-maximizing card more often in* ***Post*** *than in* ***Pre+Amount****, replicating the existence of the prepayment effect.*

2.2.2 Influence of the choice environment

HAA attribute the treatment effect they observe between **Post** and **Pre+Amount** to the existence of the prepayment in **Pre+Amount**. We identify two other ways in which the description of the experimental task differs between the two treatments. Exploring alternative instructions serves to map out the robustness of the treatment effect in the lab, but also provides a link to possible applicability in markets. The description of the experimental task is the parallel of the contract between firm and downstream sales agents in HAA's example, or the terms of a tariff in a consumer's plan for electricity, gas, or telecommunications.

In **Pre+Amount**, in order to explain the significance of the GBP 3.75 received in advance of decisions, the instructions included the following language:

> We have placed the cards ace through five of spades in the deck randomly ... The value of the five spades (ace through five) equals a total of three pounds and seventy-five cents: one plus two plus three plus four plus five is fifteen times 25p i.e. three pounds and seventy five pence. We will give you this amount up front.

[4]As all decisions were made by this point in the session, this bit of theatre could not affect results; nevertheless we wanted to be careful to maintain the framing throughout the session.

No parallel language exists in **Post**; the total value of spades is not pointed out to participants explicitly. To identify whether the mere mention of the value of spades might call attention to spades, or otherwise create a reference point, we conduct treatment **Post+Amount**, in which we retain postpayment, but include the language mentioning the total value of spades.

Hypothesis 2. *Participants will maximize less frequently in* ***Post+Amount*** *than in* ***Post****; mentioning the value of spades will result in fewer maximizing choices.*

A second difference between **Post** and **Pre+Amount** is the length and complexity of the instructions. Describing the prepayment protocol necessarily makes instructions longer, as there are more steps to explain to participants.

To check on the robustness of the prepayment effect to alternate but in-principle equivalent ways of explaining the mechanism, we replace some of the text from the HAA originals. Specifically, at the end of their instructions, HAA state,

> At the end of the game, if you have not selected all spades, we will pay you for the cards you have selected, and you will refund us money for the spades you have not selected.

Our design of alternative phrasing is based on HAA reporting of results from follow-on experiments, which they interpret as indicating that an explicit linkage between amounts of money and choices of particular cards is important for the prepayment effect to operate. In our treatment **Pre+Amount+Instr**, we therefore replace the above sentence with the following text intended to highlight that linkage:

> For each set of four playing cards, there are three possible scenarios:
>
> - There is not a spade among the four cards. Then, at the end of the session,

	Information on total value	Advance payment	Instructions same as HAA
Post	No	No	Yes
Post+Amount	Yes	No	No
Pre+Amount	Yes	Yes	Yes
Pre+Amount+Instr	Yes	Yes	No

Table 2.1: Summary of experimental treatments.

you will receive a payment for that set equal to the value of the card you select.

- There is a spade among the four cards, but you select a different card. Then, at the end of the session, you will pay us back from your up front payment an amount equal to the value of the spade, and you will receive a payment from us equal to the value of the card you did select.
- There is a spade among the four cards, and you select the spade. Then, because you have already received payment for that spade card in your up front payment, you will not pay us back anything for that set, nor will you receive any additional payment for that set.

Hypothesis 3. *The treatment effect is robust to instructions; the maximization rates will be comparable in **Pre+Amount** and **Pre+Amount+Instr**.*

2.2.3 Effects of prior experience

We now turn our attention to the characteristics of the decision-makers themselves. Our next hypothesis concerns the role of experience. The card choice task in HAA is simple. It is also artificial, in the sense that the rules for determining valuations of the cards are not drawn from a game or situation that exists "in the wild." Participants cannot draw on prior experience with the task or very similar ones, in the way that an economic agent might draw on experience in understanding the implications of prepayment arrangements for commissions.

The artificiality of the task is a useful feature, in that it allows the construction of a decision problem with the most minimal amount of complexity arising from the lack of a common standard.[5] While we cannot easily address the role that familiarity with this specific task might play in the persistence of the prepayment effect, we can ask whether participants who have previous experience with economic experiments behave differently.

Previous experience might predict behavior for two reasons. First, previous experience may affect expectations about how lab experiments operate in a generalized sense. Experience has been shown to have an effect in, for example, public goods games (Conte et al., 2014) and allocation games (Matthey and Regner, 2013). Some of the effect of experience in games would be due to more accurate beliefs about the play of others, an aspect that is absent in this individual decision task. Nevertheless prior experience may be valuable, insofar as participants will have familiarity with general lab procedures, including how to read and extract relevant information from instructions. Participants with prior experience also have self-selected into coming back to the laboratory. Abeler and Nosenzo (2014) have studied self-selection into participant pools and report that interest in monetary rewards appears strongly to drive participation.

Both channels would suggest experienced participants would be more likely to maximize earnings. To explore the possible role of experience with experiments, we conducted a stratified recruiting strategy. We identified very experienced participants as those who had participated at least 10 times previously in experimental sessions, and somewhat less experienced participants as those who had participated no more than 5 times. We recruited

[5] Schram (2005) is a good discussion of the tradeoffs between internal and external validity arising from the artificiality of laboratory games.

approximately equal numbers of participants from these two subpopulations. Those who had participated 6 to 9 times were not recruited, to give a more clear distinction between the groups.

Hypothesis 4. *Participant with greater experience in experiments will have higher maximization rates in prepayment treatments.*

2.2.4 Effects of confidence at the specific task

The distant representation condition we focus on in our experiment is one of three conditions in the full Experiment 1A design of HAA. In their close representation condition, payoffs were represented not by playing cards, but directly expressed as amounts of money. In the moderate representation condition, payoffs were depicted using playing cards, but with a label indicating their monetary value. HAA find evidence of the prepayment effect only in the distant representation condition.

The distant representation requires a particular type of operation, mathematical calculation, for participants to infer the earnings consequences of the options they face. The arithmetic required is taught at an early age in schools, and can be taken as part of the assumed skills an undergraduate student at a university would have. Although the arithmetic is straightforward enough, studies such as Pajares and Miller (1994) have noted that many adults dislike and avoid math, even those who are competent at calculation. Ashcraft (2002) observes effects of math anxiety even on simple whole-number arithmetic problems. It has been argued that math anxiety could shape individuals' behavior when facing challenging circumstances (Bandura, 1977)

The design of the card choice task requires participants to carry out, on demand, a mathematical calculation in the context of a novel setting not previously encountered. Prepayment may be an effective tactic when the task to determine the earnings-maximizing choice requires an activity the decision-maker is disinclined to carry out. To investigate this, within a battery of demographics questions asked at the end of the session, after all choices were made, we include a question asking participants,“Do you consider yourself good at mathematics?” This was implemented as a radio box, with options for Yes, No, or “Prefer not to say” as the possible responses. Such self-reports of mathematical skill have been used as a behavioral indicator in economics and psycholgy (e.g. Ashcraft and Kirk, 2001; Ashcraft and Ridley, 2005; Marsh et al., 2012; Buser et al., 2014).[6]

Hypothesis 5. *Participants who report confidence in their ability to carry out mathematical calculations will have higher maximization rates.*

2.3 Results

We report on 206 participants who participated in the task. Within our sample, the breakdown of males (44.2%) and females[7] is comparable to our participant pool and the University's student body as a whole. Less-experienced participants had participated, on average, in 1.78 previous sessions, while the very-experienced participants had been in 15.67 previous sessions on average. A total of 106 (51.5%) considered themselves good at mathematics, with 86 (41.7%) saying they were not; 14 preferred not to say.

We conducted Fisher's exact test for independence between each pair out of the four demographic characteristics of math-confidence, prior experience, gender, and native English

[6]We prefer the participant's self-reported confidence level rather than their actual mathematical ability. We placed no time restrictions or pressures on the individual decisions, and we are confident out students are capable, in principle at least, of carry out the required calculations correctly. Our hypothesis instead centers around the possibility that some participants feel less attracted or inclined to engage with the required computational task.

[7]One participant declined to disclose their gender.

Table 2.2: Low-spade maximization rates by treatments and demographics.

Subsample	Group	N	All	Maximizing 0/2	1/2	2/2
HAA results	**Post**	61	95.1	0.0	9.8	90.2
HAA results	**Pre+Amount**	50	66.0	20.0	28.0	52.0
Treatment	**Post**	49	79.6	10.2	20.4	69.4
Treatment	**Pre+Amount**	54	60.2	22.2	35.2	42.6
Treatment	**Post+Amount**	49	73.5	10.2	32.7	57.1
Treatment	**Pre+Amount+Instr**	54	70.4	18.5	22.2	59.3
Prior experience	0 to 5 sessions	112	70.1	16.1	27.7	56.3
Prior experience	10 or more sessions	94	71.3	14.9	27.7	57.5
Math-confident	No	86	59.3	22.1	37.2	40.7
Math-confident	Yes	106	78.8	12.2	17.9	69.8
Math-confident	Decline to say	14	78.6	0.0	42.9	57.1
Gender	Female	114	66.2	19.3	29.0	51.8
Gender	Male	91	76.4	11.0	25.3	63.8
Native English speaker	No	73	66.4	19.2	28.8	52.1
Native English speaker	Yes	130	74.2	12.3	26.9	60.8
Degree course	Not economics	179	67.6	16.8	31.3	52.0
Degree course	Economics	25	90.0	8.0	4.0	88.0

This table reports low-spade maximization rates disaggregated by treatments and demographic characteristics. The first two rows report the comparable results from HAA. Not all demographics breakouts of our data add up to $N = 206$ due to blank responses.

speaking.[8] The only pair for which the null hypothesis of independence is rejected at the 10% level is between gender and math-confidence: 61.5% of males (56 in total) answered this question in the affirmative, as opposed to 43.9% of females (50 in total); the difference is significant with a p-value of 0.008. Previous studies (Eccles, 1998; Buser et al., 2014) have also observed greater reported confidence in mathematics among males than females.

[8]Because our participants are drawn from across the student body and therefore a wide range of degree courses, we omit degree course here. We do look subsequently at the performance of students of economics, of whom there are few and are approximately equally scattered across the treatments.

The results in HAA focus on the rate of maximization by participants in the two "low-spades" trials, in which a spade card is present but is not the earnings-maximizing choice. We report this measure for each treatment in Table 2.2, where we also present breakouts of the low-spade maximization rate overall for each characteristic. The rightmost three columns in Table 2.2 give the percentages of participants who maximize on none, one, or both of the low-spades trials.[9] In general, the modal outcome for a participant is to maximize on both low-spades trials, with maximizing on exactly one of the two being more likely than failing to maximize on either.

We will base our tests principally on the distributions of the maximization counts by participant. For this our workhorse will be the Mann-Whitney-Wilcoxon (MWW) test. In addition to p-values, we report an effect size for each instance of the MWW test. Given two groups with sample sizes n_1 and n_2, respectively, and a MWW test statistic value U, the effect size is given by $r = U/\sqrt{n_1 n_2}$. This is the estimate of $Pr(x_2 > x_1) + \frac{1}{2}Pr(x_2 = x_1)$, where x_i is a randomly drawn individual from group $i = 1, 2$.

We look at the relationship between individual characteristics of our participants and their rates of maximization on low-spades trials. We break out the low-spades maximization data by characteristic and by treatment in Table 2.3 for characteristics on which we did not make a priori hypotheses (gender and native language), and in Table 2.5 for those on which we did make hypotheses (experience and mathematics self-confidence). Each characteristic divides our sample into two groups.[10] To look for evidence of an overall effect on maximization rates due to the characteristic, for each treatment we compare the distribution of low-spades maximization rates between the groups using MWW. Because each treatment is an indepen-

[9]A more detailed summary of distributions of choices broken down by each of the seven sets is in Appendices C.

[10]In what follows, we omit the participants who did not respond to one or more of the demographics questions.

Table 2.3: Low-spade maximization rates by treatment and demographics.

(a) By gender

	Gender = Female					Gender = Male						
			Maximizing					Maximizing				
Treatment	N	All	0/2	1/2	2/2	N	All	0/2	1/2	2/2	r	p
Post	24	70.8	16.7	25.0	58.3	22	88.6	4.6	13.6	81.8	.377	.077
Pre+Amount	21	42.9	38.1	38.1	23.8	26	69.2	15.3	30.8	53.9	.321	.025
Post+Amount	26	73.1	11.5	30.8	57.7	20	75.0	10.0	30.0	60.0	.487	.860
Pre+Amount+Instr	33	68.1	18.2	27.3	54.6	18	80.6	11.1	16.7	72.2	.412	.235
Fisher combined probability test of equality of distribution for all treatments												.047

(b) By native English speaker

	Native English speaker = No					Native English speaker = Yes						
			Maximizing					Maximizing				
Treatment	N	All	0/2	1/2	2/2	N	All	0/2	1/2	2/2	r	p
Post	16	81.3	6.3	25.0	68.8	30	78.3	13.3	16.7	70.0	.495	.943
Pre+Amount	16	62.5	25.0	25.0	50.0	31	54.8	25.8	38.7	35.5	.444	.502
Post+Amount	13	53.8	23.1	46.2	30.8	33	81.8	6.1	24.2	69.7	.709	.013
Pre+Amount+Instr	21	61.9	28.6	19.1	52.3	30	80.0	12.9	26.6	60.5	.603	.153
Fisher combined probability test of equality of distribution for all treatments												.083

This table reports low-spade maximization rates by treatment for characteristics without prior hypotheses. All reports overall maximization rate; $k/2$ the proportion of participants who maximized on k of the low spades trials, $k = 0, 1, 2$. r and p report the effect size and p-value, respectively, of the MWW test for equality of distribution across the characteristic, for the given treatment. The Fisher combined probability method is used to report a p-value for the joint null hypothesis of no effect due to characteristics across all treatments.

dent sample, the four tests by treatment are independent tests. We aggregate the p-values of the individual tests for the four treatments using the combined probability method of Fisher (1925).

Overall, unconditional on treatment, males (76.4%) maximized more often than females (66.2%). Table 2.3a shows that males have a higher maximization rate in all treatments. The overall test for a gender effect is significant at the 5% level ($p = .047$).[11] Participants who are native speakers of English (74.2%) maximized more often than those who are not (66.4%). Table 2.3b shows a less uniform pattern across treatments. Non-native speakers are much less likely to maximize than native speakers in **Post+Amount** and **Pre+Amount+Instr**. The overall test for an effect due to native English speaking is significant at the 10% level ($p = .083$).

We observe (with admitted pleasure) that students on economics courses choose the earnings maximizing card more often (90.0%) than those on other courses (67.6%).[12] Among economics students, 18 (72.0%) identified as being good at mathematics, and 3 (12.0%) declined to say, while among students from other schools, 86 (48.0%) said they were good at mathematics, and 11 (6.2%) declined to say. These distributions are significantly different ($p = .009$ using Fisher's exact test for independence). A variety of approaches have been used in the literature as to whether to include, exclude, or control for the presence of economics students in experimental samples, often depending on the research question to hand. Friesen and Earl (2015) found that students with economics training perform better in tasks involving choices with multipart tariffs. In the UK university system, students do not in general take courses on other subjects, and so we can say that non-economics students in our sample would be unlikely to have much undergraduate-level training in economic rea-

[11] We note that all sessions were led by the same female experimenter.

[12] We omit the breakout table due to the low numbers of economics students. Carrying out the same procedure as above results in a p-value of .103 for the combined probability test of no effect due to course of study.

soning. Nevertheless, we cannot distinguish whether the effect would be due to selection of students into the economics program, or whether training in the type of economic models that motivate experiments in economics makes students more likely to recognize and choose the earnings-maximizing card. As the economics students are small in number and spread uniformly across the four treatments, we omit this characteristic in further analysis.

We now look at the characteristics on which we set hypotheses. Participants with 10 or more sessions of experience maximized on 71.3% of trials overall, compared to 70.1% among those with 5 or fewer sessions. Table 2.5a shows that the two groups have similar maximization rates for each treatment; the overall combined probability test returns a p-value of .953, indicating no evidence of any systematic effect.

The maximization rate for those reporting they were good at math is 78.8%, compared to 59.3% for those saying they were not. A total of 14 participants declined to answer this question. Their overall maximization rate is 78.6%, suggesting they are more similar to those answering the question yes than those answering no; we drop these 14 from the analyses below. Table 2.5b shows that the math-confident participants maximize much more often in three of the four treatments, with the notable exception being **Pre+Amount**. The overall combined probability test results in a p-value of .0002, indicating strong evidence that the answer to this question predicts low-spade maximization behavior.

We begin the statement of the formal results following from our hypothesis by evaluating our replication of HAA's results in our overall participant pool.

Result 1 *We replicate HAA's result that the maximization rate on low-spades trials is lower in* ***Pre+Amount*** *than in* ***Post****. The maximization rate in* ***Pre+Amount*** *is comparable in our data and HAA, but we observe a significantly lower maximization rate in* ***Post****. The magnitude of the treatment effect is therefore smaller in our data overall.*

Table 2.5: Low-spade maximization rates by treatment and individual characteristics.

(a) By prior experience

	Prior experience $\in [0,5]$					Prior experience ≥ 10						
			Maximizing					Maximizing				
Treatment	N	All	0/2	1/2	2/2	N	All	0/2	1/2	2/2	r	p
Post	24	79.2	16.7	8.3	75.0	22	79.5	4.6	31.9	63.6	.468	.644
Pre+Amount	23	56.5	23.1	34.8	39.1	24	58.3	25.0	33.3	41.7	.513	.874
Post+Amount	27	70.4	14.8	29.6	55.6	19	78.9	5.3	31.6	63.1	.554	.484
Pre+Amount+Instr	29	74.1	10.3	31.0	58.6	22	70.5	22.7	13.6	63.6	.503	.965
Fisher combined probability test of equality of distribution for all treatments												.953

(b) By math-confidence

	Math-confident = No					Math-confident = Yes						
			Maximizing					Maximizing				
Treatment	N	All	0/2	1/2	2/2	N	All	0/2	1/2	2/2	r	p
Post	18	69.4	11.1	38.9	50.0	28	85.7	10.7	7.1	82.1	.356	.044
Pre+Amount	17	55.9	23.5	41.2	35.3	30	58.3	26.7	30.0	43.3	.479	.804
Post+Amount	18	63.9	16.7	38.9	44.4	28	80.4	7.1	25.0	67.9	.376	.109
Pre+Amount+Instr	31	56.5	25.8	35.5	38.7	20	97.5	0.0	5.0	95.0	.212	.0001
Fisher combined probability test of equality of distribution for all treatments												.0002

This table reports low-spade maximization rates by treatment, for characteristics with prior hypotheses. All reports overall maximization rate; $k/2$ reports the proportion of participants who maximized on k of the low spades trials, $k = 0, 1, 2$. r and p report the effect size and p-value, respectively, of the MWW test for equality of distribution across the characteristic, for the given treatment. The Fisher combined probability method is used to report a p-value for the joint null hypothesis of no effect due to characteristics across all treatments.

Support. As we do not have demographics breakouts for HAA's participants, we test Hypothesis 1 using aggregate data for all participants irrespective of demographics. Table 2.2 reports an overall low-spades maximization rate of 79.6% in **Post**, which decreases to 60.2% in **Pre+Amount**. We reject the null hypothesis that the distributions of maximization rates are the same in both treatments (MWW, $r = .639$, $p = .0069$).

The overall maximization rates on low-spades trials in **Pre+Amount** are similar in our data (60.2%) and HAA (66.0%); the distributions are not statistically different (MWW, $r = .543$, $p = .41$). Our results differ significantly in **Post**, where HAA report a 95.1% maximization rate as opposed to our 79.6% (MWW, $r = .609$, $p = .0042$). □

As shown above, there are patterns in maximization rates when participants are broken out in groups by individual characteristics. We can therefore do a more detailed analysis of our data for **Post** and **Pre+Amount**, as summarized in Table 2.7a. For each group we test the null hypothesis that the maximization rate is the same in **Post** and **Pre+Amount**, which generates the effect size r and p-value reported in the Table. The two tests on the groups generated by a characteristic are independent; for each characteristic we aggregate the results of the two tests using Fisher's method. Using this approach, we find the evidence for Result 1 is robust to breaking out the data by each of the four characteristics.

Result 2 *The mere mention of the total value of spades does not significantly affect behavior in postpayment conditions. The largest effect size is observed among non-native speakers of English, who maximize less often when the total value of spades is mentioned than when it is not.*

Support. Overall we observe a low-spade maximization rate of 73.5% in treatment **Post+Amount** as opposed to the 79.6% rate observed in **Post**. These overall rates are not statistically

Table 2.7: Summary of tests comparing low-spade maximization rates across treatments.

(a) **Post** versus **Pre+Amount**

Characteristic	Group	r	p	Group	r	p	Combined
Gender	Male	.643	.041	Female	.688	.021	.0069
Native English speaker	Yes	.668	.013	No	.617	.198	.018
Math-confident	Yes	.688	.0046	No	.596	.292	.011
Experience	$\geq$ 10 sessions	.642	.069	0-5 sessions	.661	.033	.016

(b) **Post** versus **Post+Amount**

Characteristic	Group	r	p	Group	r	p	Combined
Gender	Male	.609	.127	Female	.492	.913	.365
Native English speaker	Yes	.490	.871	No	.704	.039	.150
Math-confident	Yes	.561	.304	No	.539	.665	.525
Experience	$\geq$ 10 sessions	.504	.963	0-5 sessions	.579	.256	.592

(c) **Pre+Amount** versus **Pre+Amount+Instr**

Characteristic	Group	r	p	Group	r	p	Combined
Gender	Male	.412	.259	Female	.329	.025	.038
Native English speaker	Yes	.323	.0090	No	.500	1.000	.051
Math-confident	Yes	.235	.0002	No	.494	.945	.0020
Experience	$\geq$ 10 sessions	.411	.257	0-5 sessions	.380	.107	.126

(d) **Post** versus **Pre+Amount+Instr**

Characteristic	Group	r	p	Group	r	p	Combined
Gender	Male	.552	.444	Female	.519	.786	.717
Native English speaker	Yes	.504	.942	No	.612	.191	.489
Math-confident	Yes	.433	.172	No	.587	.279	.194
Experience	$\geq$ 10 sessions	.533	.660	0-5 sessions	.560	.370	.589

This table reports the summary of tests comparing low-spade maximization rates across treatments. MWW is used for the individual test of each group. Effect sizes r are reported such that $r > .5$ corresponds to a higher rate in the treatment listed first. Combined gives the p-value of obtained by aggregating the results of the MWW tests for the corresponding groups using Fisher's combined probability test.

different (MWW, $r = .555$, $p = .27$). Table 2.8b reports on the results of this comparison applied to each group generated by individual characteristics, in which we see that no treatment difference is established when looking across any of the characteristics. The largest effect size, and smallest p-value, is found among non-native speakers of English ($r = .704$, $p = .039$); this group's maximization rate drops from 81.3% in **Post** to 53.8% in **Post+Amount**, whereas native English speakers do not show a similar pattern. This p-value is not small enough to obtain significance at the 10% level, using the Holm-Bonferroni method to account for the multiple tests. □

Result 3 *The alternate instructions rephrasing the link between each set and payment lead to higher maximization rates, comparable to the baseline postpayment treatment.*

Support. Overall, the low-spade maximization rate in **Pre+Amount+Instr** is 70.4%, which is between the 79.6% observed in **Post** and 60.2% in **Pre+Amount**. However, in Table 2.5a we note that in **Pre+Amount+Instr** a majority of participants did not consider themselves good at math, which is the opposite pattern from the other three treatments. The results of tests controlling for each individual characteristic are shown in Table 2.7c for **Pre+Amount** versus **Pre+Amount+Instr**, and Table 2.7d for **Post** versus **Pre+Amount+Instr**. The null hypothesis of no difference in distribution is not rejected for any of the tests between **Post** and **Pre+Amount+Instr**. On the other hand, the null hypothesis is strongly rejected when controlling for math-confidence when comparing **Pre+Amount** and **Pre+Amount+Instr** ($p = .0020$), as well as rejected at 5% when controlling for gender ($p = .038$) and 10% when controlling for native English speaking ($p = .051$). □

Our formulation of Hypothesis 2 specifically related to the mention of spades under the postpayment condition only, and Hypothesis 3 the effects of rephrasing instructions under prepayment. All treatments other than **Post** involved a mention of the total value of spades in the instructions. Ex post, we observe in Table 2.3b that the maximization rate for non-native speakers is more than 20 percentage points lower across these three treatments in which the total value of spades is mentioned, compared to **Post**. While **Pre+Amount+Instr** results in an increase in maximization for native English speakers compared to **Pre+Amount**, a similar effect is not evident among non-native speakers.

We now look more specifically at the two individual characteristics on which we had set prior hypotheses.

Result 4 *We do not find any evidence that participants who have participated in 10 or more previous sessions are more or less likely to maximize earnings than those who have been in 1 to 5 sessions previously.*

Support. Table 2.5a presents MWW tests of the null hypothesis of no difference in maximizing rates between the two experience groups. The null hypothesis is not rejected for any treatment; p-values are uniformly high and effect sizes are uniformly close to .5, corresponding to no effect. Of the four individual characteristics considered, breakouts by experience show the least between-group variation within each treatment, as well as the least evidence for any differential treatment effects. □

Result 5 *Reported mathematics confidence overall is a strong predictor of the likelihood to choose earnings-maximizing cards in low-spades trials. However, the treatment difference in **Post** versus **Pre+Amount+Instr** is accounted for mainly by its effect among participants who identify as being good at math.*

Support. Table 2.5b presents MWW tests of the null hypothesis of no difference in maximizing rates. Overall, there is evidence of a strong effect correlating to the answer to this question ($p = .0002$). The effect is not uniform across treatments. In **Post**, those identifying as good at math maximize significantly more often, by an 85.7% to 69.4% margin; the MWW test shows this difference is significant ($r = .356$, $p = .044$). Likewise there is a difference between the groups in **Pre+Amount+Instr**, with math-confident participants maximizing on 97.5% of trials and others on 56.5% (MWW $r = .212$, $p = .0001$). However, in **Pre+Amount** the performance of the two groups is not distinguished; math-confident participants maximize on 58.3% of trials and others on 55.9% (MWW $r = .479$, $p = .804$). □

The positive correlation overall between math-confidence and performance on the task is intuitive, although it is interesting that it comes through so strongly on a task which might not seem that demanding at first look. More surprising is the result that it is math-confident participants whose maximization rates lower most sharply in **Pre+Amount**. When we look only at math-confident participants, the size of our treatment effect between **Post** and **Pre+Amount** is comparable to the results reported by HAA. We observe a drop in maximization rate from 85.7% to 58.3% in this group, and HAA report a drop from 95.1% to 66.0%. HAA conducted their experiments at Duke University, a private institution that is one of the most selective in the United States. Our replication was done at a middle-tier public university in the United Kingdom, which is best known for its degree programs in areas such as literature and creative writing, and which offers no engineering or physics courses at all. It is plausible that our participants who identify as math-confident are more comparable to the sample at Duke; if that is the case, our results provide a firm replication of HAA's effect.

Our results seem rule out an account in which the treatment effect between **Post** and **Pre+Amount** occurs due to less-numerate participants making more frequent calculation errors in **Pre+Amount**. Such a hypothesis would be supported by a larger drop in the maximization rate of participants with less math-confidence; we find exactly the opposite. The lack of a large treatment effect among less math-confident participants may arise because of the extra noise due to a higher error rate in the arithmetic calculations required; the higher baseline maximization rate of math-confident participants in **Post** makes it easier to pick up a treatment effect.

Although math-confident participants may not be making arithmetic errors, they may still be making errors in judgment in **Pre+Amount** due to other factors.[13] If this is the case, then alternative phrasings like those in **Pre+Amount+Instr** may have the effect of debiasing the decision-maker. These effects have been explored in psychology (e.g. Evans et al., 1994), law (e.g. Babcock et al., 1997), and accounting (e.g. Clarkson et al., 2002) as well as economics (e.g. List, 2001). In the case of the instructions used in Treatment **Pre+Amount+Instr**, explicitly stepping through the process by which payments will be realized might influence whatever processes participants use to come to their decisions.

2.4 Conclusion

HAA reported a striking result: in a simple choice task with no objective risk, participants were less likely to choose earnings-maximizing cards when they received a prepayment based on some other, non-earnings-maximizing choice. We have shown this effect is qualitatively robust, even with a different participant pool and somewhat higher incentives.

Given the apparently straightforward calculations required to maximize earnings in this decision task, it is remarkable that undergraduate students both at Duke (HAA) and University of East Anglia (this paper) would, overall, leave money on the table. We therefore take a

[13]For the purposes of this paper, we put to one side the question of normative implications. If a decision-maker is truly loss-averse, then choosing the non-earnings-maximizing card might be viewed as optimal from the perspective of their preferences. McQuillin and Sugden (2012) provide one survey of the issues in reconciling behavioral and normative economics.

closer look at this decision task, both to map out the extent to which maximization rates depend on details of the experimental protocol, and to understand better whether certain types of participants are less likely to maximize earnings.

We find that the effect of prepayment does depend on the description of the experimental task. The methodological observation that participant decisions are not independent of instructions is hardly novel, but the potential practical implications are noteworthy. We can think of the description of the experimental task as the analog of the description of offers to consumers or terms and conditions of agency contracts. One interpretation of HAA's results and our replication is that it is easy to influence decisions, even when there is no objective risk and the choice architecture is not very complex. HAA's instructions, used in the **Pre+Amount** treatment, while brief, are not overtly misleading. Our **Pre+Amount+Instr** instructions are somewhat more explicit, which may serve a debiasing function. A regulator whose objective was to keep people from making apparently suboptimal decisions might find descriptions similar to ours preferable because of their debiasing effects. However, creating effective written communication is challenging.[14] Because instructions like HAA's are not overtly misleading, and because the effect of written communication on an audience is difficult to judge, even by experienced writers, the regulator might find it difficult to distinguish between well-intentioned but unclear writing, as opposed to deliberate obfuscation.

We also find that characteristics of the participant are strong predictors of the maximization rate. Participants who state they do not consider themselves to be good at math maximize far less frequently; the magnitude of the difference is comparable to the magnitude of the prepayment effect between **Post** and **Pre+Amount**. HAA only observed the prepayment effect when participants needed to carry out mathematical calculations to determine the values of

[14]Pinker (1994, 2014) discusses some reasons why writing for clear communication is difficult, and even writers sincerely attempting to be clear may not be successful.

the cards.

Experience can sometimes serve to correct apparent errors in judgment or decisions made by relatively inexperienced decision-makers. Participants who have been in previous lab experiments have some experience with processing the information in experimental instructions, which are the terms and conditions under which experimenters offer participants the chance to earn money. We find at most a modest effect of general experience in laboratory experiments on performance in this task.

This simple choice task devised by HAA generates an interesting amount of variation in performance, depending on how it is presented, and on the characteristics of the decision-makers. The task is sufficiently stylized that broad claims about external validity should be tempered. However, the stark simplicity of the setting helps to illustrate some possible subtle mechanisms firms could use to influence the behavior of agents or consumers, with corresponding implications for the problems that market designers or regulators face in evaluating the appropriateness of the structure of contracts or offers.

2.5 Appendices A

Comparison of instructions

In this appendix, we provide the full text of the instructions for each of the four treatments. In addition, we provide the instructions as used by Hochman et al. (2014) for comparison.

Treatment Post

This paper

This is an experiment in the economics of decision making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

On your computer monitor, you will be given sets of four playing cards, face-up, several times. Each time, you will select and keep one card.

After all of these sets are completed, you will be paid based on the cards you have selected. Each card is worth its point value times 10p, so a three is worth three times 10p, a nine is worth nine times 10p, et cetera. Aces are worth 10p, jacks are worth eleven times 10p, queens are worth twelve times 10p, and kings are worth thirteen times 10p.

However, those values apply only to cards that are NOT spades. Spades (♠) are worth their point value times 25p, not 10p. The ace of spades is worth 25p, the two of spades is worth two times 25p, and so on.

At the end of the game, we will pay you for the cards you have selected.

HAA

Thank you for your participation. Feel free to ask questions at any time if anything is unclear. There are no tricks or catches to this game, we simply ask that you pay attention to the instructions and think carefully about your decisions. You will be paid some amount of money at the end of the game; how much you are paid will be determined by the decisions you make.

You will be given sets of four playing cards, face-up, several times. Each time, you will select and keep one card.

After all of these sets are completed, you will be paid based on the cards you have selected.

Each card is worth its point value in dimes, so a three is worth three dimes, a nine is worth nine dimes, et cetera. Aces are worth one dime, jacks are worth eleven dimes, queens are worth twelve, and kings are worth thirteen.

However, those values apply only to cards that are NOT spades. Spades are worth their point value in quarters, not dimes. The ace of spades is worth one quarter, the two of spades is worth two quarters, and so on. We have placed the cards ace through five of spades in the deck randomly.

At the end of the game, we will pay you for the cards you have selected.

Treatment Post+Amount

This is an experiment in the economics of decision making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

On your computer monitor, you will be given sets of four playing cards, face-up, several times. Each time, you will select and keep one card.

After all of these sets are completed, you will be paid based on the cards you have selected.

Each card is worth its point value times 10p, so a three is worth three times 10p, a nine is worth nine times 10p, et cetera. Aces are worth 10p, jacks are worth eleven times 10p, queens are worth twelve times 10p, and kings are worth thirteen times 10p.

However, those values apply only to cards that are NOT spades. Spades (♠) are worth their point value times 25p, not 10p. The ace of spades is worth 25p, the two of spades is worth two times 25p, and so on. We have placed the cards ace through five of spades in the deck randomly. The value of the five spades, ace through five, equals a total of three pounds and seventy-five pence: one plus two plus three plus four plus five is fifteen times 25p i.e. three pounds and seventy-five pence.

At the end of the game, we will pay you for the cards you have selected.

Treatment Pre+Amount

This paper

This is an experiment in the economics of decision making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

On your computer monitor, you will be given sets of four playing cards, face-up, several times. Each time, you will select and keep one card.

After all of these sets are completed, you will be paid based on the cards you have selected. Each card is worth its point value times 10p, so a three is worth three times 10p, a nine is worth nine times 10p, et cetera. Aces are worth 10p, jacks are worth eleven times 10p, queens are worth twelve times 10p, and kings are worth thirteen times 10p.

However, those values apply only to cards that are NOT spades. Spades (♠) are worth their point value times 25p, not 10p. The ace of spades is worth 25p, the two of spades is worth two times 25p, and so on. We have placed the cards ace through five of spades in the deck randomly.

The value of the five spades (ace through five) equals a total of three pounds and seventy-five pence: one plus two plus three plus four plus five is fifteen times 25p i.e. three pounds and seventy-five pence. We will give you this amount up front.

However, if you do not choose all of the five spade cards, you will need to give us back some of this money at the end of the game. The amount you return will be the value of the spade card(s) that you did NOT choose.

For example, if you do not pick up the three of spades, you will return three times 25p to us from your three pounds and seventy-five pence.

At the end of the game, if you have not selected all spades, we will pay you for the cards you have selected, and you will refund us money for the spades you have not selected.

HAA

Thank you for your participation. Feel free to ask questions at any time if anything is unclear. There are no tricks or catches to this game, we simply ask that you pay attention to the instructions and think carefully about your decisions. You will be paid some amount of money at the end of the game; how much you are paid will be determined by the decisions you make.

You will be given sets of four playing cards, face-up, several times. Each time, you will select and keep one card.

After all of these sets are completed, you will be paid based on the cards you have selected. Each card is worth its point value in dimes, so a three is worth three dimes, a nine is worth nine dimes, et cetera. Aces are worth one dime, jacks are worth eleven dimes, queens are worth twelve, and kings are worth thirteen.

However, those values apply only to cards that are NOT spades. Spades are worth their point value in quarters, not dimes. The ace of spades is worth one quarter, the two of spades is worth two quarters, and so on. We have placed the cards ace through five of spades in the deck randomly.

The value of the five spades (ace through five) equals a total of three dollars and seventy-five cents: one plus two plus three plus four plus five is fifteen quarters i.e. three dollars and seventy five cents. We will give you these fifteen quarters up front.

However, if you do not choose all of the five spade cards, you will need to give us back some of this money at the end of the game. The amount you return will be the value of the spade card(s) that you did NOT choose.

For example, if you do not pick up the three of spades, you will return three quarters to us from your three dollars and seventy-five cents.

At the end of the game, if you have not select all spades, we will pay you for the cards you have selected, and you will refund us money for the spades you have not selected.

Treatment Pre+Amount+Instr

This is an experiment in the economics of decision-making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

On your computer monitor, you will be given sets of four playing cards, face-up, several times. No card will appear more than one time during the experiment. Each time, you will select and keep one card. After all of these sets are completed, you will be paid based on the cards you have selected.

The value of a card to you depends on the card's suit and point value. Spades (♠) are worth their point value times 25p. The ace of spades is worth 25p, the two of spades is worth two times 25p, and so on.

We have placed the cards ace through five of spades in the deck randomly. The values of these five spades (ace through five) equal a total of three pounds and seventy-five pence, because one plus two plus three plus four plus five is fifteen times 25p is three pounds and seventy-five pence. We will give you this amount up front.

Cards of the other suits, hearts (♡), diamonds (♢), and clubs (♣), are worth their point value times 10p. So, a three is worth three times 10p, a nine is worth nine times 10p, et cetera. In these suits, aces are worth 10p, jacks are worth eleven times 10p, queens are worth twelve times 10p, and kings are worth thirteen times 10p.

At the end of the experiment, you will leave the lab with a total payment equal to the sum of the values of the cards you select. For each set of four playing cards, there are three possible scenarios:

- There is not a spade among the four cards. Then, at the end of the session, you will receive a payment for that set equal to the value of the card you select.
- There is a spade among the four cards, but you select a different card. Then, at the end of the session, you will pay us back from your up front payment an amount equal to the value of the spade, and you will receive a payment from us equal to the value of the card you did select. For example, if you did not select three of spades but instead select four of diamonds; we will pay you 40p corresponding to the four of diamonds and you need to refund us 3 times 25p corresponding to the three of spades.
- There is a spade among the four cards, and you select the spade. Then, because you have already received payment for that spade card in your up front payment, you will not pay us back anything for that set, nor will you receive any additional payment for that set.

Screenshots of participant interface

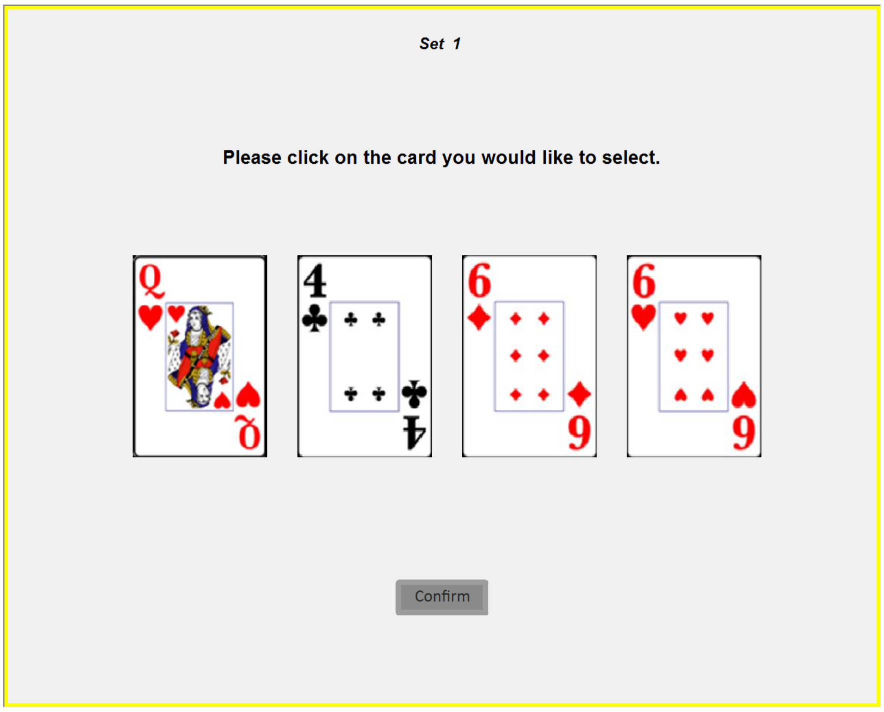


Figure 2.1: Screenshot of Set 1 (unselected) in the experiment

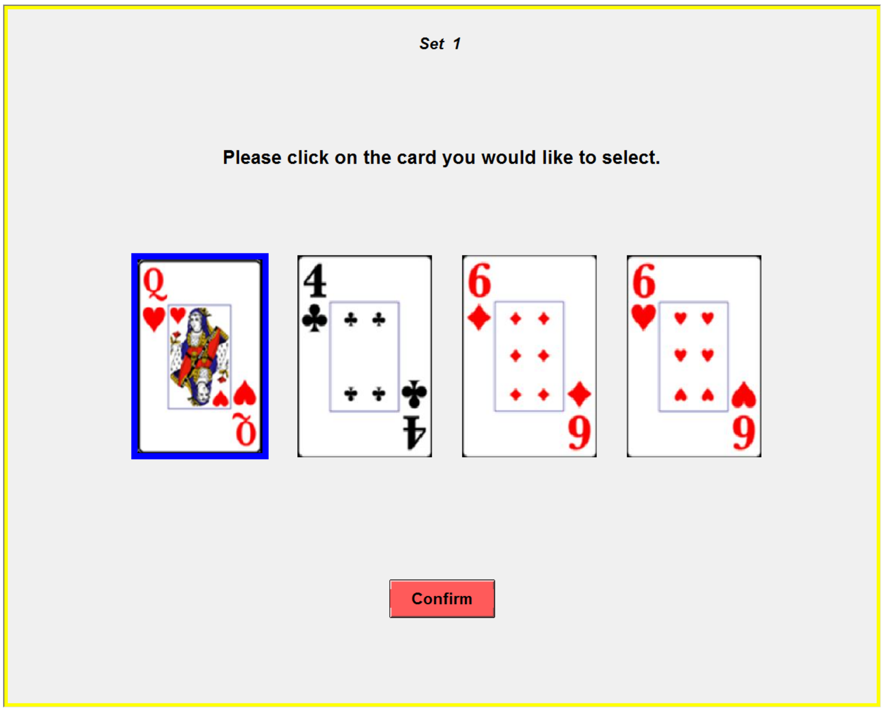


Figure 2.2: Screenshot of Set 1 (selected) in the experiment

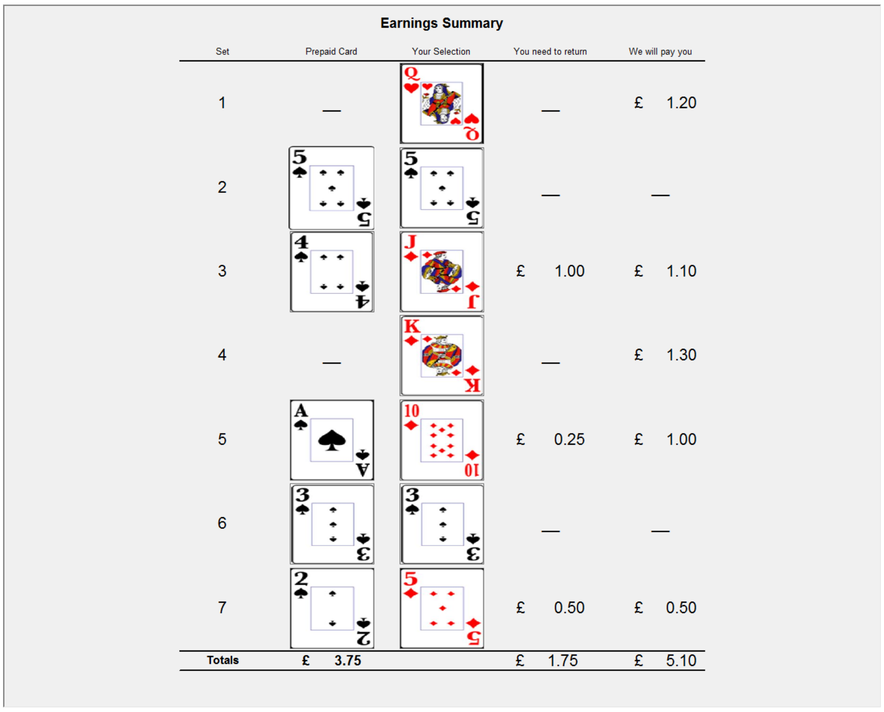


Figure 2.3: Screenshot of summary screen

All sets in the experiment

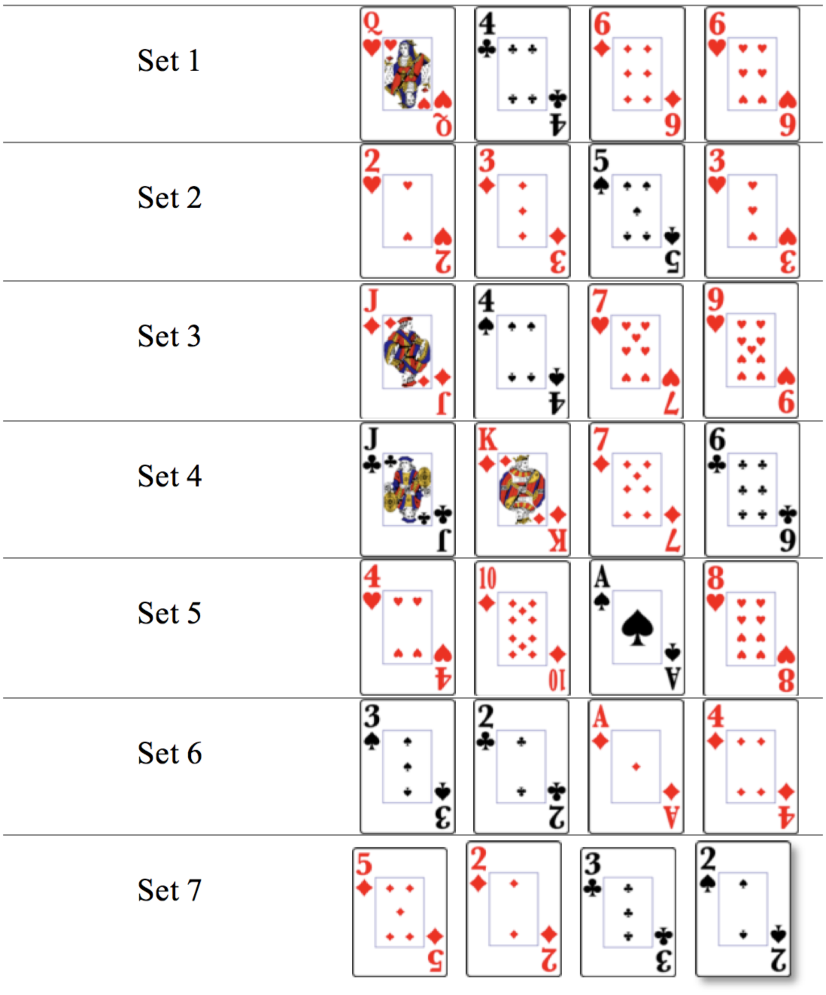


Figure 2.4: All sets in the experiment

Choice distributions at the set level

In this section we provide a more detailed view on the seven sets of cards faced by the participants. In each table, the first row shows the four cards that were used in the set. The next row contains the values of the cards; the data for the card(s) which maximize earnings are displayed in bold. The total number of choices and corresponding frequencies for each card are presented for each treatment, **Post**, **Post+Amount**, **Pre+Amount**, and **Pre+Amount+Instr**, in separate rows, recalling that **Post** and **Pre+Amount** are replications of HAA's.

Table 2.9: Summary of Choices in the 7 Sets

Set 1	Q♡		4♣		6♢		6♡	
Value	**GBP 1.20**		GBP 0.40		GBP 0.60		GBP 0.60	
Post	**94%**	**46**	4%	2	2%	1	0%	0
Post+Amount	**88%**	**43**	8%	4	2%	1	2%	1
Pre+Amount	**96%**	**52**	4%	2	0%	0	0%	0
Pre+Amount+Instr	**87%**	**47**	6%	3	7%	4	0%	0

Set 2	2♡		3♢		5♠		3♡	
Value	GBP 0.20		GBP 0.30		**GBP 1.25**		GBP 0.30	
Post	0%	0	0%	0	**100%**	**49**	0%	0
Post+Amount	0%	0	6%	3	**94%**	**46**	0%	0
Pre+Amount	0%	0	2%	1	**98%**	**53**	0%	0
Pre+Amount+Instr	0%	0	7%	4	**93%**	**50**	0%	0

Set 3	J♢		4♠		7♡		9♡	
Value	**GBP 1.10**		GBP 1.00		GBP 0.70		GBP 0.90	
Post	**73%**	**36**	27%	13	0%	0	0%	0
Post+Amount	**71%**	**35**	29%	14	0%	0	0%	0
Pre+Amount	**54%**	**29**	46%	25	0%	0	0%	0
Pre+Amount+Instr	**65%**	**35**	30%	16	2%	1	4%	2

Set 4	J♣		K♢		7♢		6♣	
Value	GBP 1.10		**GBP 1.30**		GBP 0.70		GBP 0.60	
Post	2%	1	**98%**	**48**	0%	0	0%	0
Post+Amount	6%	3	**92%**	**45**	0%	0	2%	1
Pre+Amount	2%	1	**96%**	**52**	0%	0	2%	1
Pre+Amount+Instr	2%	1	**96%**	**52**	2%	1	0%	0

Set 5	4♡		10♢		A♠		8♡	
Value	GBP 0.40		**GBP 1.00**		GBP 0.25		GBP 0.80	
Post	0%	0	**86%**	**42**	14%	7	0%	0
Post+Amount	0%	0	**76%**	**37**	22%	11	2%	1
Pre+Amount	0%	0	**67%**	**36**	31%	17	2%	1
Pre+Amount+Instr	0%	0	**76%**	**41**	20%	11	4%	2

Set 6	3♠		2♣		A♢		4♢	
Value	**GBP 0.75**		GBP 0.20		GBP 0.10		GBP 0.40	
Post	**86%**	**42**	0%	0	4%	2	10%	5
Post+Amount	**67%**	**33**	0%	0	12%	6	20%	10
Pre+Amount	**87%**	**47**	2%	1	0%	0	11%	6
Pre+Amount+Instr	**80%**	**43**	2%	1	6%	3	13%	7

Set 7	5♢		2♢		3♣		2♠	
Value	**GBP 0.50**		GBP 0.20		GBP 0.30		**GBP 0.50**	
Post	**53%**	**26**	0%	0	2%	1	**45%**	**22**
Post+Amount	**41%**	**20**	0%	0	0%	0	**59%**	**29**
Pre+Amount	**7%**	**4**	0%	0	0%	0	**93%**	**50**
Pre+Amount+Instr	**15%**	**8**	0%	0	0%	0	**85%**	**46**

Chapter 3

What's ours is ours: An experiment on the efficiency of bargaining over the fruits of joint activity

3.1 Introduction

The Treaty of Hong Canal is an influential event in the history of China. Chu and Han were two kingdoms who challenged the authority of the incumbent Qin dynasty. After a long military campaign, they were successful in deposing the Qin, before falling into contention with each other. In 203BC they reached a cease-fire agreement known as the "Treaty of Hong Canal". They agreed that areas west of the canal would belong to Chu, and those to the east of it to Han. Although ultimately Han prevailed and formed the next imperial dynasty in China, the story became an influential allegory for conflict and agreement. It appears in the layout of Chinese chess board, in which the starting positions of the players are divided by the "river", which is a stylised depiction of the Hong Canal and refers to the Chu-Han contention.

The Hong Canal may have served as a kind of focal point (Schelling, 1980) in resolving, at least temporarily, the conflict between Chu and Han. Since Schelling, it has been established that players can coordinate using "cues" that classical game theory considers irrelevant. Experimental evidences, including Mehta et al. (1994), Isoni et al. (2013), Isoni et al. (2014), Crawford et al. (2008), Bacharach and Bernasconi (1997) and Bardsley et al. (2010a) have shown that participants in coordination games are able to use salient relational cues or distinct labels to achieve high rates of successful coordination.

The backstory of the Treaty of Hong Canal presents another interesting feature that might have influenced the outcome of the negotiations. Chu and Han had collaborated in the revolution against Qin, and they came to control the region through their joint activity of fighting together against the Qin Dynasty. Was the Treaty of Hong Canal successfully agreed in part because it was implicitly a bargain struck dividing territories which had been gained by previous joint activity?

Schelling (1980) explained that people can, and in some cases do, use focal points to facilitate coordination, because the players recognise that they have a common interests, and that the focal point cue can serve as an equilibrium selection device. The two players can reason in a parallel way without any explicit communication about how to coordinate. Schelling's intuition has been developed further in a family of theories of team reasoning. Team reasoning was first proposed by Hodgson (1967) and expanded by Sugden (1993, 1995, 2000, 2005) and Bacharach (1995, 1999). Intuitively, a player is said to engage in team reasoning if she works out what strategy profile is best for the team as a whole, and then carries out her component of that strategy profile (Bacharach, 2006).

Bargaining games offer an additional complexity relative to games of pure coordination, because the two players may have conflicts of interest in who can get the larger surplus. For example, the Hong Canal almost surely did not divide the conquered territories into two parts of equal value. Schelling (1980) argued that tacit bargaining games are essentially the same as coordination games, and that both players would be better off if they could set aside the issue of payoff asymmetry in the outcome and focus on coordination. In a game with a salient focal point cue, if that focal point happened to suggest a lower payoff to a certain player, then "beggars cannot be choosers about the source of their signal (Schelling, 1980, pp.66)". Of course, when the payoff asymmetry suggested by such a focal point is large, the player who is unfavoured in the suggested outcome might be less inclined to accept Schelling's argument of the primacy of coordination, an intuition which has been demonstrated experimentally by Crawford et al. (2008) and Isoni et al. (2014).

One factor which might encourage the use of team reasoning, even in the face of large asymmetry in payoffs, is identification with the other player. This could arise because the two players identify as being part of the same group. Charness et al. (2014), for example, have shown that an interactive team-building activity can enhance group identity. Bargaining can also be influenced by the origin of the potential surplus to be bargained over (e.g. Karagözoğlu and Riedl, 2014; Bolton and Karagözoğlu, 2016).

We report a laboratory experiment which leverages the bargaining table design by Isoni et al. (2014). The bargaining table is a graphical representation of a bargaining situation between two players. There is a 9×9 grid of squares, with each player having a "base" on one side. Discs worth various amounts of money are placed at locations on the table; the players face the problem of how to divide the discs between them. We use layouts of the discs from Isoni et al.'s design in which a possible efficient division of the discs is suggested by a cue derived from the physical locations of the discs on the table. Some layouts suggest a rule of claiming the disc(s) which are closer to one's own base (the cue of closeness). Other layouts suggest a rule of claiming discs based on a close visual grouping (the cue of accession). Both types of cue indicate divisions of discs which leave an unbroken region of empty cells in the middle of the bargaining table grid, which echoes the Hong Canal and the river on the Chinese chessboard.

Our key contribution is to incorporate a prior activity which occurs before bargaining takes place on the bargaining table. We vary whether this activity is carried out separately by each participant, or jointly by the two participants who will subsequently engage in bargaining. When the prior activity is joint, we also vary whether the discs on the bargaining table are presented as having been collected as a result of the prior activity, or whether the prior activity is unrelated to the bargaining problem.

We find that participants are more likely to coordinate using relational cues in the bargaining game when the discs being bargained over are motivated as being a result of the prior activity. By comparing the two joint activity treatments against the separate activity baseline, we conclude that this increased tendency to follow focal points, especially when payoff allocation are asymmetric, can be attributed mainly to having obtained the discs from the joint activity and only in part to the fact that participants had a prior interaction; the linkage between the prior activity and the bargaining problem is also important in increasing participants tendency to follow focal points.

Compared with existing studies of examining team reasoning and Level-K theories as an explanation of coordination games (e.g. Bardsley et al., 2010a,b), our design allows for a robustness check for using team reasoning theory as an explanation for the high coordination rates often observed in tacit bargaining games. This study also contributes to the literature examining the effect of induced group identity in strategic games. Many existing studies induce common identity either by priming natural identity based on gender or country of origin (Shih et al., 1999; Benjamin et al., 2007), or identity based on existing group identity as students in the same university or members of the same organization (Attanasi et al., 2016). Others use a minimal group paradigm, where groups are generated based on, for example, one's stated preference between two works of art (e.g. Tajfel et al., 1971; Yamagishi and Kiyonari, 2000; Chen and Li, 2009). Our approach is more in the spirit of studies which use team-building activities to induce common identity (see Eckel and Grossman, 2005; Charness et al., 2014, for example), but in which we can distinguish between the case in which the team-building has led to a bargaining situation over assets derived from the previous joint activity, versus the case in which the team-building exercise is separate.

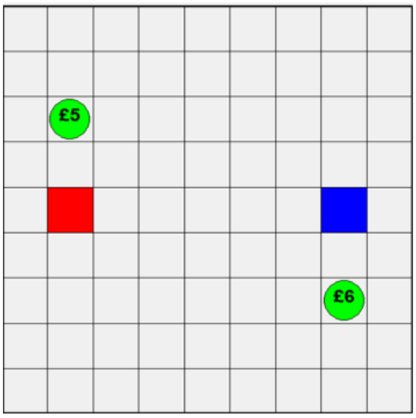
The rest of this paper is structured as follows. Section 3.2 describes the experimental design. Section 3.3 presents the main hypotheses. Section 3.4 presents the data and results. Section 3.5 concludes with a discussion.

3.2 Experimental design

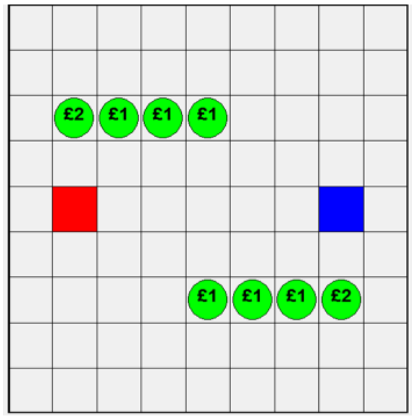
The experiment consisted of 12 different scenarios. For each scenario, participants were assigned into pairs and they will not be matched with the same participant in two consecutive periods. Each scenario consisted of two stages. In all treatments, Stage 1 was a task involving finding a route around 10 points on a map. In Stage 2, the two participants played a tacit bargaining game. Across treatments we varied the linkage between the Stage 1 and Stage 2 activities, and whether Stage 1 was completed individually or as a pair.

3.2.1 Stage 2: The tacit bargaining game

The Stage 2 bargaining game was implemented using the "bargaining table design" of Isoni et al. (2014). Figure 3.1 shows two of the tables used in our experiment.



(a) Game 2; Asymmetric Payoffs; Cue: Closeness;



(b) Game 10; Symmetric Payoffs; Cue: Accession;

Figure 3.1: Example of bargaining tables.

The square on the left was coloured red; the square on the right was coloured blue.

In the table, each participant had a base, represented by either a red square or a blue square. The colour and location of the base for each participant were the same in all scenarios.[1] On the table were two, four, or eight discs, worth monetary amounts. Players could claim as many or as few discs as they wished, by clicking on the discs they wanted to claim. Players made these claims without knowing the choice of their counterpart. An agreement occurred if the claims of the two players had no discs in common; in this case, each participant would earn an amount equal to the total value of the discs they claimed. However, if any disc was claimed by both participants there was no agreement: neither participants got any discs and earned nothing from the scenario. We used a subset of the tables from Isoni et al.. These tables were designed such that the layout of discs on the table suggested a way to coordinate the claims to avoid disagreement. Our tables use either one of two relational cues designed by Isoni et al.:

- Closeness: Discs are positioned so as to be clearly closer to one base or the other,

[1]The protocol followed Isoni et al. (2014)'s design, to avoid position or colour effects. The location of discs and bases permutated to ensure subjects see the same table

Table 3.1: Payoff allocations for all 12 scenarios

Payoff allocations	**Spatial cues**[a]	**2 discs**	**4 discs**	**8 discs**
$5\ :5$	C	G1=$5\|\|5$[b]	G5= $3,2\|\|2,3$	G9 =$2,1,1,1\|\|1,1,1,2$
	A	-	G6=$(3\|2)(2\|3)$[c]	G10=$(2,1,1\|1)(1\|1,1,2)$[d]
$6\ :5$	C	G2=$5\|\|6$	G7=$3,3\|\|2,3$	G11=$2,2,1,1\|\|1,1,1,2$
	A	-	G8=$(3\|3)(2\|3)$	G12=$(2,2,1\|1)(1\|1,1,2)$
$8\ :3$	C	G3=$3\|\|8$		
$10:1$	C	G4=$1\|\|10$		

[a] C: closeness; A: accession;
[b] "||"denotes the central column that separates the table into two parts;
[c] "( )" denotes block of discs;
[d] The two bars inside the round brackets indicate the number and value of discs that are placed in the central column.

suggesting a rule to claim discs which are closer to one's own base. Game 2 in Figure 3.1 is an example of a game with a closeness cue.

- Accession: Discs are positioned in two groups, suggesting a rule to claim discs which are in the group which comes closest to one's own base. Game 10 in Figure 3.1 is an example of a game with an accession cue.

Table 3.1 summarizes the 12 scenarios we selected from Isoni et al.. The scenarios are grouped by the most equal payoff allocation possible, which cue is present (closeness or accession), and how many discs are on the table (2, 4, or 8). We label as symmetric games the games in which a payoff allocation of £5 to each participant is possible and efficient. In the remaining games, which we label as asymmetric games, equal and efficient payoffs to each participant could not be obtained. Symmetric games always have payoff allocation of $5:5$; payoff allocations for asymmetric games are $6:5$, $8:3$ to $10:1$. In games with 2 discs, closeness and accession are equivalent.

The notation of the games, as shown in Table 3.1, followed Isoni et al.. The two vertical lines represent the central column in the table that separates the two players' sides. For example, G5: $3, 2||2, 3$ means that on the left side of the table there are two discs valued £3 and £2 and on the right hand side there are another two worth £2 and £3 respectively. The round brackets represent blocks of discs. For example, G10: $(2, 1, 1|1)(1|1, 1, 2)$ means that there are two blocks of discs each with four discs valued £2 £1, £1 and £1. Between the two vertical lines there are two numbers, these represent discs worth £1 that lie in the central column of the table. The full set of tables we employed can be found in Appendices B (section 3.6).

3.2.2 Stage 1: The Shortest Route Task

The Stage 1 task involved finding a route which visited 10 points laid out on a two-dimensional map. We call this the Shortest Route Task (*SRT* for short). An example of a typical map can be seen in Figure 3.2.

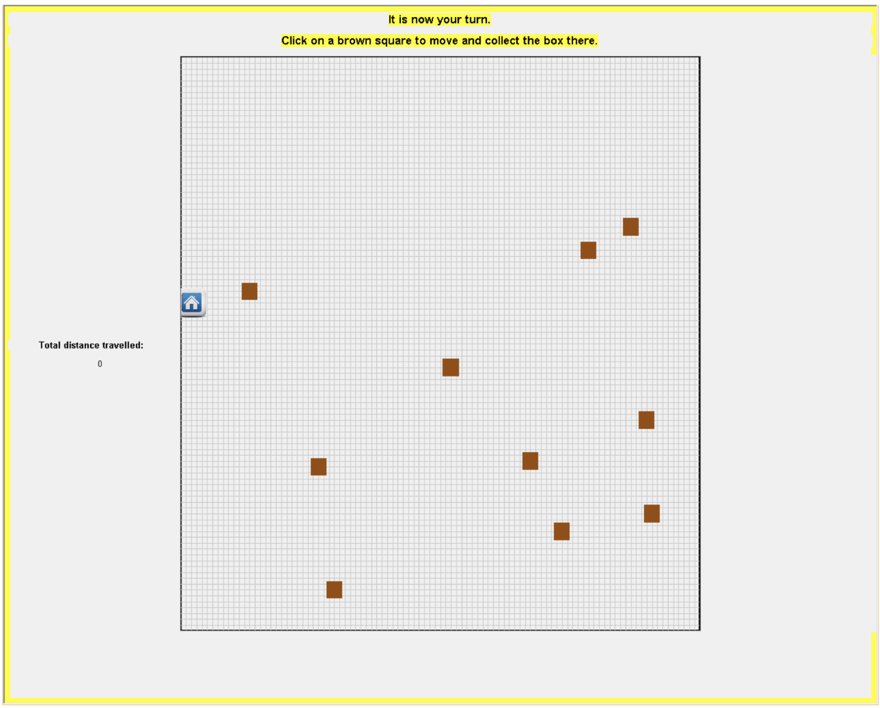


Figure 3.2: An example of a typical map.

Participants started from the home location, indicated by the icon of a house, and traveled around the map collecting boxes, represented by the brown squares. A participant selected the next box to collect by clicking on it with her mouse. After she clicked on it, a line connecting the box to the previous location would appear on the map.[2] The brown square turned grey, and an icon representing the collected box appeared on the right side of the screen. Once the tenth and final box was collected, the route was completed automatically by returning to the home location. Figure 3.3 shows an example of a completed route with the shortest total distance.

While moving around the map collecting boxes, the total distance traveled so far was reported at the left of the screen. After the bargaining in Stage 2 was completed, participants learned how the total length of their route compared to the routes constructed by other participants, with a feedback screen as in Figure 3.4.

Participants were encouraged to find a short route in the SRT, and the relative ranking report could provide some (additional) intrinsic motivation to find a short route. We did not provide financial incentives based on the SRT, as we did not want to introduce possible wealth effects to confound the bargaining process.

The SRT is an instance of the traveling salesman problem (hereafter refers to as *TSP*) which is a classical combinatoric optimization problem. The game describes a situation in which a salesman must travel between N cities and return where he starts. There are increasing costs associated with the distance he traveled, so he wants to keep the total distance as short as possible. The task is typically regard as a "hard" optimization problem, and has intrigued mathematicians and computer scientists for decades (e.g. Hoffman and Wolfe, 1985; Reinelt, 1994; Applegate et al., 2006; Lenstra et al., 2009; Cook, 2012). Psychologists (e.g.

[2] All distances were represented as if the boxes were on a grid, and travel was only along the up-down and left-right directions on the grid; that is, all distances used the "taxicab" or "Manhattan" metric. This allowed us to make all distances exact integers, as well as to be able to draw the paths so a path never overlapped itself.

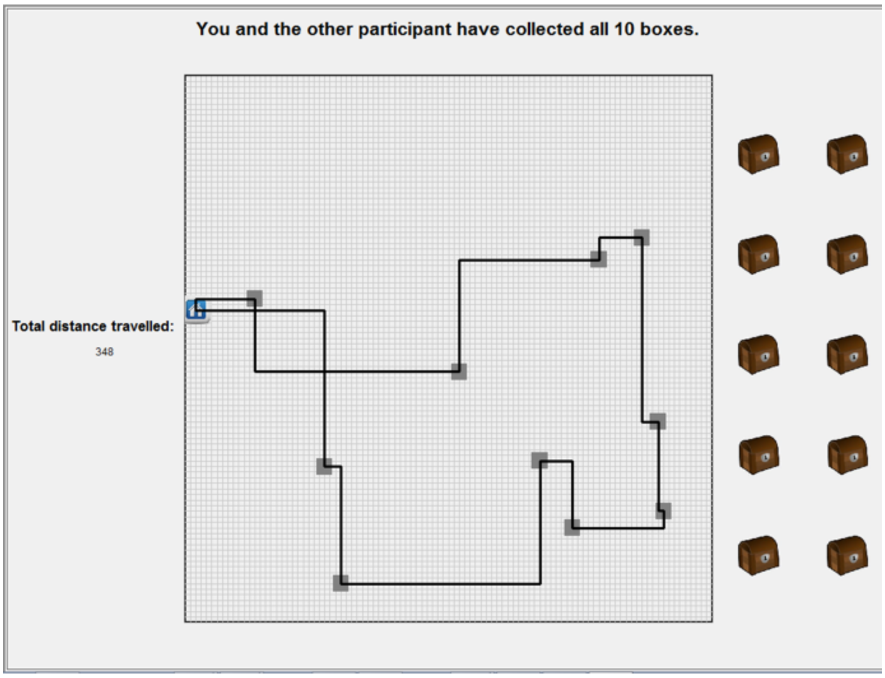


Figure 3.3: Shortest route in the sample SRT.

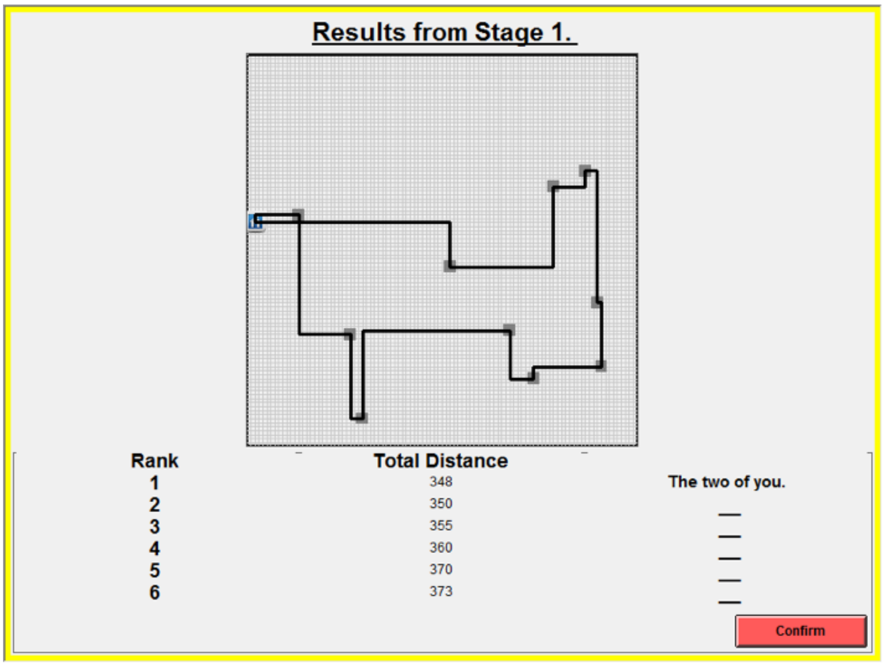


Figure 3.4: An example of the ranking table

Ormerod and Chronicle, 1999; MacGregor et al., 2000, 2006) have studied the performance of humans in solving TSPs. The results suggest that in problems of size similar to the ones we used, humans do a good, but not perfect, job of finding short routes. More importantly, there is no evidence of significant heterogeneity in skill levels: a participant who finds a good solution to one instance of the problem is not significantly more likely to find a good solution to another instance.

We selected the maps for the SRT based on informal piloting with colleagues. In particular, we chose maps in which the naive heuristic of always moving to the next closet uncollected box would not yield a good solution. We hinted this to participants by writing in the instructions:

> The route with the shortest total distance is not necessarily the one which always moves to the next closest box. Instead it may sometimes be useful to select a more distant box first to set up shorter moves later on.

3.2.3 Treatment design: Connecting the stages

In the Treaty of Hong Canal, the parties needed to decide how to divide gains they had gained jointly. We are interested in whether bargaining is different when the possible gains are obtained by joint action. There are two channels through which the joint gains could have an effect on the bargaining outcome. It could be important that the bargaining is over those joint gains; or, it might simply be enough that the parties have some prior interaction, even if that interaction is not linked directly to the gains to be bargained over. We conduct three treatments to attempt to separate out these explanations.

JE (Joint Endowment)

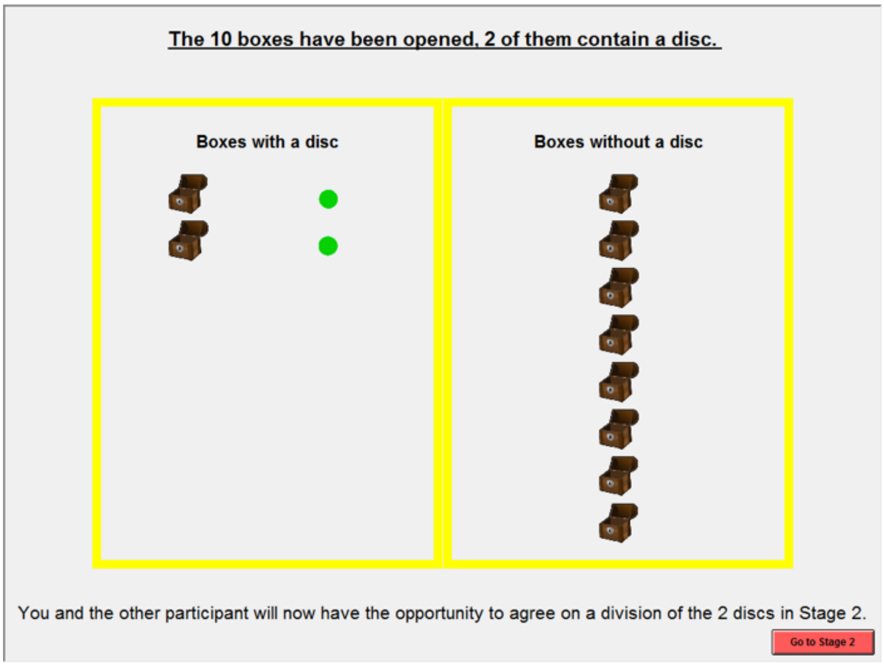


Figure 3.5: An example of opened boxes screen in the sample SRT.

In Stage 1, the participants in a pair constructed a path in the SRT by taking turns selecting the next box to visit. One participant was chosen at random to collect the first box; after that, the other participant chose the second box to collect, and so on, until all 10 boxes were collected. Each participant was therefore responsible for clicking on 5 of the boxes in defining the route. Once all 10 boxes were collected, the closed boxes would be opened. It was explained that some of the boxes contained a disc, and the others were empty. Table 3.5 presents an example of the screen used to display the opened boxes.

In this example, two of the 10 boxes collected in Stage 1 contained a disc, while the rest were empty. The screen pooled boxes that contained a disc together and those without a disc together, so there was no way to link any box to any location on the map. After the screen in Figure 3.5, participants moved to the Stage 2 bargaining table. Here participants saw the layout of the discs on the table and their values, but with no way to link those discs back to the previous screen.

The structure of this treatment presents the discs on the bargaining table as having been obtained by joint action. Using a combinatoric optimization problem means the quality of the solution found cannot be allocated meaningfully between the choices of the two players. While the task is easy to explain, evidence suggests there are not systematic differences in ability at solving the problem. Therefore, performance on finding a short route should not suggest a participant deserves a greater or smaller portion of the discs to bargain over. Also, because the link between the boxes on the map and the tokens on the bargaining table is obfuscated, bargaining cannot be based on which participant happened to "find" certain discs. We therefore control for entitlement effects, which previous studies have shown can influence players' bargaining positions (e.g. Oxoby and Spraggon, 2008; Price and Sheremeta, 2015; Karagözoğlu and Riedl, 2014).

JA (Joint Activity)

While **JE** presents the discs on the bargaining table as having been obtained by a joint activity, it may be that it is the joint activity itself that is important in affecting bargaining strategies, rather than the link between the bargaining problem and the activity. To control for this, treatment **JA** differs from **JE** only in that no link is made between the Stage 1 and Stage 2 activities. The linking screen in Figure 3.5 was not used, and instructions were adjusted accordingly to remove any linkage between Stage 1 and Stage 2; in the experiment, participants moved directly from Stage 1 to Stage 2.

SA (Seperate Activity)

Because we use bargaining table layouts which appeared in Isoni et al., we can use their results as one baseline. However, our protocol does differ from theirs, in that our participants see fewer tables (12 instead of 24), and alternate the SRT and bargaining table tasks. To ensure that the SRT itself does not change bargaining behavior, we conducted **SA**, in which the two participants complete the SRT individually in Stage 1, before moving on to Stage 2. As in **JA**, there is no linkage between the Stage 1 and Stage 2 tasks.

The experiment was conducted in the laboratory of the Centre for Behavioural and Experimental Social Science (CBESS) at the University of East Anglia. Participants were recruited from the lab's standing pool of participants, which is managed using the hRoot system (Bock et al., 2014). Only participants who had no prior experience in focal point types of experiment were recruited. All tasks in the experiment were computerized using zTree (Fischbacher, 2007). We pre-divided the pool of eligible participants into three sub-pools (**JE**, **JA**, and **SA**) at random and recruited all sessions of a treatment from the corresponding sub-pool; this ensures there were no selection effects due to the order in which sessions were conducted. Sessions were run between April 2016 to October 2016. Sessions lasted from 45 minutes to 1 hour.

3.3 Research hypotheses

Team reasoning theory suggests that successful resolution to bargaining problems will be more likely if the parties are more likely to see themselves as sharing some kind of identity with their counterpart. In our stylised representation of a conflict like the one between Chu and Han, this identification can arise through two distinct, but related, channels. The participants may be more inclined to engage in team reasoning if they have had some previous interaction with the counterpart. This may be even more likely if the bargaining situation has some link with that previous interaction. Both channels are present in the Chu-Han conflict leading up to the Treaty of Hong Canal; our distinction between **JA** and **JE** treatments allows us to draw a distinction between the two channels. In contrast, standard game theory makes no prediction about how any prior interaction would affect the likelihood of an equilibrium being selected.

Main hypothesis 1 *Bargaining will be most efficient in **JE**, followed by **JA**, followed by **SA**. Higher efficiency will be underpinned by participants following the focal point cues more often.*

It is well established that focal point cues are less effective in the face of conflicting interests, even when the conflict is small (e.g. Crawford et al., 2008; Isoni et al., 2014, 2013). Our interpretation of team reasoning theory suggests that while prior joint activity will make it more likely that a participant will prioritise the overall outcome of the team, it will not always overwhelm the tension of conflict in interest, in particular when the difference in payoffs is large. Therefore we expect to see effects of changing the degree of conflict in payoff allocations across all our treatments.

Main hypothesis 2 *In each treatment, as the payoff allocation suggested by the focal point cue becomes increasingly unequal, participants are less likely to choose according to the focal point.*

3.4 Results

We report a total of 145 pairs of observations; 49 pairs in treatment **JE**, 48 in treatment **JA** and 48 in treatment **SA**. Table 3.2,Table 3.3 and Table 3.4 provide breakdowns of the total claims by participants in scenarios with 2 discs, 4 discs and 8 discs. Participants' claims can worth from £0 to £11. In each table, we present numbers of participants claiming discs worth all possible combination of values. For games in which the claims suggested by the focal solution would result in asymmetric payoffs, we distinguish between the claims of the player who would obtain a higher payoff (the *favoured* player) and the player who would obtain a lower payoff (the *unfavoured* player). We do observe systematic differences between the patterns of claims between the favoured (*Fav*) and unfavoured (*Unfav*) players in these games. Moreover, weakly dominated strategy (claiming no discs) is rarely been played in 2 discs scenarios (0.6%), 4 discs scenarios (0.4%), and 8 discs scenarios (0.2%). Claiming all discs on the table (worth £10 or £11) is also rarely played in 2 discs scenarios (0.7%), 4 discs scenarios (0.6%), and 8 discs scenarios (0.5%).

We next look at the resulting rates of agreement. Table 3.5 reports three measures of agreement. The first column reports the proportion of pairs whose claims did not conflict, and therefore resulted in an agreement. The second column specialises this to the case of efficient agreement, that is, in which each disc was claimed by exactly one player. The final column reports proportions of pairs in which agreement was obtained, where both players' claims consisted only of discs among the subset suggested by the focal point.

To measure treatment effects, we conduct logit regressions, reported in Table 3.6, in which the probability of agreement is determined by the game and the treatment, with standard errors clustered at the session level. We report specifications in which the dependent variable is the overall agreement rate, as well as for focal point agreements. We also report separately estimations using all games, and those using only asymmetric games, as it is in asymmetric games where team reasoning may mitigate the tension from the asymmetry in payoffs.

Result 1 *There is no significant treatment effect in overall agreement rate. However, agreement consistent with the solution suggested by the focal point is significantly more frequent in **JE** than in **JA** or **SA**.*

Table 3.2: Distribution of claimed values by treatment in 2 discs games.

				Number of participants claiming discs worth											
Scenario	Treatment	Player	Mean	£0	£1	£2	£3	£4	£5	£6	£7	£8	£9	£10	£11
G1: $5\|\|5$	**JE**		£4.95	1	-	-	-	-	97	-	-	-	-	0	-
	JA		£4.95	1	-	-	-	-	95	-	-	-	-	0	-
	SA		£5.00	0	-	-	-	-	96	-	-	-	-	0	-
G2: $6\|\|5$	**JE**	Fav	£5.86	0	-	-	-	-	7	42	-	-	-	-	0
		Unfav	£5.02	0	-	-	-	-	48	1	-	-	-	-	0
	JA	Fav	£5.79	0	-	-	-	-	10	38	-	-	-	-	0
		Unfav	£5.15	0	-	-	-	-	41	7	-	-	-	-	0
	SA	Fav	£5.88	0	-	-	-	-	6	42	-	-	-	-	0
		Unfav	£5.33	0	-	-	-	-	37	10	-	-	-	-	1
G3: $8\|\|3$	**JE**	Fav	£7.59	0	-	-	4	-	-	-	-	45	-	-	0
		Unfav	£4.12	0	-	-	38	-	-	-	-	11	-	-	0
	JA	Fav	£6.90	1	-	-	9	-	-	-	-	38	-	-	0
		Unfav	£4.42	0	-	-	35	-	-	-	-	12	-	-	1
	SA	Fav	£7.48	0	-	-	5	-	-	-	-	43	-	-	0
		Unfav	£4.52	0	-	-	34	-	-	-	-	13	-	-	1
G4: $10\|\|1$	**JE**	Fav	£9.84	0	1	-	-	-	-	-	-	-	-	47	1
		Unfav	£4.88	0	28	-	-	-	-	-	-	-	-	20	1
	JA	Fav	£9.04	2	3	-	-	-	-	-	-	-	-	42	1
		Unfav	£5.69	1	22	-	-	-	-	-	-	-	-	24	1
	SA	Fav	£8.31	1	8	-	-	-	-	-	-	-	-	38	1
		Unfav	£6.81	0	17	-	-	-	-	-	-	-	-	31	0

This table presents an overview of all players' claims in 2 discs scenarios in each treatment. For example, under claimed value £5 and in the row **JE** there is a number of 97, meaning that 97 out of 98 participants in **JE** claimed £5 in G1= $5||5$.

Table 3.3: Distribution of claimed values by treatment in 4 disc games.

				Number of participants claiming discs worth											
Scenario	Treatment	Player	Mean	£0	£1	£2	£3	£4	£5	£6	£7	£8	£9	£10	£11
G5: $3,2\|\|2,3$	**JE**		£4.88	1	-	1	5	1	88	0	1	-	-	1	-
	JA		£4.80	1	-	2	7	1	82	2	0	-	-	1	-
	SA		£4.92	0	-	5	2	1	84	2	0	-	-	2	-
G6: $(3\|2)(2\|3)$	**JE**		£4.85	0	-	0	9	0	87	1	1	-	-	0	-
	JA		£4.70	0	-	3	11	0	80	2	0	-	-	0	-
	SA		£4.77	0	-	7	7	0	77	3	0	-	-	2	-
G7: $3,3\|\|2,3$	**JE**	Fav	£5.45	1	-	0	6	-	5	36	-	1	0	-	0
		Unfav	£4.88	0	-	1	3	-	42	3	-	0	0	-	0
	JA	Fav	£5.27	0	-	0	10	-	5	33	-	0	0	-	0
		Unfav	£4.94	0	-	0	4	-	41	2	-	1	0	-	0
	SA	Fav	£5.54	0	-	1	5	-	3	39	-	0	0	-	0
		Unfav	£4.81	0	-	1	6	-	37	3	-	1	0	-	0
G8: $(3\|3)(2\|3)$	**JE**	Fav	£5.02	1	-	0	10	-	14	23	-	1	0	-	0
		Unfav	£4.94	0	-	0	5	-	37	7	-	0	0	-	0
	JA	Fav	£5.00	1	-	0	10	-	12	25	-	0	0	-	0
		Unfav	£5.02	0	-	0	7	-	29	11	-	0	1	-	0
	SA	Fav	£5.42	0	-	1	4	-	19	22	-	1	0	-	1
		Unfav	£5.04	0	-	0	5	-	34	8	-	0	1	-	0

This table presents an overview of all players' claims in 4 discs scenarios in each treatment. For example, under claimed value £5 and in the row **JE** there is a number of 88, meaning that 88 out of 98 participants in **JE** claimed £5 in G5= $3,2||2,3$.

Table 3.4: Distribution of claimed values by treatment in 8 disc games.

				Number of participants claiming discs worth											
Scenario	Treatment	Player	Mean	£0	£1	£2	£3	£4	£5	£6	£7	£8	£9	£10	£11
G9:	**JE**		£4.89	0	0	0	1	12	83	1	1	0	0	0	-
$2,1,1,1\|\|$	**JA**		£4.72	0	0	3	5	13	72	1	2	0	0	0	-
$1,1,1,2$	**SA**		£4.77	1	1	3	2	12	70	5	1	0	0	1	-
G10:	**JE**		£4.80	0	0	0	3	14	81	0	0	0	0	0	-
$(2,1,1\|1)$	**JA**		£4.73	0	0	4	4	10	74	4	0	0	0	0	-
$(1\|1,1,2)$	**SA**		£4.78	0	0	2	7	9	75	1	1	0	0	1	-
G11:	**JE**	Fav	£5.59	1	0	0	0	2	15	30	0	0	0	0	1
$2,2,1,1\|\|$		Unfav	£4.88	0	1	0	0	5	40	3	0	0	0	0	0
$1,1,1,2$	**JA**	Fav	£5.48	0	0	1	2	2	11	32	0	0	0	0	0
		Unfav	£4.83	0	0	0	2	6	39	0	1	0	0	0	0
	SA	Fav	£5.38	0	0	2	3	4	9	27	2	1	0	0	0
		Unfav	£4.96	0	0	2	1	5	35	3	1	0	0	0	1
G12:	**JE**	Fav	£5.61	0	0	0	1	5	8	33	2	0	0	0	0
$(2,2,1\|1)$		Unfav	£4.90	0	0	0	1	6	39	3	0	0	0	0	0
$(1\|1,1,2)$	**JA**	Fav	£5.10	0	0	0	6	8	9	25	0	0	0	0	0
		Unfav	£4.81	0	0	0	4	4	37	3	0	0	0	0	0
	SA	Fav	£5.40	0	0	1	3	5	6	33	0	0	0	0	0
		Unfav	£5.02	0	0	2	3	2	37	1	1	0	0	0	2

This table presents an overview of all players' claims in 8 discs scenarios in each treatment. For example, under claimed value £5 and in the row **JE** there is a number of 83, meaning that 83 out of 98 participants in **JE** claimed £5 in G9= $2,1,1,1||1,1,1,2$.

Table 3.5: Agreement rate, efficient agreement rate and rate of focal point agreements.

Scenario	Treatment	Agreement Rate	Efficient Agreement Rate	Focal Point Agreement Rate
G1: $5\|\|5$	**JE**	92%	98%	92%
	JA	92%	98%	90%
	SA	90%	100%	88%
G2: $6\|\|5$	**JE**	84%	100%	84%
	JA	73%	100%	69%
	SA	79%	100%	73%
G3: $8\|\|3$	**JE**	73%	100%	71%
	JA	63%	97%	58%
	SA	77%	100%	69%
G4: $10\|\|1$	**JE**	53%	100%	53%
	JA	40%	84%	40%
	SA	42%	95%	29%
G5: $3, 2\|\|2, 3$	**JE**	84%	85%	84%
	JA	83%	85%	81%
	SA	81%	87%	77%
G6: $(3\|2)(2\|3)$	**JE**	63%	81%	59%
	JA	60%	72%	50%
	SA	60%	66%	46%
G7: $3, 3\|\|2, 3$	**JE**	73%	72%	73%
	JA	71%	76%	69%
	SA	73%	74%	71%
G8: $(3\|3)(2\|3)$	**JE**	69%	59%	61%
	JA	56%	56%	42%
	SA	48%	78%	40%
G9: $2, 1, 1, 1\|\|$	**JE**	86%	79%	86%
	JA	75%	83%	73%
	SA	65%	71%	65%
G10: $(2, 1, 1\|1)$	**JE**	73%	83%	73%
	JA	73%	86%	69%
	SA	77%	73%	75%
G11: $2, 2, 1, 1\|\|$	**JE**	80%	51%	78%
	JA	73%	69%	71%
	SA	71%	53%	67%
G12: $(2, 2, 1\|1)$	**JE**	73%	69%	73%
	JA	65%	68%	58%
	SA	69%	73%	65%

Note: Agreement rate measures the percentage of pairs whose claims do not conflict; Efficient agreement rate is percentage of agreement that is efficient. Focal point agreement rate is the percentage of agreements following focal point. Focal point agreement is defined as both player follow focal point by choosing only discs on his own side (no matter the number of discs), and not choosing any of the disc on the other player's side.

Table 3.6: Logit regression with overall agreement rate and focal point agreement rate (for participants as pairs).

VARIABLES	Agreement Rate	Focal Point Agreement	Agreement Rate (Asymmetric)	Focal Point Agreement (Asymmetric)
G2: $6\|\|5$	-1.019***	-1.059***		
	-0.313	-0.242		
G3: $8\|\|3$	-1.426***	-1.500***	-0.408*	-0.441*
	-0.336	-0.249	-0.245	-0.231
G4: $10\|\|1$	-2.537***	-2.564***	-1.522***	-1.509***
	-0.347	-0.289	-0.225	-0.21
G5: $3,2\|\|2,3$	-0.751**	-0.734***		
	-0.346	-0.262		
G6: $(3\|2)(2\|3)$	-1.862***	-2.112***		
	-0.333	-0.274		
G7: $3,3\|\|2,3$	-1.357***	-1.273***	-0.339	-0.213
	-0.308	-0.241	-0.259	-0.245
G8: $(3\|3)(2\|3)$	-2.006***	-2.280***	-0.990***	-1.224***
	-0.312	-0.305	-0.26	-0.268
G9: $2,1,1,1\|\|$	-1.214***	-1.096***		
	-0.335	-0.273		
G10: $(2,1,1\|1)$	-1.251***	-1.204***		
	-0.306	-0.26		
G11: $2,2,1,1\|\|$	-1.251***	-1.238***	-0.232	-0.179
	-0.326	-0.228	-0.252	-0.243
G12: $(2,2,1\|1)$	-1.525***	-1.531***	-0.507**	-0.472*
	-0.311	-0.273	-0.245	-0.252
JE	0.325	0.534**	0.337	0.548**
	-0.241	-0.25	-0.233	-0.252
JA	-0.0348	0.0247	-0.123	-0.0394
	-0.221	-0.298	-0.268	-0.286
Constant	2.230***	1.994***	1.240***	0.954***
	-0.309	-0.309	-0.238	-0.267
Observations	1,740	1,740	1,015	1,015

Note: Standard error adjusted for 49 clusters for session. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Independent variables are games and treatments; in games G1: $5||5$ is the baseline; in treatments **SA** is the baseline. Dependent variables are Agreement rate; Focal point agreement rate; And the last column report results for asymmetric games only.

Support. The regression in Table 3.6 shows a positive point estimate for the coefficient on **JE** on overall agreement rate for both all games and for asymmetric games only, but the coefficient is not significantly different from zero. Looking at the rate of agreements consistent with the focal point solution, the coefficient on **JE** is significantly greater than zero. In all regressions the coefficient on **JA** is small.

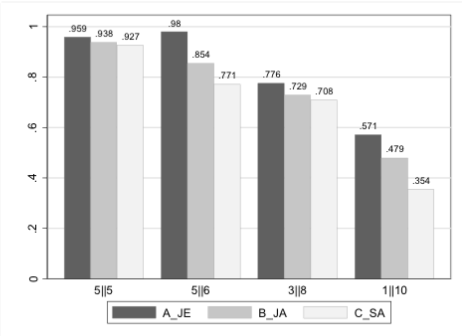
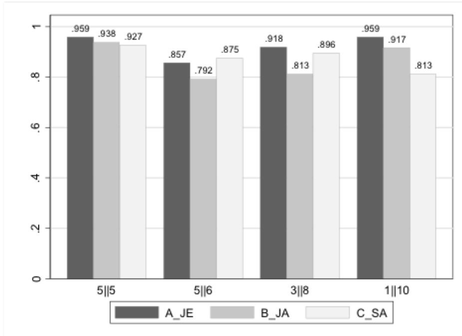
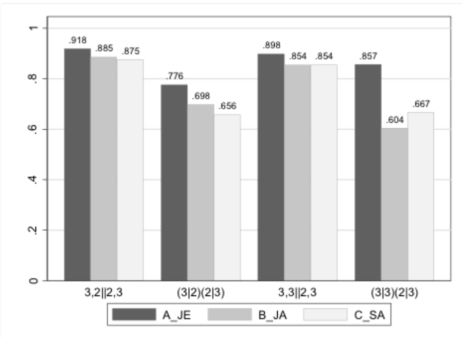
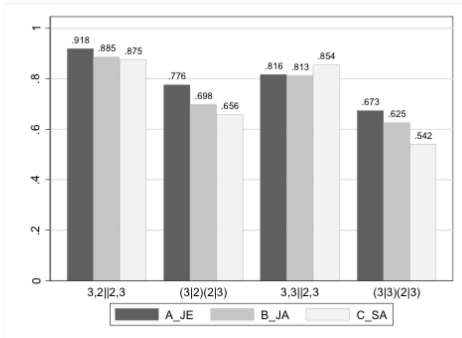
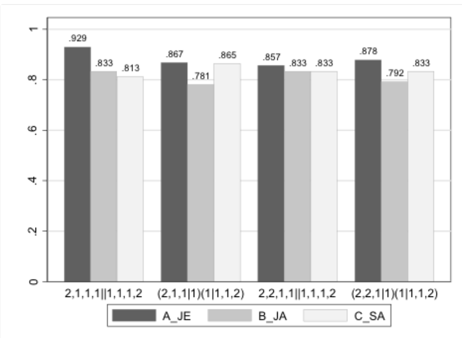
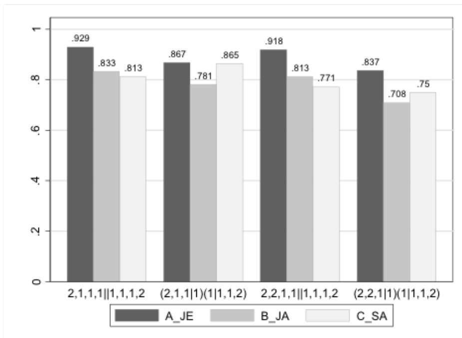
One account of these results is that claims in **JE** are more predictable and systematic, in that they are consistent with the solutions suggested by the focal point. The effect on the overall agreement rate is less, however, because some of the pairs who agree along focal point lines in **JE** might have wound up in agreement by chance in **JA** or **SA**. This could occur, for example, if players in **JA** or **SA** would play a mixed strategy equilibrium, resulting in agreement with a positive probability but not with certainty, or if they used reasoning similar to level-k and happened to submit a pair of claims that did not conflict.

While we observe an increase in focal point agreements in **JE**, we do not observe the same in **JA**. This suggests that the linkage between the Stage 1 and Stage 2 tasks is important. This is remarkable because the only difference between the two treatments, at the level of implementation in the experiment, is that **JA** omits the one screen which "opens" the boxes and counts out the number of discs. This is a rather light-touch manipulation.

To investigate this in more detail, we drill down to the level of individual players' claims. Table 3.7 illustrates that players who are unfavoured by the outcome suggested by the focal point tend to claim less in total. The size of the asymmetry in suggested payoffs is different among 2-disc, 4-disc, and 8-disc games, so we look at each of these groups of games separately.

Table 3.7 compares, participants' rate of making claims consistent with the focal point suggestion across 2 disc games, 4 discs games and 8 discs games for 2-disc games; We report the results for unfavoed/favored players separately in left/right side of the table.

Table 3.7: Proportion of participants making claims consistent with focal point suggestions.

<table>
<tr><th></th><th>Unfav</th><th>Fav</th></tr>
<tr><td>2 discs</td><td>
</td><td>
</td></tr>
<tr><td>4 discs</td><td>
</td><td>
</td></tr>
<tr><td>8 discs</td><td>
</td><td>
</td></tr>
</table>

Note: Left figures report choices of Unfavored players; Right figures repot choices of Favored players. From top to bottom, we aggregate scenarios with 2 discs, 4 discs and 8 discs. Each sub-figure presents the proportion of participants who make claims consistent with focal point cues in three treatments.

□

Result 2 *In all treatments, as payoffs becomes increasingly unequal, players are less willing to follow focal point.*

Support. Table 3.8 reports the results of logit regressions, with the dependent variable being whether a player's claim was consistent with the focal point suggestion. We report models using all data; symmetric games only; and asymmetric games, distinguishing the claims of favoured and unfavoured players. To control for any interaction effects within a session, robust standard error is clustered at session level (in total there are 49 sessions).

When all games are considered, compared with the baseline G1: $5||5$, all other games have significantly lower rate for participants to choose focal points, given other controlling factors constant. Claims are significantly more likely to be consistent with the focal point in **JE** than in **SA**.

Considering only symmetric games, relative to the baseline G1: $5||5$, players are significantly less likely to make claims consistent with the focal point in other symmetric games such as $3, 2||2, 3$ and $(2, 1, 1|1)(1|1, 1, 2)$. As the number of discs increase, focal point cues become less effective.

When payoff allocations suggested by the focal point are unequal, for unfavoured players, compared with the baseline G2: $6||5$, higher inequality between payoffs (G3: $8||3$; G4:$10||1$) results significantly lower rate of choosing focal point. When payoff allocation is the same at $6:5$, compared with baseline treatment G2: $6||5$, except for G8: $(3|3)(2|3)$, all other games with the same payoff allocation do not significantly different from the baseline 2 discs game. For favored player, there is no systematic difference across games. Claims are significantly more likely to be consistent with the focal point in **JE** than in **SA** for both favoured and unfavoured players.

Table 3.8: Logit regression results for subjects' tendency to follow focal points.

VARIABLES	Follow focal point	Follow focal point in symmetric games	Unfavored players follow focal point in asymmetric games	Favored players follow focal point in asymmetric games
G2: $6\|\|5$	-0.386*			
	-0.233			
G3: $8\|\|3$	-0.734***		-0.869***	0.287
	-0.232		-0.3	-0.279
G4: $10\|\|1$	-1.404***		-2.055***	0.494
	-0.256		-0.285	-0.323
G5: $3,2\|\|2,3$	-0.734***	-0.733***		
	-0.262	-0.261		
G6: $(3\|2)(2\|3)$	-2.111***	-2.107***		
	-0.274	-0.272		
G7: $3,3\|\|2,3$	-0.441*		0	-0.101
	-0.235		-0.315	-0.315
G8: $(3\|3)(2\|3)$	-1.500***		-1.009***	-1.217***
	-0.297		-0.339	-0.323
G9: $2,1,1,1\|\|$	-1.096***	-1.095***		
	-0.273	-0.272		
G10: $(2,1,1\|1)$	-1.204***	-1.202***		
	-0.26	-0.26		
G11: $2,2,1,1\|\|$	-0.520**		-0.226	-0.0511
	-0.235		-0.321	-0.347
G12: $(2,2,1\|1)$	-0.778***		-0.277	-0.489
	-0.277		-0.335	-0.324
JE	0.551**	0.505*	0.733***	0.493**
	-0.232	-0.306	-0.264	-0.25
JA	0.0812	0.134	0.1	-0.0186
	-0.287	-0.372	-0.28	-0.297
Constant	1.969***	1.962***	1.649***	1.527***
	-0.303	-0.326	-0.301	-0.299
Observations	3,480	1,450	2,030	2,030

Note: Robust standard errors in parentheses; Standard error adjusted for 49 clusters for session. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable is whether participants follow focal point. Independent variables are games and treatments; The first column reports results for all games and all subjects; the second column reports only symmetric games and all subjects; the third column reports only asymmetric games and only unfavored players; the fourth column reports only asymmetric games and only favored players' results. If all games are presented or only symmetric games are presented G1: $5||5$ is the baseline for game dummies; if only asymmetric games are presented G2: $6||5$ is the baseline for game dummies. **SA** is baseline for treatment dummies.

Overall, our finding is consistent with previous literature (for example Isoni et al., 2013) that as payoff allocations become increasingly unequal, participants' tendency to follow focal point will be decreased, especially for unfavored players. □

Result 3 *In treatments **JE** and **JA**, involving jointly solving the SRT before bargaining, participants report more positive feelings towards the other player.*

Support. After all participants finished the last scenario, we asked participants to self-evaluate to what extent they would identify with the other player as "we" using the "We Scale" measure (Cialdini et al., 1997). The "We Scale" measure is often used in literature to measure social closeness. And in our experiments, we use it to measure a generalised feeling of closeness with other participants in the experiment. Table 3.9 presents the results of ordered probit regression models with the dependent variable as participant's self-reported we-scale value, which ranges from 1 to 7. Explanatory variables include treatment dummies and other demographic variables obtained from a standard battery of questionnaire questions at the end of the experiment.

Compared with the baseline treatment **SA**, participants in **JE** and **JA** report significantly higher "we-scale" identifications. Other demographic variables do not have systematic influence on the measures. The shift in reports in **JE** and **JA** suggest the joint completion of the SRT was effective in inducing conditions under which team reasoning theory would be more likely to apply. Our results are in accordance with Charness et al. (2014)'s finding that team-building exercise (a word formation task) could greatly increase the level of contributions in public goods game regardless of whether one is linked to people from one's team-building exercise. Charness et al. (2014) argue that the reason for such results could be that the positive feeling engendered by the group exercise spills over to other participants when these other participants are known to have also participated in a team-building exercise. □

Table 3.9: Ordered Probit Regression results of “We Scale” measures

VARIABLES	(1) We Scale	(2) We Scale	(3) We Scale
JE	0.432***	0.419***	0.522***
	-0.155	-0.158	-0.159
JA	0.589***	0.575***	0.474***
	-0.163	-0.164	-0.171
Control for demographic variables			
Gender	No	Yes	Yes
Age	No	Yes	Yes
Native-English Speaker	No	Yes	Yes
Other controlling variables			
University status(Bachelor, Master, Mphil/PhD, Staff)	No	No	Yes
Past participation times in CBESS experiments	No	No	Yes
Observations	287	285	285

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable is participants’ self-reported measure of “we scale” with the other participant. Independent variables of interests are treatment variables: JE and JA with SA as the baseline treatment; The first column reports results for treatment variables only; the second column reports the results of treatment variables after controlling for demographic variables: Gender, Age and whether the participant is a native-English speaker; the third column in addition controlling for other characteristics of participants as appeared in the questionnaire, the University Status (Bachelor, Master, Mphil/PhD or Staff) and past participation times in CBESS experiments (Never, Less than 5 times, 5-10 times,10-20 times and more than 20 times).

Table 3.10: Ordered Probit regression results for tendency to follow focal point.

VARIABLES	(1) JE	(2) JA	(3) SA
Standard SRT-Difference (SRT_{Diff})	-0.166**	-0.129***	-0.0346
	-0.0655	-0.0415	-0.0441
Num Discs: 4	-0.667***	-0.470***	-0.509***
	-0.126	-0.115	-0.0957
Num Discs: 8	-0.591***	-0.375***	-0.542***
	-0.127	-0.117	-0.0956
Observations	588	576	1,152

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. In specification (1) and (2), dependent variable is the rate of choosing focal point for participants as a pair (the value of the dependent variable ranges from 0 to 2); in specification (3) the dependent variable is a dummy variable measures whether or not participant choose according to focal point. (1) specified in **JE** treatment, (2) for **JA** treatment, and (3) for **SA** treatment. Independent variable of interest is SRT_{Diff}, which is a standardized measure of participants' performance in SRT. In JE and JA, participants matched in pairs to solve for SRT, thus this variable measured the pair's standardized performance. In SA treatment, participant solved the SRT individually, SRT_{Diff} measures individual performance. "Num Disc" is a category variable measures numbers of discs in the game, the baseline categories is 2 discs case.

Result 4 *Pairs who perform better in the SRT are more likely to choose consistent with the focal point cue. In contrast, performance on the individual SRT does not predict the likelihood of focal point choices.*

Support. Table 3.10 shows the results of ordered probit regression. For specifications 1 and 2, the independent variable is the number of players in the pair whose claims were consistent with the focal point cue. For specification 3, the independent variable is whether each individual player chose consistently with the focal point.

For dependent variables, SRT_{Diff} is the standardized performance in SRT, measured by the difference between individual pairs' SRT score and the average SRT scores divided by standard deviation of all pairs' scores: $SRT_{Diff_i} = \frac{SRT_i - mean(SRT)}{sd(SRT)}$.

The results show that in the individual treatment, SRT task has no significant correlation with one's tendency to choose focal point; while in treatments in which the SRT is performed jointly, better performance in SRT, as measured by lower SRT_{Diff}, is positively correlated with pairs' tendency to make claims consistent with the focal point suggestion.

We note again that participants did not find out their relative ranking on the SRT until after bargaining concluded in a period. Therefore, good feelings arising from a good ranking could not explain the difference in bargaining behaviour in **JE** and **JA**. Because solving out the SRT is not feasible, we expect that different people will use different heuristics to try to construct a good solution. If two people with a similar way of looking at a given SRT meet, then it is likely that, when they alternate moves, the moves each one makes will be compatible with the plan of their coplayer, and therefore result in a good score. On the other hand, if two people have substantially different heuristics in mind, the moves of one player are likely to interfere with the plans of the other, leading to inferior performance. While the players would not know their final ranking, they would experience whether their coplayer tended to make moves which they found expected or unexpected, and this could influence their bargaining decisions in Stage 2.

Such a mechanism would likewise be consistent with team reasoning theory. If two players find in the SRT that they both appear to conceptualise the solution to the SRT in similar ways, this might suggest they will likewise have a similar viewpoint in other interactions. This could then both support an increased likelihood of individuals thinking according to team reasoning on their own, as well as an increased expectation the other player will do the same, enhancing the focality of the team reasoning solution. □

3.5 Conclusion

History tells us that the Treaty of Hong Canal set the boundary between Chu and Han using a geographical reference point. Viewed from the perspective of bargaining theory, one can wonder whether the fact that agreement was reached, and in particular an agreement using such a salient focal point, was more likely because the territory being divided was initially obtained through a joint activity between the two sides.

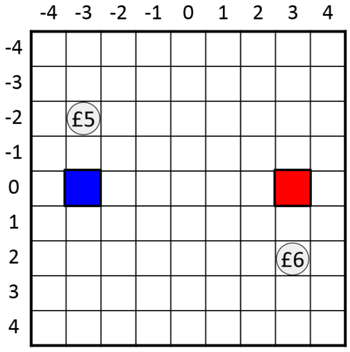
Because history does not show us alternative what-if scenarios, we construct a bargaining experiment which reproduces some stylised features of the Chu-Han contention. Players bargain over valuable objects (disc) laid out on a two-dimensional field (the bargaining table), with a separating gap (the canal) between them. We vary whether the parties have previous experience in a joint activity prior to bargaining, and whether that prior activity links to the bargaining problem by being the source of the discs being bargained over.

We find that both the prior joint activity and the link between that activity and the bargaining problem are required to change claims in the bargaining problem. Claims are indeed more likely to follow focal point cues in this condition, even, and especially, when the division suggested by the focal point is unequal between the parties. In the terms of the story, our results would say that the fact that the treaty was based on the Hong Canal was more likely because Chu and Han were dividing up territories they had been able to acquire control over through their preceding campaigns.

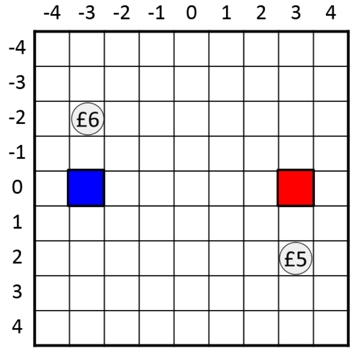
However, we do not find that agreement rates overall are significantly higher, at least for the scenarios and bargaining rule (simultaneous claims) we consider. Agreements consistent with the focal point largely "crowd out" agreements that would occur by some other rule, or perhaps more likely by chance. This would suggest that Chu and Han would perhaps have been likely to come to some agreement if their dispute had arisen from some other source other than their joint campaign, but that the agreement would be less likely to have occurred using the canal as the border. And, indeed, the treaty was broken the following year by Han, who eventually triumphed and founded the next dynasty to rule China: the fact the gains were obtained jointly and the solution along a focal point did not result, in this case, in a stable long-term agreement.

3.6 Appendices B

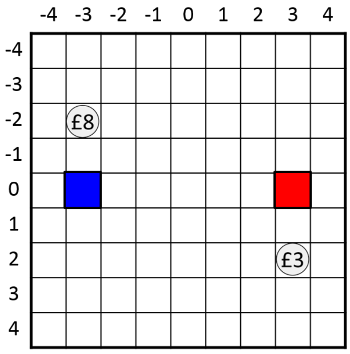
All games in the experiment



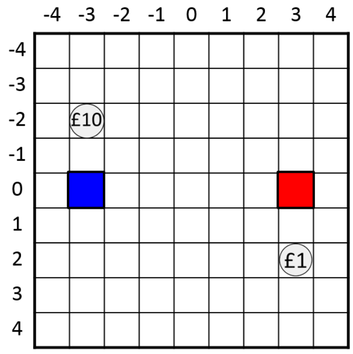
Game 1= $5||5$
Cue: C



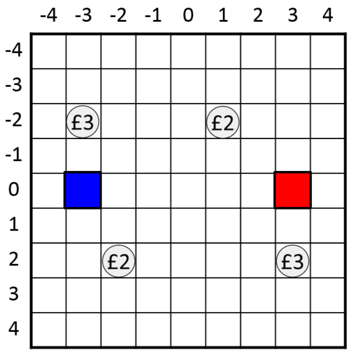
Game 2= $6||5$
Cue: C



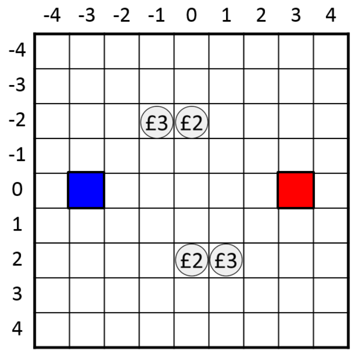
Game 3= $8||3$
Cue: C



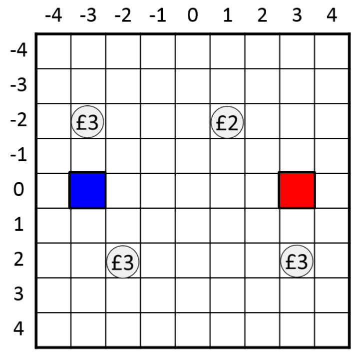
Game 4= $10||1$
Cue: C



Game 5= $3, 2||2, 3$
Cue: C

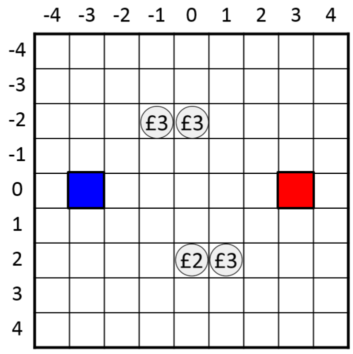


Game 6= $(3|2)(2|3)$
Cue: A



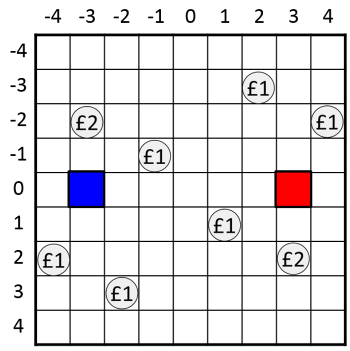
Game 7= $3, 3||2, 3$

Cue: C



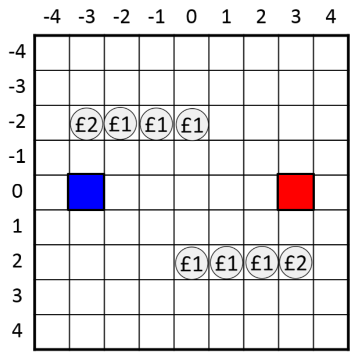
Game 8= $(3|3)(2|3)$

Cue: A



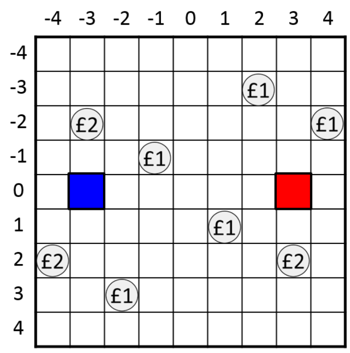
Game 9= $2, 1, 1, 1||1, 1, 1, 2$

Cue: C



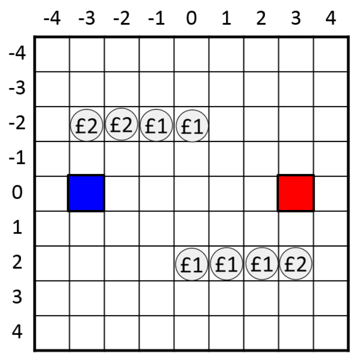
Game 10= $(2, 1, 1|1)(1|1, 1, 2)$

Cue: A



Game 11= $2, 2, 1, 1||1, 1, 1, 2$

Cue: C



Game 12= $(2, 2, 1|1)(1|1, 1, 2)$

Cue: A

Instructions

Treatment JE

Introduction

This is an experiment in the economics of decision-making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

Everyone in the room is receiving exactly the same instructions.

You will be presented with twelve (12) different scenarios, one after the other. Each scenario consists of two (2) stages. Everyone in the room will make decisions in the same 12 scenarios. Each scenario is an interaction between two participants. For each scenario, you will be matched with another participant in the room. Each match is anonymous: You will never find out with whom you are matched in a scenario. You will not be matched with the same participant in two consecutive scenarios.

At the end of the experiment, one of the scenarios will be randomly selected to determine the earnings for the session. Because you will not know which scenario will be selected until you have made decisions in all of them, **you should treat each scenario as if it was the selected one.** So, when thinking about each scenario, remember that it could be the selected one and think about it in isolation from the others. Your total earnings for the session will be given by the earnings from the selected scenario, plus a £5 participation payment.

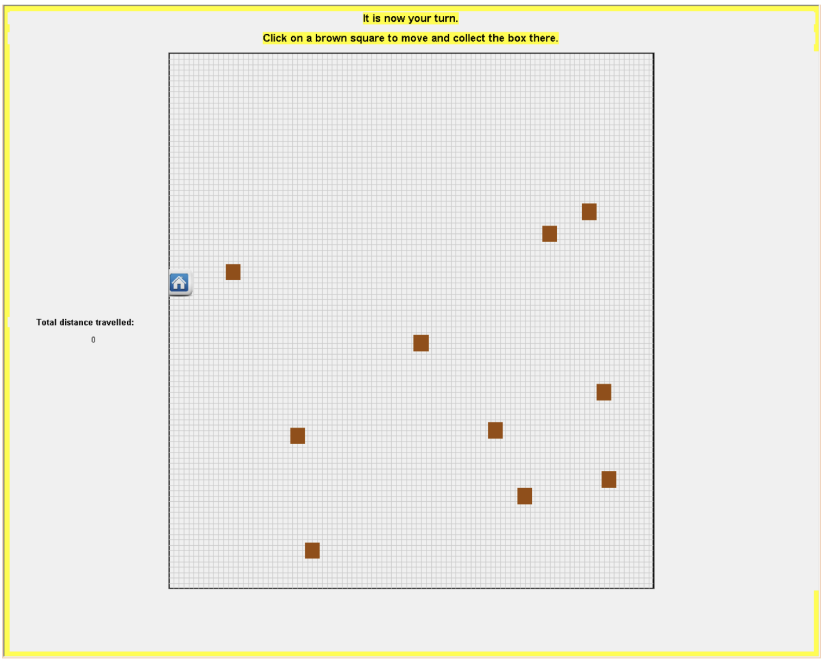
The scenario

Each scenario consists of 2 stages. At the start of the scenario, you will be matched with one other participant. You will remain matched with that participant through the whole scenario, but will be matched with a different participant in the subsequent scenario.

Stage 1

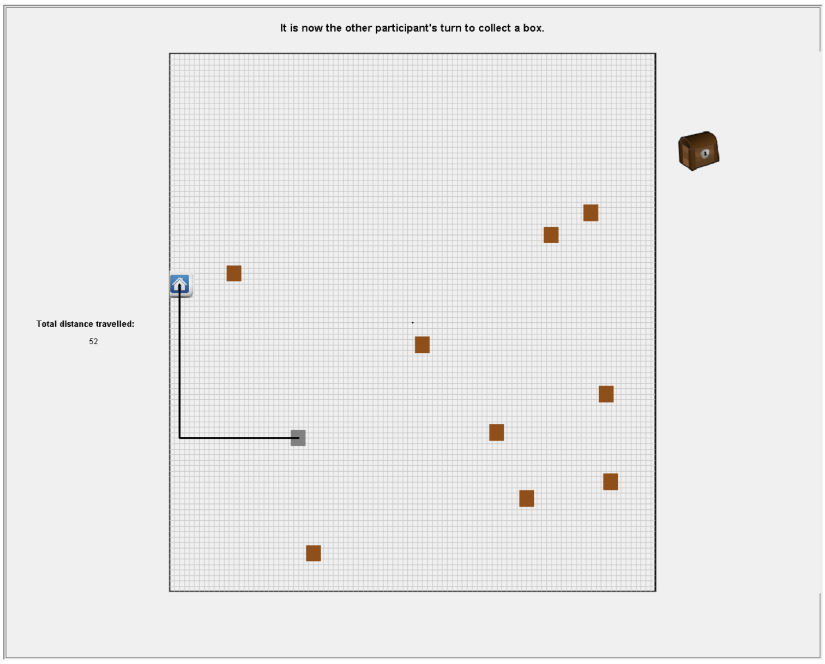
In Stage 1, you and the other participant with whom you are matched will collect ten (10) boxes. Each box either contains one disc, or is empty. Discs are worth various amounts of money. In Stage 2 of the scenario, you and the other participant will have the opportunity to agree on a division of the discs.

These boxes will be placed at 10 different points on a map. Each box is represented by a square. The locations of the 10 boxes will be different in each scenario. You and the participant with whom you are matched will start from a home location, which will be indicated by a picture of a house. The two of you will move around the map collecting the boxes, and then return to the home location. Here is an example of a typical map.



The two of you will take turns deciding which box to collect next. When it is your turn, you will see the message“It is now your turn” at the top of the screen. Click on a brown square to move and collect the box located there. Each collected box appears as a picture on the right side of the screen.

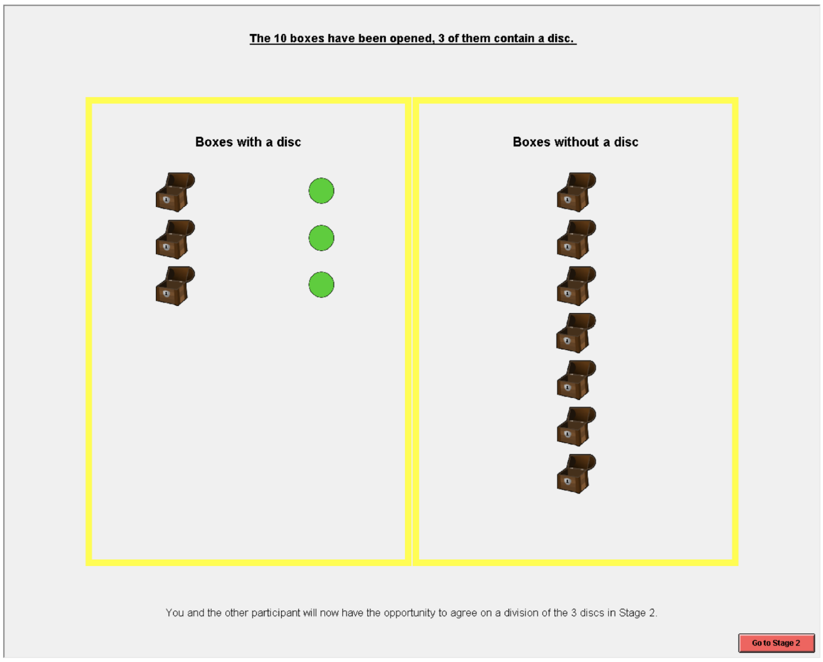
After you click to collect a box, it will be the other participant’s turn. Your screen will display the message“It is now the other participant’s turn to collect a box.” as shown in this screen:



As the two of you move around the map collecting boxes, the computer will draw the path the two of you take. The locations of boxes which have already been collected will be shown as grey squares; the locations of boxes which still have to be collected will be shown as brown squares. As there are 10 boxes to be collected, you and the other participant will each collect 5 boxes.

At the left of the map, the computer will report the total distance travelled by the two of you. After Stage 2 of the scenario, you will see a ranking listing the total distance the two of you travelled, and the distances travelled by other participants in the session. The route with the shortest distance will receive the top rank. You may be able to improve your ranking by thinking ahead. The route with the shortest total distance is not necessarily the one which always moves to the next closest box. Instead, it may sometimes be useful to collect a more distant box first to set up shorter moves later on.

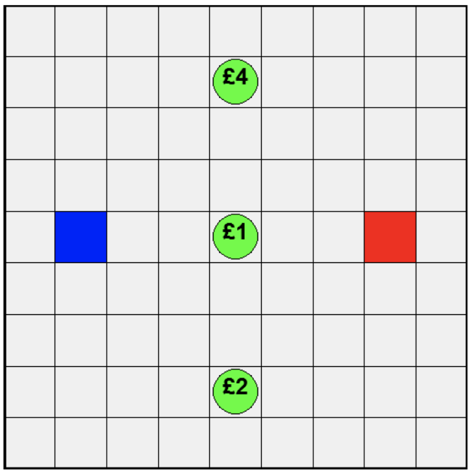
After the two of you have collected all 10 boxes, the boxes will be opened. Some boxes will be empty, and some will contain a disc.



In this example, 3 of the 10 boxes contained a disc, and 7 of the 10 boxes were empty. In Stage 2, you and the other participant will learn how much each disc is worth, and will have the opportunity to agree on a division of the discs.

Stage 2

In Stage 2, each scenario is represented by a picture like this on your screen.



We will call this picture a **table**. The discs which the two of you collected together in Stage 1 of the scenario will be laid out on it. Each disc is labelled with its corresponding monetary value. In this example, the 3 discs collected in Stage 1 are worth £4, £1, and £2, respectively.

You and the other participant will be either Red or Blue. The role of Red or Blue will be randomly decided by the computer. Each of you has a **base**, represented by a red square for the Red participant and a blue square for the Blue participant. You will see "YOU" on your base. Your base will keep the same colour and the same position on the table in all the scenarios you will encounter.

The basic rules

You and the other participant have the opportunity to agree on a division of the discs.

Each of you separately record which discs you propose to take. We will say that you are **claiming** those discs. You can claim as many (or as few) discs as you want. These claims determine whether there is an agreement or not.

There is an agreement if you have not claimed any of the discs that the other participant claimed, that is, if you and the other participant claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total value of these discs.

But if **any** disc has been claimed by both you and the other participant, there is no agreement. In this case, you get no discs and so earn nothing from the scenario.

You can claim a disc by clicking on it with your mouse. If you do this, a coloured line connecting the disc to your base will appear on the table. If you have claimed a disc but change your mind and decide you no longer want to claim it, you simply click on it again. The coloured line connecting it to your base then disappears.

In each scenario, you can claim as many discs as you like. You should remember that the other participant will be claiming discs too.

You will not know which discs the other participant has claimed.

When you are happy with the claims you have made in a scenario, you go on to the next scenario by pressing the CONFIRM button.

Your earnings

When you have finished all 12 scenarios, you will be told which of them was selected to determine your earnings. The earnings of you and the participant matched with you in that scenario are determined by the decisions you have made in Stage 2. The Table in that scenario in Stage 2 will appear on your screen again, and this time you will see both the claims you made and the claims made by the other participant. You will not be able to change your claims at this stage.

How much you earn depends on these claims. Remember the rules that determine your earnings:

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- But if any disc has been claimed by both you and the other participant, there is no agreement. In this case, you get no discs and so earn nothing from the scenario.

We will now show some examples of how these rules work.

Example 1

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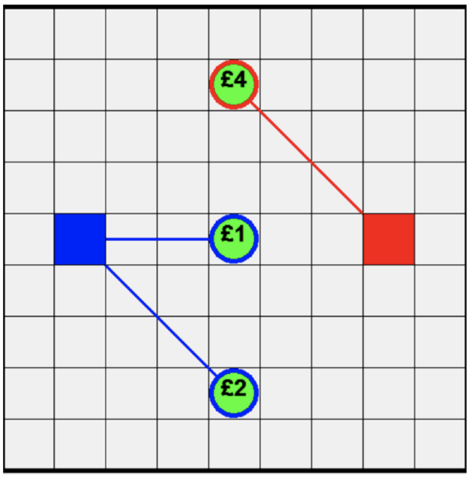
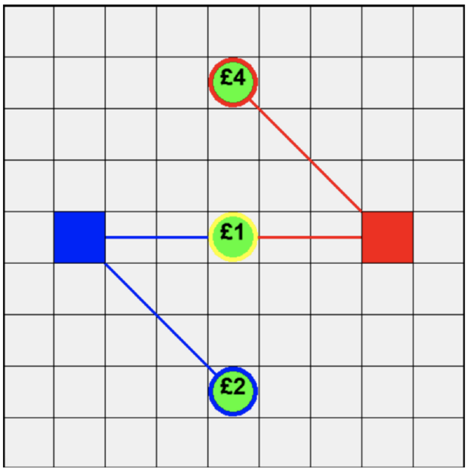


In this case, no disc has been claimed by both Red and Blue, and so there is an agreement. According to this agreement, Blue gets the £4 disc, and Red gets the £2 disc and the £1 disc. So Blue earns £4 and Red earns £3 from the Scenario.

Example 2

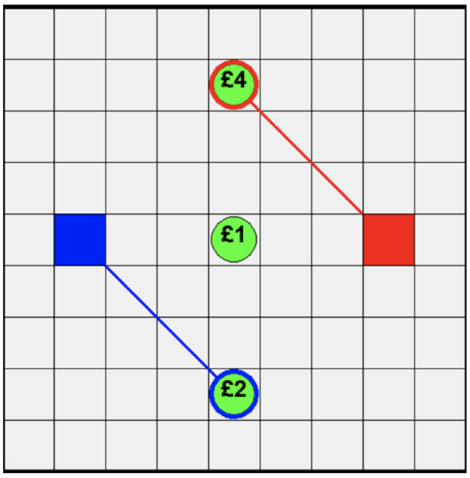
Suppose instead the claims are as now shown. The £1 disc, which is outlined in yellow on the screen, has been claimed by both Red and Blue.



In this case, because the £1 disc has been claimed by both Red and Blue, there is no agreement. So neither participant gets any discs, and so they both earn nothing from the Scenario.

Example 3

Suppose instead the claims are as now shown. Here, no one has claimed the £1 disc.



In this case, no disc has been claimed by both Red and Blue, and so there is an agreement. According to this agreement, Blue gets the £4 disc and Red gets the £2 disc. No one gets the £1 disc. So Blue earns £4 and Red earns £2 from the Scenario.

Your total earnings from the experiment will be given by the earnings from the Scenario selected for payment, as just described, plus a £5 participation payment.

Treatment JA

Introduction

This is an experiment in the economics of decision-making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory

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Everyone in the room is receiving exactly the same instructions.

You will be presented with twelve (12) different scenarios, one after the other. Each scenario consists of two (2) stages. Everyone in the room will make decisions in the same 12 scenarios. Each scenario is an interaction between two participants. For each scenario, you will be matched with another participant in the room. Each match is anonymous: You will never find out with whom you are matched in a scenario. You will not be matched with the same participant in two consecutive scenarios.

At the end of the experiment, one of the scenarios will be randomly selected to determine the earnings for the session. Because you will not know which scenario will be selected until you have made decisions in all of them, **you should treat each scenario as if it was the selected one.** So, when thinking about each scenario, remember that it could be the selected one and think about it in isolation from the others. Your total earnings for the session will be given by the earnings from the selected scenario, plus a £5 participation payment.

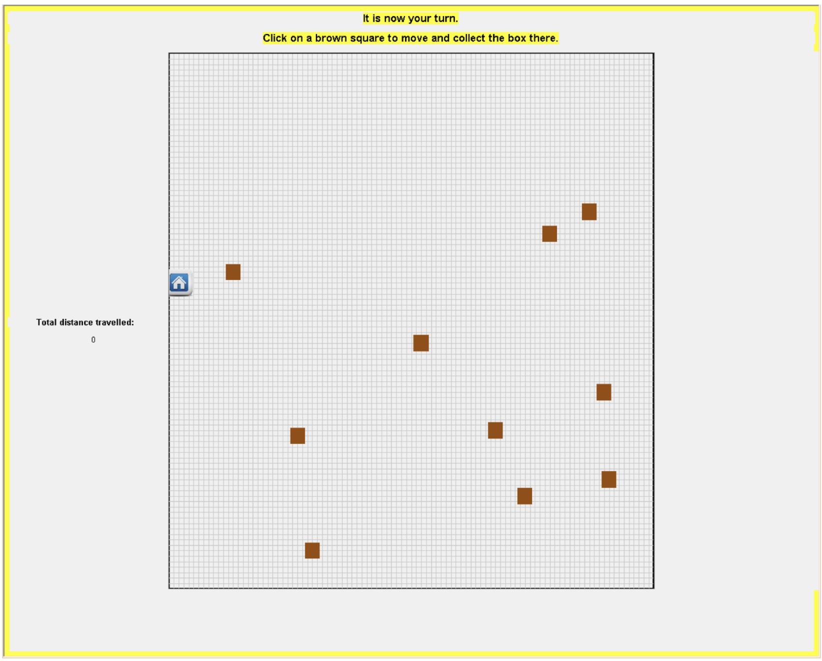
The scenario

Each scenario consists of 2 stages. At the start of the scenario, you will be matched with one other participant. You will remain matched with that participant through the whole scenario, but will be matched with a different participant in the subsequent scenario.

Stage 1

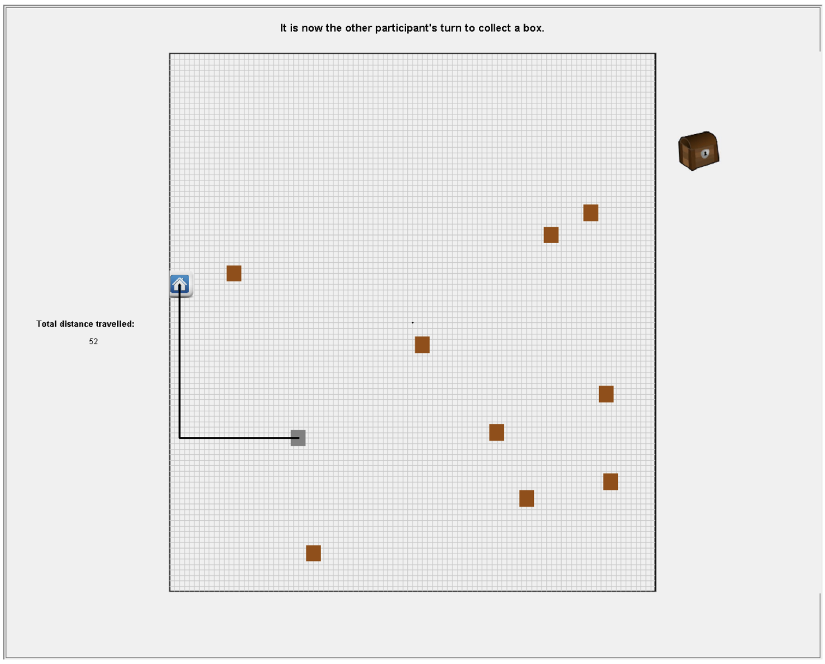
In Stage 1, you and the other participant with whom you are matched will collect ten (10) boxes. These boxes will be placed at 10 different points on a map. Each box is represented by a square. The locations of the 10 boxes will be different in each scenario.

You and the participant with whom you are matched will start from a home location, which will be indicated by a picture of a house. The two of you will move around the map collecting the boxes, and then return to the home location. Here is an example of a typical map.



The two of you will take turns deciding which box to collect next. When it is your turn, you will see the message“It is now your turn” at the top of the screen. Click on a brown square to move and collect the box located there. Each collected box appears as a picture on the right side of the screen.

After you click to collect a box, it will be the other participant’s turn. Your screen will display the message“It is now the other participant’s turn to collect a box.” as shown in this screen:



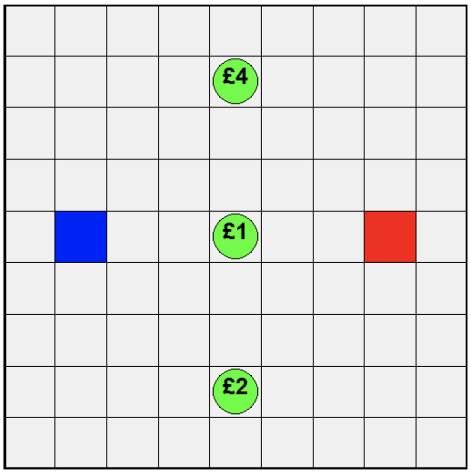
As the two of you move around the map collecting boxes, the computer will draw the path the two of you take. The locations of boxes which have already been collected will be shown as grey squares; the locations of boxes which still have to be collected will be shown as brown squares. As there are 10 boxes to be collected, you and the other participant will each collect 5 boxes.

At the left of the map, the computer will report the total distance travelled by the two of you. After Stage 2 of the scenario, you will see a ranking listing the total distance the two of you travelled, and the distances travelled by other participants in the session. The route with the shortest distance will receive the top rank. You may be able to improve your ranking by thinking ahead. The route with the shortest total distance is not necessarily the one which always moves to the next closest box. Instead, it may sometimes be useful to collect a more distant box first to set up shorter moves later on.

When all 10 boxes have been collected, you and the other participant will continue on to Stage 2.

Stage 2

Stage 2 of each scenario is represented by a picture like this on your screen.



We will call this picture a **table**. Several discs are laid out on it. Each disc is labelled with its corresponding monetary value. In this example, the 3 discs collected in Stage 1 are worth £4, £1, and £2, respectively.

You and the other participant will be either Red or Blue. The role of Red or Blue will be randomly decided by the computer. Each of you has a **base**, represented by a red square for the Red participant and a blue square for the Blue participant. You will see "YOU" on your base. Your base will keep the same colour and the same position on the table in all the scenarios you will encounter.

The basic rules

You and the other participant have the opportunity to agree on a division of the discs.

Each of you separately record which discs you propose to take. We will say that you are **claiming** those discs. You can claim as many (or as few) discs as you want. These claims determine whether there is an agreement or not.

There is an agreement if you have not claimed any of the discs that the other participant claimed, that is, if you and the other participant claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total value of these discs.

But if **any** disc has been claimed by both you and the other participant, there is no agreement. In this case, you get no discs and so earn nothing from the scenario.

You can claim a disc by clicking on it with your mouse. If you do this, a coloured line connecting the disc to your base will appear on the table. If you have claimed a disc but change your mind and decide you no longer want to claim it, you simply click on it again. The coloured line connecting it to your base then disappears.

In each scenario, you can claim as many discs as you like. You should remember that the other participant will be claiming discs too.

You will not know which discs the other participant has claimed.

When you are happy with the claims you have made in a scenario, you go on to the next scenario by pressing the CONFIRM button.

Your earnings

When you have finished all 12 scenarios, you will be told which of them was selected to determine your earnings. The earnings of you and the participant matched with you in that scenario are determined by the decisions you have made in Stage 2. The Table in that scenario in Stage 2 will appear on your screen again, and this time you will see both the claims you made and the claims made by the other participant. You will not be able to change your claims at this stage.

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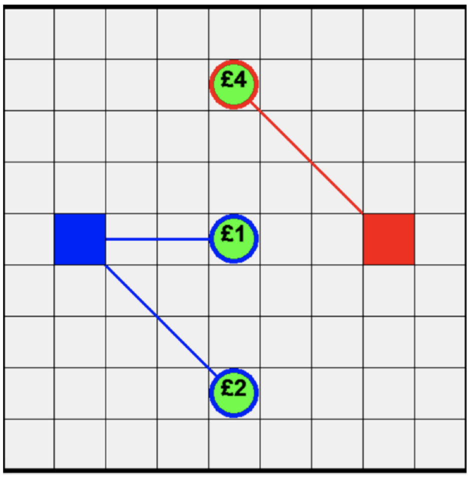

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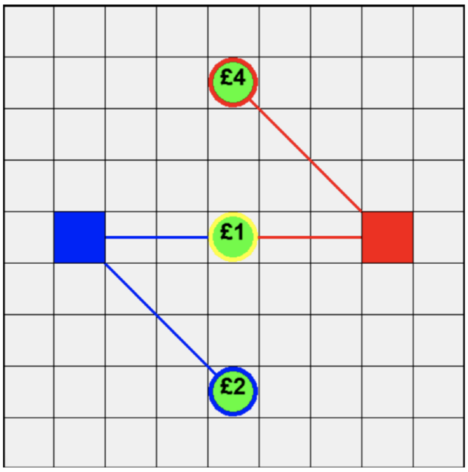

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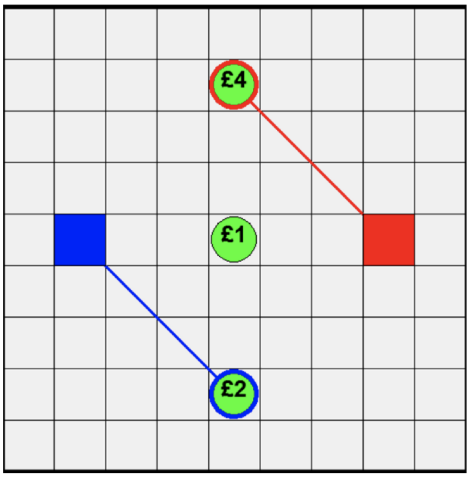

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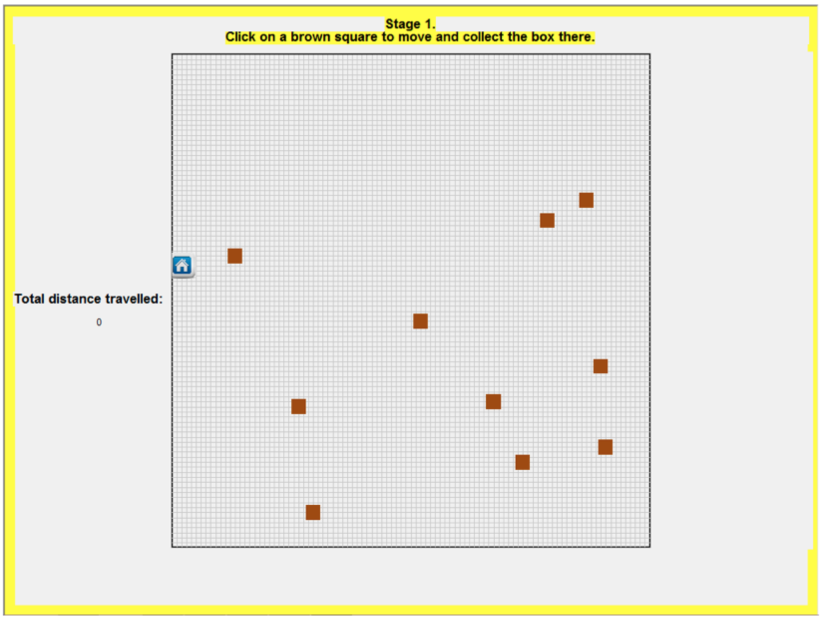

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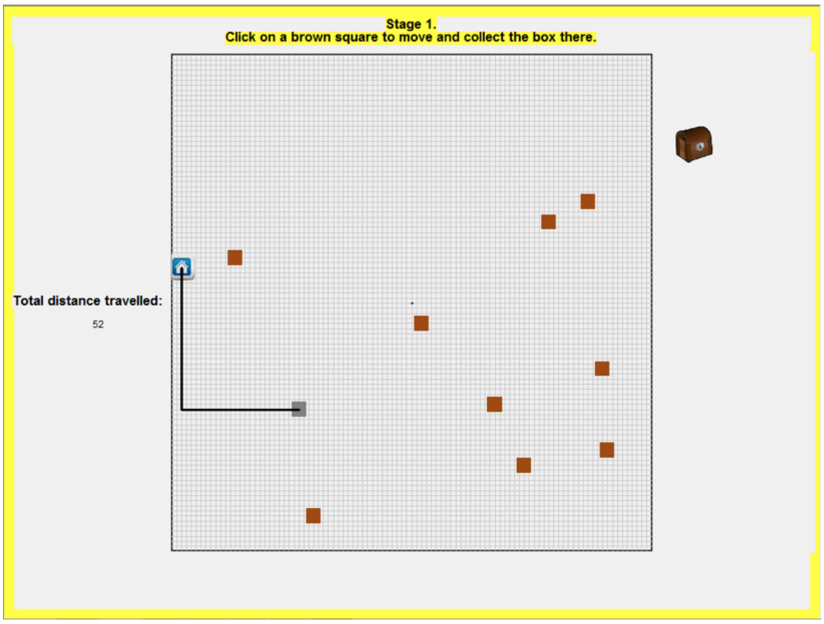

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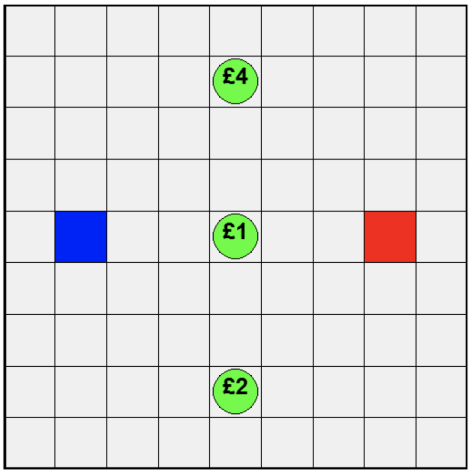

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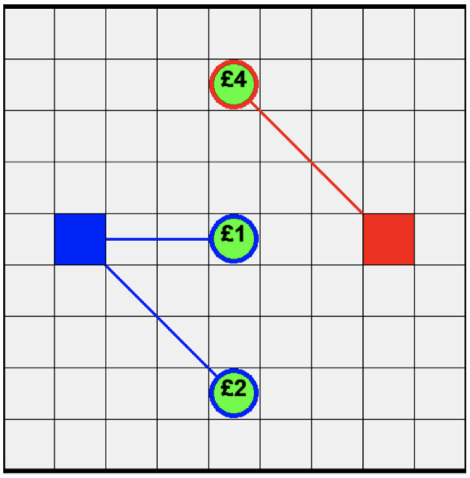

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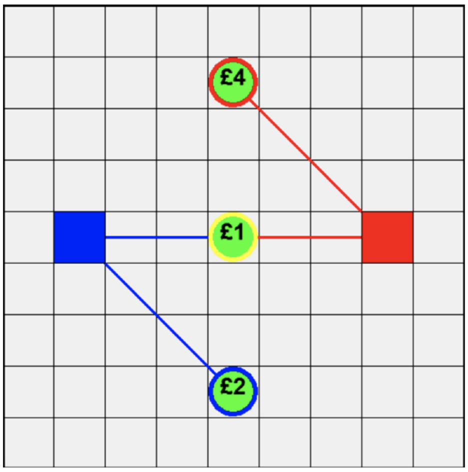

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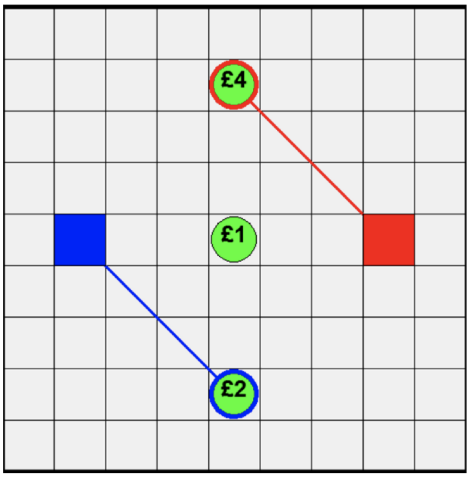

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Your total earnings from the experiment will be given by the earnings from the Scenario selected for payment, as just described, plus a £5 participation payment.

Chapter 4

Opposites do not attack: War and peace in a dynamic bargaining experiment with costly conflict

4.1 Introduction

In this paper, we report results from a dynamic bargaining experiment played in real time. The bargaining environment combines elements of tacit bargaining (Schelling, 1980; Isoni et al., 2013) and wars of attrition (Fudenberg and Tirole, 1986; Bulow and Klemperer, 1997). In our game two players have the opportunity to coordinate, possibly with the assistance of focal point cues, to share the economic surplus which is continuously realised. However at any point of time, one or both players can start costly conflict, leading to non-recoverable costs at both the individual and social levels.

Our experimental design has three essential features:

1. There is an odd number of indivisible valuable assets that can generate surplus continuously. Players bargain non-cooperatively with regarding to the division of these assets in each period. There are salient focal point cues in the game to facilitate players' coordination, while the soft leverage is not binding.

2. If players reach an agreement on the division of the assets, they will share the total economic surplus in continuous time. Within each single period, equal division of the assets is impossible.

3. Both players can initiate conflict with regarding to the possession of each of the indivisible assets, a situation we will refer to as a *war*. Wars will turn the assets into battlefield. Both players incur non-recoverable costs during wars. War can be terminated if either one of the two players exits the conflicting situation. When that happens, the remaining player starts earning surplus from that asset.

We are interested in studying dynamic bargaining games with the above features because it could help us understand the determinants of wars (competition) and peace (cooperation). In the real world, there are many bargaining situations with features as described above. In the *Airline Price War* of 1992 (Morrison et al., 1996), oligopolistic coordination broke down and all companies attempted to defeat others by lowering resale prices; eventually the whole market suffered substantial losses. During the *Chu-Han Contention* in 203 BC in China (Twitchett et al., 1978), two military parties broke the cease fire agreement, the Treaty of Hong Canal, and started to fight against each other until one capitulated. Finally, in the recent *South China Sea Disputes* (Dutton, 2011) several countries broke the peace and started disputing the ownership of an ambiguous territory among them. In these real-world situations, timing is important, with both gains and costs incurred and accumulated in real time. Although there might be various efficient divisions the bargainers could coordinate on, the presence of conflict results in an outcome which is Pareto-inferior.

There is a large literature, both theoretical and experimental, studying the factors influencing cooperation or conflict in bargaining situations. (e.g. Isoni et al., 2013, 2014; Lau and Mui, 2008; Silby et al., 2015; Cason et al., 2013; Ponsati and Sákovics, 1995) We contribute to this literature by studying the dynamics of cooperation and conflict when payoffs are realised incrementally over time.

Our design not only allows us to capture the results after the repeated interactions, but also provides a platform to examine interaction effects of personal traits on bargaining outcomes. Building on existing studies of gender effects (Cadsby et al., 2013; Eagly and Crowley, 1986; Björkqvist, 1994; Hyde, 2005) and the influence of one's Locus of Control (Rotter, 1966) on bargaining (Ryon and Gleason, 2014; Bigoness, 1976, 1978; Ford Jr, 1983; Assor and O'Quin, 1982; Wall, 1977; Bobbitt, 1967), we look at the effect of these two factors on players' bargaining outcomes. We argue that the game can reveal hidden attributes of bargaining representatives' interactions that the one-shot game could not capture.

We define cooperative behaviour, where participants do not trespass each other's assets in continuous time, as *peace*; competitive behaviour, where participants have conflict in the possession of assets for an extended period of time, as *war*. We report results about war, peace and their correlation with personal traits. In general, we find participants often engage in costly wars which results in inefficient outcomes. The presence of possible focal points does not significantly influence the efficiency of bargaining outcomes. However, it does subtly affect the distributive features of the bargaining outcomes, such as earnings differences and locations of the conflicts. Participants who find a peaceful accommodation often use turn-taking strategies to achieve approximately equal and efficient outcomes. Female participants are more likely to incur higher conflict costs than male. Pairs in which the participants have opposite Locus of Control types incur the lowest costs of conflict and therefore result in the most efficient bargaining outcomes.

Our findings contribute to the literature of dynamic bargaining games in real time. One study that can be compared with ours is Luhan et al. (2017), who report results from a real-time tacit bargaining experiment. Our experiment design differs from Luhan et al. in that participants can see the other participant's choices simultaneously on their screen. This feature in our experiment, we argue, is a more generalised representation of many real-life repeated bargaining situations. Another study that examines explicit real-time bargaining is Van Dolder et al. (2015), who use data from a television programme. Bargaining stakes are discounted 1% per second passed until three participants are able to reach an agreement. In their game, participants have to accept the unequal distribution and that is their fundamental conflict of interests; while in our design, having conflict is a subjective choice; and equal and efficient distribution is attainable by adopting certain types of strategies.

We also contribute to the literature of wars of attrition and locus on control. A war of attrition is a situation in which two players exert non-recoverable costs in continuous time in order to claim a reward. Despite its importance in economic theories (Fudenberg and Tirole, 1986; Bulow and Klemperer, 1997) as well as evolutionary biology (Riley, 1980), there are few experimental studies examining competitive behaviour in wars of attrition (existing experimental studies include market exit and all-pay auctions Oprea et al., 2013; Hörisch and Kirchkamp, 2007; Krishna and Morgan, 1997), especially from psychological personal traits aspects. Our result that pairs in which participants have opposite LOC type come into less conflict is thus worth exploring further. We argue that this finding can be attributed to the the nature of continuous repeated interaction in the game. The process of which could give rooms to reveal and react to each other's preferences and bargaining stances.

The rest of the paper is organized as follows. Section 4.2 introduces the game and relevant theoretical background. Section 4.3 explains experimental design and procedure.

Section 4.4 presents research hypotheses. Section 4.5 reports the results and Section 4.6 concludes.

4.2 The dynamic bargaining environment

4.2.1 The game

Two players, called Player A and Player B, bargain over a set of indivisible assets $\mathcal{D} = \{1, \ldots, D\}$. At each moment in time, each player $i \in \{A, B\}$ can *claim* any subset of the discs. Formally, a claim is an action $a_i \in 2^{\mathcal{D}}$, where $2^{\mathcal{D}}$ denotes the set of subsets of $\mathcal{D}$.

Players choose one claim for each of a finite number of periods $T \geq 1$, numbered $t = 1, \ldots, T$. Claims in period t are made simultaneously. At each period t, both players know the full history of claims in periods $1, \ldots, t-1$. Let $\mathcal{H}_t$ denote the set of possible histories prior to period t, and let $\mathcal{H} = \cup_{t=1}^{T} \mathcal{H}_t$ be the set of all histories. A *strategy* s_i for player i specifies an action for each possible history, $s_i : \mathcal{H} \to 2^{\mathcal{D}}$.

In our experiment, all assets are identical in terms of payoffs. Let a_A and a_B denote the actions of players A and B, respectively, at some period t. Player i receives revenue of $V_e > 0$ for each asset claimed by player i but not by player $j \neq i$, that is, $\{a_i \cap a_j^C\}$.[1] We will refer to such assets as being *possessed* by player i. Player i incurs a cost of $V_c > 0$ for each asset claimed by both players, that is, $\{a_i \cap a_j\}$; we will refer to assets in this set as being *in conflict*. Any remaining assets, $\{a_i^C \cap a_j^C\}$, result in no revenue or cost to either player; we will refer to assets in this set as being *idle*.

The overall payoff to each player is determined by the non-discounted revenues received and costs incurred across all T periods. A given pair of strategies s_A and s_B generates claims

[1] The notation S^C denotes the complement of a set S.

a_A^t and a_B^t for all periods t. Let $\alpha_t = |a_A \cap a_B^C|$ be the number of discs possessed by A at period t and likewise $\beta_t = |a_B \cap a_A^C|$ be the number of discs possessed by B at period t. Define $\gamma_t = |a_A \cap a_B|$ to be the number of discs in conflict at period t. Then the payoff to player A is

$$u_A(s_A, s_B) = \sum_{t=1}^{T} [\alpha_t(s_A, s_B)V_e - \gamma_t(s_A, s_B)V_c] \tag{4.1}$$

and the payoff to player B is

$$u_B(s_A, s_B) = \sum_{t=1}^{T} [\beta_t(s_A, s_B)V_e - \gamma_t(s_A, s_B)V_c] \tag{4.2}$$

4.2.2 Characterisation of equilibria

Proposition 1. *If $T = 1$, then in any Nash equilibrium, there is no conflict and no idleness, that is, $\gamma_1 = 0$ and $\alpha_1 + \beta_1 = D$.*

Proof. The argument is by contradiction. Because the game is one-shot, the strategy and action sets are identical, so we work with actions. Suppose first that an action profile (a_A, a_B) is a Nash equilibrium, but there is positive conflict $\gamma_1 > 0$. Consider an alternate action a'_A for player A, such that $a'_A = \{a_A \cap a_B^C\}$. That is, relative to a_A, in a'_A player A chooses not to claim assets claimed by player B. Observe that $\alpha_A(a'_A, a_B) = \alpha_A(a_A, a_B)$, while $\gamma(a'_A, a_B) = 0$. Therefore $u_A(a'_A, a_B) > u_A(a_A, a_B)$, generating a contradiction with the assumption that (a_A, a_B) forms a Nash equilibrium.

To show that there is no idleness, again, arguing by contradiction, assume an action profile (a_A, a_B) with $\gamma(a_A, a_B) = 0$ is a Nash equilibrium, but $\alpha(a_A, a_B) + \beta(a_A, a_B) < D$. This implies that the set of idle discs $a_A^C \cap a_B^C$ is nonempty. Consider an alternate action a''_A for player A, such that $a''_A = \{a_A \cup (a_A^C \cap a_B^C)\}$. Observe that $\alpha_A(a''_A, a_B) > \alpha_A(a_A, a_B)$ while $\gamma(a_A, a_B) = \gamma(a''_A, a_B) = 0$. Therefore $u_A(a''_A, a_B) > u_A(a_A, a_B)$, generating a contraction with the assumption that (a_A, a_B) forms a Nash equilibrium. $\square$

Proposition 2. *If $T = 1$, then any (pure) action profile (a_A, a_B) with $\gamma(a_A, a_B) = 0$ and $\alpha(a_A, a_B) + \beta(a_A, a_B) = D$ is a Nash equilibrium.*

Proof. To prove this, we will show that for all other actions a'_A, player A must have lower utility, that is player A has no incentive to deviate from a_A (similar with player B):

$$u_A(a_A, a_B) > u_A(a'_A, a_B) \tag{4.3}$$

First, in cases where $a'_A \cap a^C_A \neq \emptyset$, i.e. $a'_A \cap a_B \neq \emptyset$ ($\because a^C_A = a_B$). $\Rightarrow \gamma(a'_A, a_B) \equiv |a'_A \cap a_B| > 0$. On the other hand, $\alpha(a'_A, a_B) \equiv |a'_A \cap a^C_B| = |a'_A \cap a_A| \leqslant |a_A| \equiv \alpha(a_A, a_B)$; Both two factors resulting that: $u_A(a'_A, a_B) < u_A(a_A, a_B)$.

Second, in cases where $a'^C_A \cap a_A \neq \emptyset$, i.e. $\exists x$: $x \subset a_A$ & $x \not\subset a'_A$. $\Rightarrow (a'_A \cap a_A) \subset a_A$ $\Rightarrow (a'_A \cap a^C_B) \subset a_A$ ($\because a^C_B = a_A$). By definition: $\alpha(a'_A, a_B) \equiv |a'_A \cap a^C_B| < |a_A| \equiv \alpha(a_A, a_B)$. On the other hand, $\gamma(a'_A, a_B) \equiv |a'_A \cap a_B| \geqslant 0$ while, $\gamma(a_A, a_B) = 0$. As a result, $u_A(a'_A, a_B) < u_A(a_A, a_B)$, as desired. $\square$

Turning now to the case of the repeated game with $T > 1$, we show that both peace and war can be sustained in subgame perfect Nash equilibria.

Proposition 3. *Let $T > 1$, and let (s_A, s_B) be a pair of strategies such that, for each $t = 1, \ldots, T$, α_t and β_t are constant for all $h_t \in \mathcal{H}_t$, with $\alpha_t + \beta_t = D$, and $\gamma_t = 0$. Then, (s_A, s_B) is a subgame perfect Nash equilibrium.*

Proof. In any finitely-repeated game, it is always a subgame perfect Nash equilibrium to play a Nash equilibrium of the stage game at each time t, where the stage-game equilibrium at time t can depend on t but does not depend on the specific history played up to t. $\square$

Proposition 4. *Let $T > 1$. Then there exists a subgame perfect equilibrium with $\gamma_t > 0$ for all $t = 1, \ldots, T-1$ along the equilibrium path of play.*

Proof. See Appendix 4.7. □

Unlike the one-shot game, the repeated game has subgame perfect Nash equilibria both without conflict and with conflict. This sets our game apart from wars of attrition, as the decision to engage in costly conflict is endogenous and not imposed in the structure of the game. This equilibrium selection issue makes this an interesting game to study experimentally.

4.3 Experimental design and procedure

4.3.1 Experimental design

For our experiment, we set $T = 100$ and $D = 9$.[2] We choose $V_c = V_e = 2$ pence. Setting the benefit of ownership of an asset equal to the cost of conflict on that asset simplifies the mental arithmetic for earnings calculations for the participants.[3] Each period lasts approximately one second, and was referred to as a *tick*. In real time, therefore, a round of the bargaining game lasted just over 100 seconds.

Our presentation of the bargaining environment extends the bargaining table design of Isoni et al.. The assets are represented as discs laid out on a 11×9 grid. We divide the table into three distinct zones, as seen in Figure 4.1. Each participant each has a base. The base of the participant is always on the left, shown in blue, and labeled with the word "YOU." The base of the other player is always on the right, and shown in red.[4]

[2]We set D as an odd number so that in stage game, equal and efficient outcomes cannot be achieved.
[3]We were influenced by the results in Chapter 2 of this dissertation in making this choice.
[4]Therefore, the two participants in a game saw the same bargaining table, but rotated through 180 degrees.

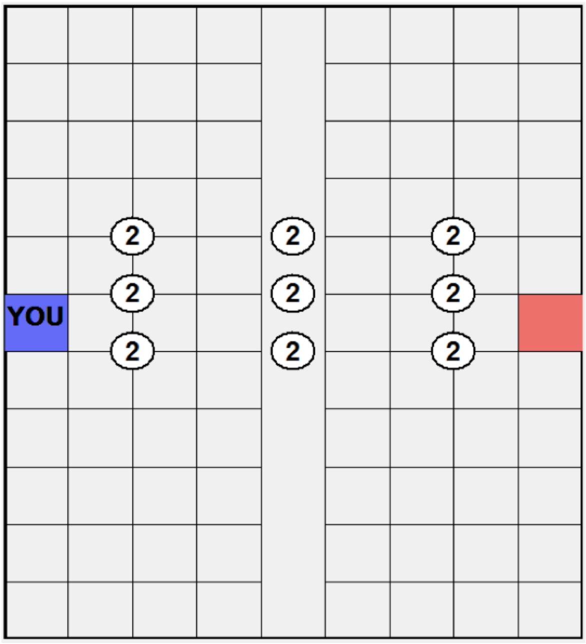


Figure 4.1: An example of a bargaining table.

The square on the of left zone is in blue, this represents own base; the square on the right zone is in red, this represents other's base.

The central column of the table lacks horizontal grid lines. This suggests a division of the table into three "zones," one corresponding to each player, and a central zone. We will refer to the zone closest to the base of Player A as *Zone A*, the zone closest to the base of Player B as *Zone B*, and the central column as *Zone C*. The nine discs are laid out across the three zones. We used the three columns shown in the Figure, varying only the vertical location of discs. Denote the number of discs in Zone A as D_A, number of discs in Zone B as D_B, and the number of discs in Zone C as D_C. By convention, in all scenarios $D_A \geqslant D_B$. When $D_A > D_B$ we refer to Player A as the *favoured* player, insofar as the focal cue of closeness places more discs close to the base of Player A than to the base of Player B.

Our experiment employs a within-treatment design based on two dimensions of the scenarios: *Imbalance* and *Central*. *Imbalance* is defined as $D_A - D_B$, and captures the degree of

Table 4.1: All scenarios in the experiment.

	Imbalance							
Central	0	1	2	3	4	5	6	7
0		S(1,0)		S(3,0)		S(5,0)		S(7,0)
1	S(0,1)		S(2,1)		S(4,1)		S(6,1)	
2		S(1,2)		S(3,2)		S(5,2)		
3	S(0,3)		S(2,3)		S(4,3)			
4		S(1,4)		S(3,4)				
5	S(0,5)		S(2,5)					
6		S(1,6)						
7	S(0,7)							

All scenarios are represented by two dimensions: *Imbalance* (I) and *Central* (C) and denoted $S(I, C)$. The horizontal axis of the table varies in *Imbalance* levels and the vertical axis varies in *Central* levels. There are 20 scenarios in total.

the asymmetry in the allocation of discs based on the cue of closeness. The existing literature (see Mehta et al., 1994; Crawford et al., 2008; Isoni et al., 2013, 2014, for examples) shows that the power of a cue such as closeness will decline as the asymmetry in the allocations suggested by the cue becomes increasingly unequal. *Central* is defined as D_C. Discs in Zone C are equidistant to the participants' bases, and so closeness does not suggest any allocation of these discs on its own.

There are 20 possible layouts of the discs that satisfy the constraints that $D_A \geq D_B > 0$ and $D_A + D_B + D_C = 9$. These scenarios are organised in Table 4.1.

4.3.2 Experimental procedure

The experiment was conducted in the laboratory of the Centre for Behavioural and Experimental Social Science (CBESS) at the University of East Anglia. Participants were recruited from the lab's standing pool of participants, which is managed using the hRoot system. (Bock et al., 2014) Sessions were conducted in February and March 2017. There were four sessions, each with 24 participants. Sessions lasted from 60 to 75 minutes. Average earnings (including a £9 participation payment fee) were approximately £16. All tasks in the experiment were computerized using zTree (Fischbacher, 2007).

Upon arrival, participants drew a ball from a set of 24 numbered balls to randomize their seat numbers. In each of participant's desk, there was a hard copy of instructions and a computer terminal. The instructions were read out loud by an experimenter (same experimenter for all sessions) and at the same time they appeared on each participant's screen. In one screen-shot of the instruction, participants could practice how to claim and cancel claims using an example. After the instructions, there were 4 practice questions (see Appendices C in Section 4.7 for details) to ensure participants' understanding of the instructions.

Participants were matched only once with another 20 participants in the session. Each scenario lasted around 100 seconds (referred to as *ticks* in the instructions), and before the start of one scenario there was an opening screen lasted for 8 seconds (see the screenshot in Figure 4.2) to facilitate participants' preparation for the countdown. The other purpose of the opening screen was to remind participants that they would be matched with a different participant in each of these scenarios. For each scenario participants were assigned randomly to the Player A or Player B roles.

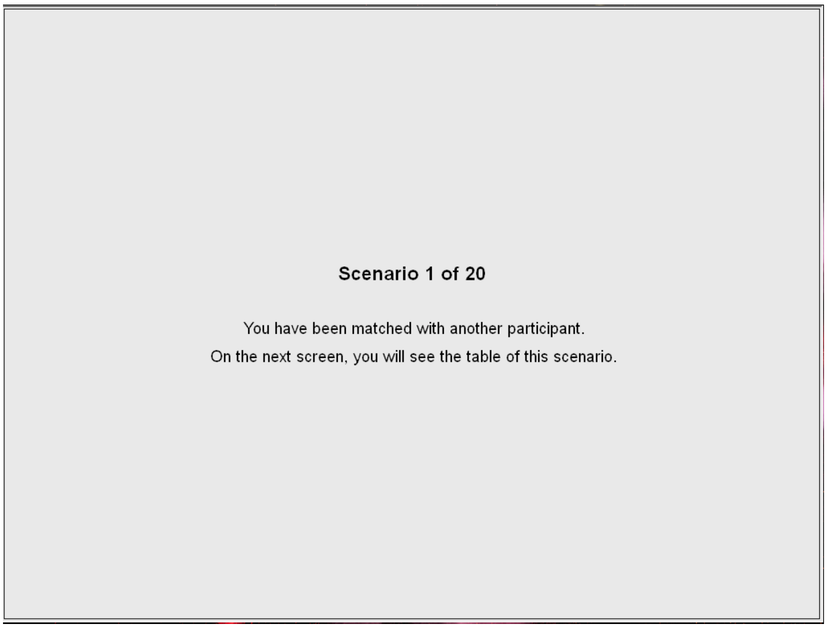


Figure 4.2: Screenshot of the opening screen

An example of a scenario in progress can be seen in Figure 4.3. As the scenario started, the timer on the left side of the screen began to count, approximately one tick per second. Participants could then make claims by clicking on the disc(s) they would like to claim. When a participant clicked on a previously-unclaimed disc, a blue flag appeared on the disc; this flag indicated the participant's own claim. As the other participant also claimed discs, the other participant's claims were indicated by red flags on the claimed discs. A claim on a disc could be canceled at any time by clicking again on the claimed disc. Whenever either participant made any change to their claims, the screen was updated immediately and simultaneously for both participants.

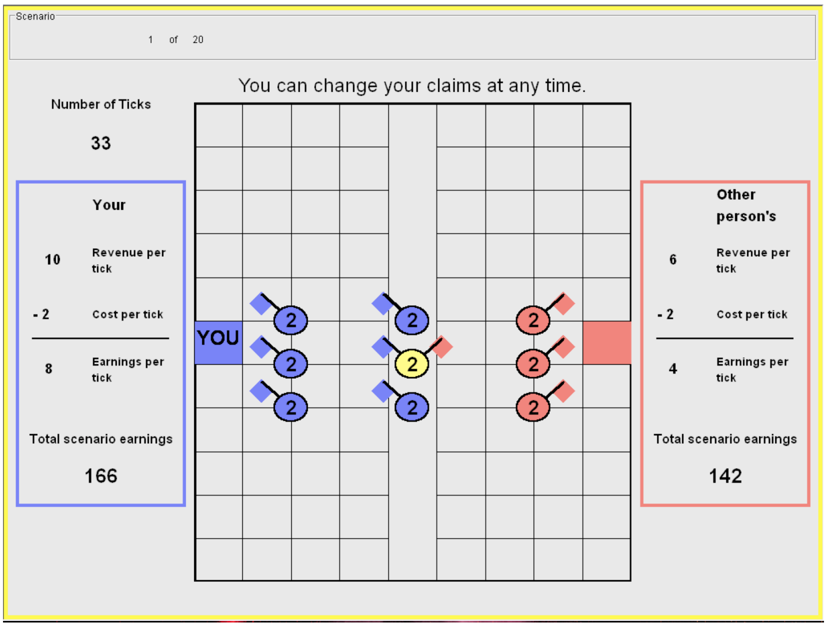


Figure 4.3: Screenshot of a scenario in the experiment.

Numbers of Ticks indicates the time elapsed in the scenario. The left base was coloured blue, and all discs with flag pointing to the left base were coloured blue; these represented the claims of the participant. The right base was coloured red, and all discs with flag pointing to the right base were coloured red; these represented the claims of the other player. The disc with two flags was coloured yellow, indicating a conflict as both participants claimed it. The earnings summary on the left side of the screen was outlined by a blue square; the earnings summary on the right side of the screen was outlined by a red square.

Discs were coloured to indicate ownership status. Blue discs were discs claimed only by the participant, and therefore the participant earned 2p per tick from each blue disc. Red discs were discs claimed only by the other participant, the other participant earned 2p per tick from each red disc. We refer to these discs as being *possessed* by the participant. Discs claimed by both participants were coloured yellow. These indicated conflict, and each participant incurred a cost of 2p per tick from each yellow disc. The cumulative earnings were displayed in boxes alongside the bargaining table. At the end of the 100th tick, participants saw a summary screen (Figure 4.4) for around 8 seconds, showing the total earnings from the scenario for both players.

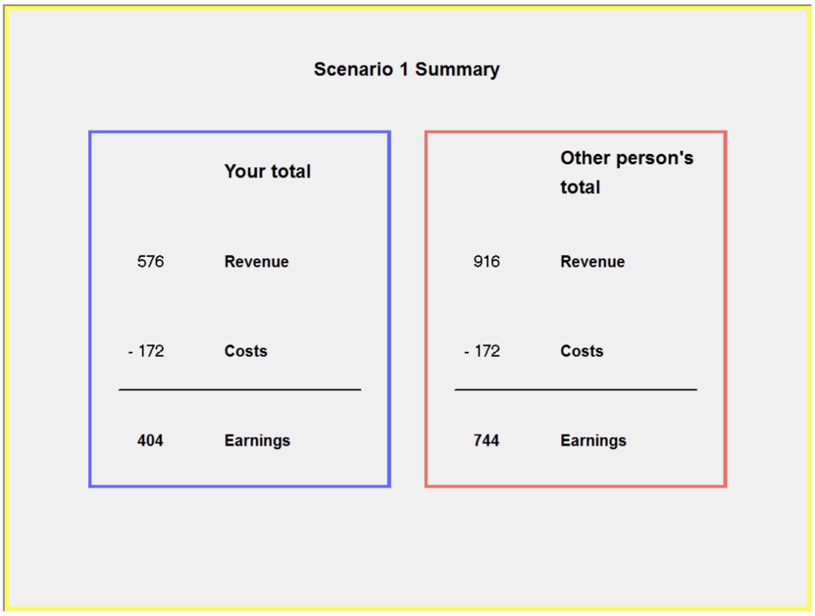


Figure 4.4: Screenshot of summary screen for earnings.

The square on the left was outlined in blue, represented own earnings; The square on the right was outlined red, represented the other participant's earnings.

Participants played different scenarios, in the same order within a session. The order for each session was generated randomly by computer. After participants finished all 20 scenarios, they answered a standard demographic questionnaire, including questions on gender, age, school of study, university status and past experience with CBESS experiments. In addition, they completed an inventory of 13 questions used to assess their locus of control. (See Appendix C for full details.)

4.4 Research hypotheses

Our predictions focus on four aspects:

1. How often do participants engage in wars?

2. What are the factors which make wars more likely, and how long or intense are wars?
3. When peaceful outcomes occur, how are they negotiated or sustained?
4. Do the personal attributes (gender and locus of control) of the players predict the outcomes of bargaining?

4.4.1 War or peace

At each tick, two participants have an opportunity to agree on the division of 9 discs. Discs claimed simultaneously by both players result in conflict costs incurred by both participants. We define a situation in which one or more discs are being claimed by both participants as a *war*. When such a situation arises, it is analogous to a war of attrition; each participant has the option of removing their claim on the disc, but if they do so they in effect concede it to the other participant.

Because in our game there are subgame perfect equilibria both with and without conflict on the equilibrium path, conflict is not inevitable. This distinguishes our game from war of attrition experiments (e.g. Oprea et al., 2013; Bilodeau et al., 2004) which impose conflict as the initial state. An experiment that has a similar feature of voluntary entry is Phillips and Mason (1997). They examine a repeated duopoly market game where participants choose quantities to produce with varying fixed costs. They report a high level of competitive behaviour of participants entering price wars. Other experimental settings such as all-pay auctions (Hörisch and Kirchkamp, 2010; Gelder and Kovenock, 2017), rent-seeking contests (Mago et al., 2013; Deck and Kimbrough, 2015) and market exit (Oprea et al., 2013), almost all report participants tend to engage in conflict to a greater degree than predicted by equilibrium baselines.[5]

[5] See e.g. Kimbrough et al. (2017) for a review.

The large number of subgame perfect equilibria make this game an interesting one for an experiment, because it is not a priori clear what equilibrium or equilibria will be selected. However, based on the results of laboratory experiments on games with conflict aspects, we predict socially-costly conflict will occur frequently.

Hypothesis 1. *Participants will start and persist in pursuing wars.*

4.4.2 Focality and Wars

To examine participants' competitive behaviour, we look at the amount of resources wasted during fighting. Our prediction of *size of war* focus on existing focal point cues in the games.

It is now well-established that focal point cues can facilitate participants' coordination in bargaining games (Isoni et al., 2013; Crawford et al., 2008; Isoni et al., 2014). Thus we predict that the absence of a focal point cue, or the decrease in the power of the focal point cue, will result in more conflict, as the coordination suggested by the focal point will be less effective.

As *Imbalance* increases, the allocation based on focal point cues becomes increasing unequal, based on existing literatures (Isoni et al., 2013; Crawford et al., 2008; Bardsley et al., 2010a), the power of focal point cues will be deceased.

Hypothesis 2 *The frequency and size of wars will be increasing in Imbalance, ceteris paribus.*

As *Central* increases, the proportion of discs for which the focal point cue does not suggest an allocation increases. Therefore, the overall power of focal point cues in the bargaining table will be decreased. For example, in the extreme case where *Central* $= D$, all of the discs are located in Zone C, equidistant from both bases, and therefore the discs' location does not suggest an allocation.

Hypothesis 3 *The frequency and size of wars will be increasing in Central, ceteris paribus.*

4.4.3 Peace

In our experiment, both war and peace are consistent with subgame perfect equilibrium. In a situation in which participants (tacitly) agree to avoid conflict, the game has similarities to a coordination game. Based on studies of tacit and explicit bargaining games with the existence of focal point cues (Mehta et al., 1994; Bardsley et al., 2010a; Isoni et al., 2013, 2014), we predict that participants will tend to claim discs from their own zone but not from the other participant's zone; showing an *own side effect*.

Hypothesis 4 *Participants will tend to claim discs in their own zone more often than discs in the other participant's zone.*

In previous studies, "turn-taking" strategies are found to be used in repeated battle of the sexes games as a device for mitigating conflict and enhancing coordination (Lau and Mui, 2008, 2012). The intuition under the turn-taking equilibrium is to allow participants to take turns holding the higher valued assets for an extend periods of time, as a result resolving the conflict of getting unequal payoffs at any moment in time. Based on existing studies of repeated coordination games (e.g. Bhaskar, 2000; Mailath and Samuelson, 2006; Lau and Mui, 2008; Silby et al., 2015; Luhan et al., 2017), we predict that participants will adopt turn-taking strategy or other coordination devices in order to achieve equal and efficient payoff allocations.

Hypothesis 5 *When the interaction is peaceful, this will be sustained by the use of devices such as turn-taking, to achieve allocations which are both equal and efficient.*

4.4.4 Individual traits and bargaining behaviour

In Hypotheses 1 to 5, we examined participants' competitiveness and cooperativeness behaviour across scenarios. In this section we examine whether such behaviour is homogeneous across individual traits (gender and LOC).

It is found that in most contest games (Cadsby et al., 2013; Chowdhury et al., 2016) or in non-physical conflict situations (Björkqvist, 1994; Hyde, 2005) that females exert higher efforts than male counterparts. Nevertheless the evidence on competitiveness between genders is still mixed (See Eagly and Crowley, 1986, for a review of gender and cooperative behaviours).

Hypothesis 6 *Costs of conflict in all scenarios is not significantly different between male and female.*

Locus of control (LOC) is predicted to affect individuals' attitudes towards bargaining and conflict. Rotter's locus of control scale is a widely used psychology concept that specified one's perception of causality. An individual with *internal locus of control* (an "internal") perceives himself in control of events affecting him. On the other hand, an individual with *external locus of control* (an "external") believe that events that influence his life are predominantly determined by chance or other factors beyond his control. Economists have demonstrated that an individual's LOC can have a significant influence on his bargaining stances (e.g. Lefcourt, 1972, 2014; Assor and O'Quin, 1982; Cupach et al., 2009).

Existing studies of individual locus of control and bargaining behaviours (e.g. Bobbitt, 1967; Wall, 1977) have shown that when participants are exposed to a competitive stance, internals bargain more cooperatively (concede more) than do externals. However, when participants encountering a cooperative bargaining stances, internals bargain more competitive than do externals.

The reasoning underlying the predictions is that, in competitive situations, internals, who believe they can significantly influence their outcomes by their own behaviour, will try to cooperate in an attempt to induce the other participants to cooperate. However, when facing cooperative bargaining situations, internals will bargain more competitively in an attempt to exploit (gain higher payoffs than) the other player.

Following the logic above, pairs that are most likely to suffering from war of attritions (costly conflict) are those where both participants are externals. The logic is that in this experiment, staying in wars incurs substantial costs, therefore participants who have an internal LOC will make an effort to avoid the conflicting situation in an attempt to increase own earnings and induce the other participant to cooperate. However, participants with external LOC, who believe their outcomes depend on factors other than own behaviour, will stay inactive in cases when wars happen.

Hypothesis 7 *Pairs in which neither participant has an internal local of control will incur higher costs of conflict.*

4.5 Results

4.5.1 Overview

At any time t, each asset can be in one of four states: claimed by both participants; claimed by participant A only; claimed by participant B only; and claimed by neither participant. The bargaining outcome is measured based on these four states.

Figure 4.5 shows the proportion of pairs who have no conflict, exactly 1 disc in conflict, and 2 or more discs in conflict, across all 20 scenarios at each tick. The horizontal axis presents the number of tick (from first tick to 100th tick), and the vertical axis presents proportion of pairs in all scenarios (48 pairs $\times$ 20 scenario). Across all ticks, the majority of observations do not have any discs in conflict. The proportion of pairs who have no discs in conflict has a spike in the beginning few ticks due to initial claims and conflict resolution, then has a steady increasing trend until the 50^{th} tick. At the 50^{th} tick, there is a steep decrease for a very short period of ticks, after which the consistent increasing trend restarts until the end of the game. The change of proportion in cases of 1 disc almost mirrors that of no discs but in the opposite direction. We see around 10% of pairs switching from no conflict to 1 disc in conflict at the 50^{th} tick. The proportion of pairs who have 2 or more discs in conflict is relatively constant, with only a slightly decreasing trend across the 100 ticks.

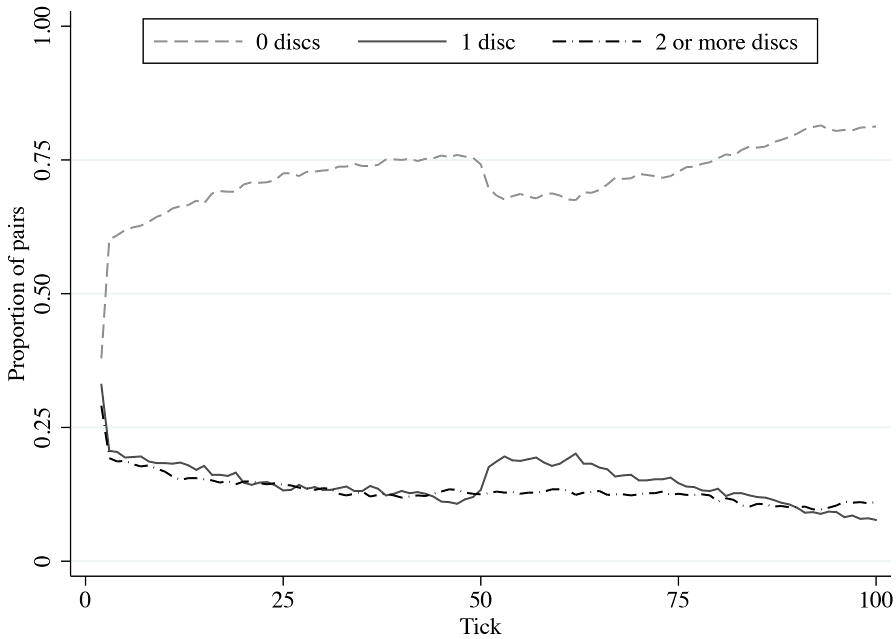


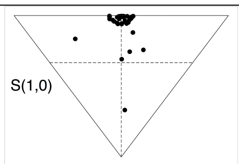
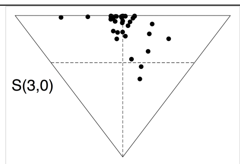
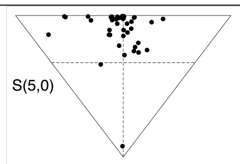
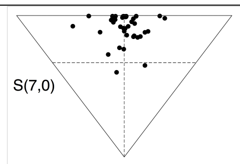
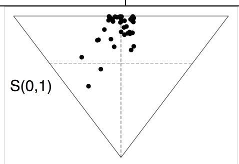
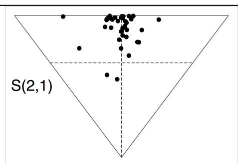
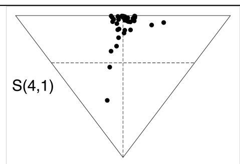
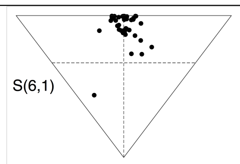
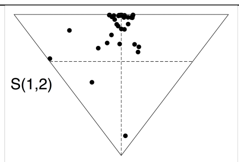
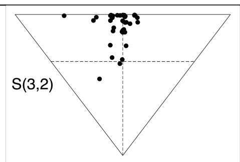
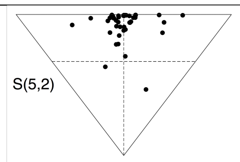
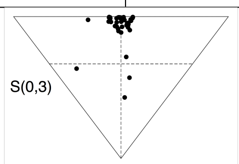
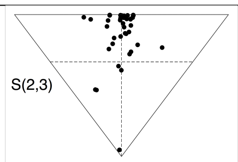
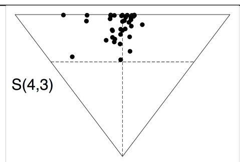
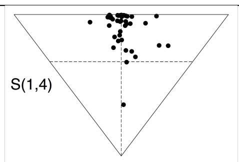
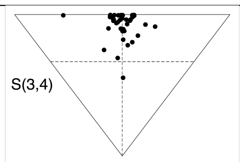
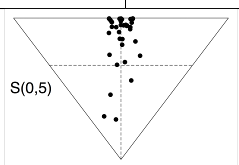
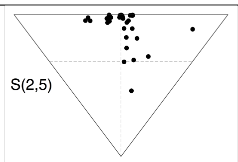
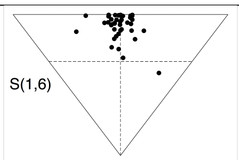
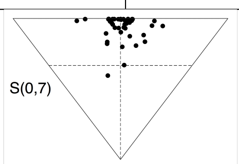
Figure 4.5: Average conflict over time

The proportion of pairs that have no conflict, 1 disc in conflict and 2 or more discs in conflict over 100 ticks.

Table 4.2 reports an overview of average participants' earnings at the end of the 100^{th}

tick in each scenario. The table is organized by *Imbalance* for horizontal axis and *Central* for vertical axis. Each sub-figure represents one scenario, and each dot is the final earnings of a pair of participants (48 dots per scenario). In each sub-figure, horizontal axis represents the difference in earnings between the participants ($\pi_A - \pi_B$) and vertical axis represents total earnings in a pair ($\pi_A + \pi_B$). The triangle represents the possible outcomes. We present three outcome measures within a sub-figure. First is the Efficiency Possibility Frontier (EPF), represented by the top horizontal line of the triangle. The closer a dot is to the EPF, the more efficient is the pairs' bargaining outcome. For example, if the total earnings of a pair is $1800p$, then the pair would stay on the EPF. Second is the *Equality* reference line, which is the dashed vertical line within the triangle. Distances to the Equality reference line measure earnings difference at the end of 100 ticks. Dots located at the left correspond to higher earnings for participant B; dots located at the right correspond to higher earnings for participant A. Dots on the reference line correspond to equal earnings. For example, at the intersection of the EPF and the Equality Reference line are the pairs who get equal and efficient bargaining outcomes (each get £9). Third is the *Zero Total Earnings* reference line, represented by the dashed horizontal line within the triangle. Dots below this line correspond to negative total earnings ($\pi_A + \pi_B < 0$). For example in scenario $S(4, 3)$, there is a dot laid on the Zero Total Earnings reference line and intersect with the Equality Reference line, which means both participants' earnings were £0, which is equal but (very) inefficient. Overall, in most of the scenarios, there is a clustering at the intersection of the EPF and the Equality reference line, showing a preference for equal and efficient outcomes.

Table 4.2: Earnings distribution of all pairs across scenarios.

	Imbalance							
Central	0	1	2	3	4	5	6	7
0								
1								
2								
3								
4								
5								
6								
7								

4.5.2 Competitive behaviour in games

Result 1 *Most bargaining pairs incur at least some costs of conflict during the 100 ticks. Average costs of conflict is 124 across all scenarios, causing significant efficiency loss. This generally supports* ***Hypothesis 1****.*

Support (a). Efficient SPE predicts that each disc is claimed by exactly one participants at each tick, that is the average earnings for all participants should be $900p$ ($£\ 9$). In our experiment, participants' average earnings is $698.8p$, showing a substantial efficient loss. Inefficiency can come from two sources, costs of conflict and idleness. First we look at the costs. Figure 4.6 shows the distribution of overall costs of conflict during 100 ticks. In total there are 20×48 observations, it can be seen that that costs of conflict is a very skewed to the left (P-value from skewness test<0.0001[6]). The highest 10% costs of observations have costs ranging from 384 to 1684. In total, 16.6% pairs' decisions have absolutely no conflict throughout the 100 ticks. The mean is at 124 (median is 32). The total conflict costs are measured in two forms: 1) forgone opportunities, as the fruitful assets become unable to reproduce due to conflict; 2) attrition of resources devoted to war (based on Hirshleifer, 1991). In our experiments, the average total conflict costs are 124×3.[7] Compared with total potential gains ($1800p$), 20.7% of the resources are wasted due to conflict.

Table 4.3 presents the breakdowns of costs of conflict measures in each scenario. We report three outcome variables: the percentage of pairs that have positive costs of conflict, average costs and median costs of conflict in each scenario. All scenarios are arranged by their corresponding *Central* and *Imbalance*. In general, we cannot observe any systematic differences across scenarios.

[6]Skewness test here implement the test as described by D'agostino et al. with the adjustment made by Royston

[7]The total efficiency loss is calculated from adding up forgone opportunity costs (124) and attrition costs (124×2 participants).

Table 4.3: War rate, Costs of conflict summary across scenarios.

	Imbalance							
Central	0	1	2	3	4	5	6	7
0		87.5% 87.6 (14)		77.1% 100 (12)		77.1% 150 (24)		87.5% 122.6 (31)
1	75% 126.5 (28)		77.1% 130.3 (42)		87.5% 96.8 (21)		89.6% 119.6 (44)	
2		81.2% 142.1 (22)		70.8% 108.7 (12)		87.5% 113.5 (40)		
3	83.3% 104.5 (34)		85.4% 201.7 (52)		85.4% 113.1 (33)			
4		87.5% 145.1 (35)		83.3% 111.5 (47)				
5	87.5% 185.6 (43)		83.3% 103.1 (23)					
6		87.5% 122 (73)						
7	87.5% 102.4 (43)							

The percentage number in each cell represents the proportion of pairs who have positive costs of conflict within 100 ticks. The number under the percentage is the average costs across all 48 pairs. The number in the parenthesis is the median of costs of conflict across 48 pairs.

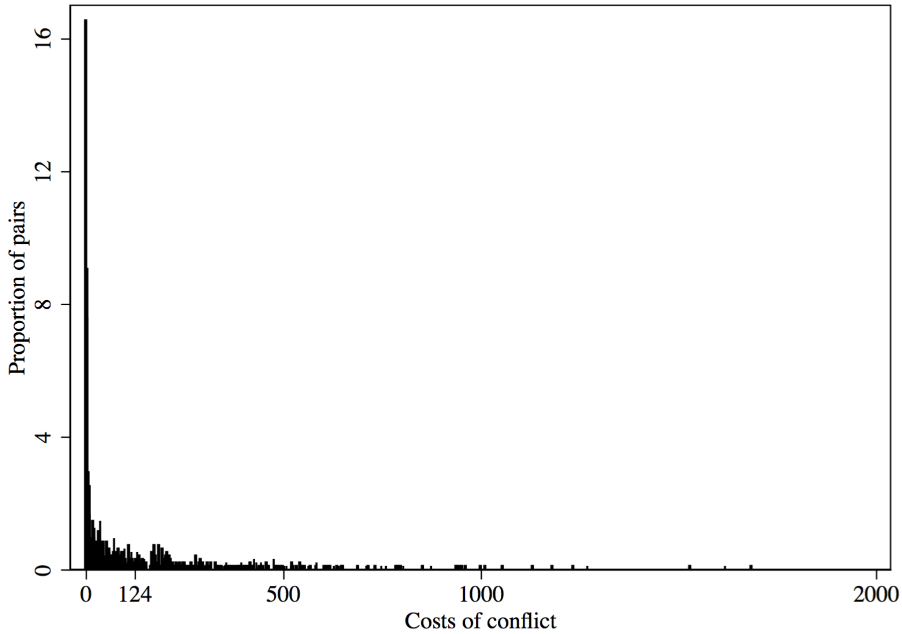


Figure 4.6: Distribution of accumulated costs of conflict at the end of the 100^{th} tick.

□

Support (b). Another source of inefficiency comes from idleness. Our results show that some discs were unclaimed by both participants for a non-negligible amount of ticks. Some participants systematically maintained idle discs and had lower costs of conflict than average.

Table 4.7 presents the proportion of idleness in all pairs across all scenarios at each tick. It can be seen from the table that the first few ticks have high initial idleness and drop dramatically to a relatively low level, showing participants' initial claims. After the initial claims, total idlenesses maintain at a relative low level (around 5%) with a small spike at the 50^{th} tick.

Overall, proportion of idleness constitutes very small percentage of all discs in the table. Excluding idleness from initial claims, the average proportion of idleness (in total value) in terms of available assets across 100 ticks is 0.04%. This finding is consistent with previous

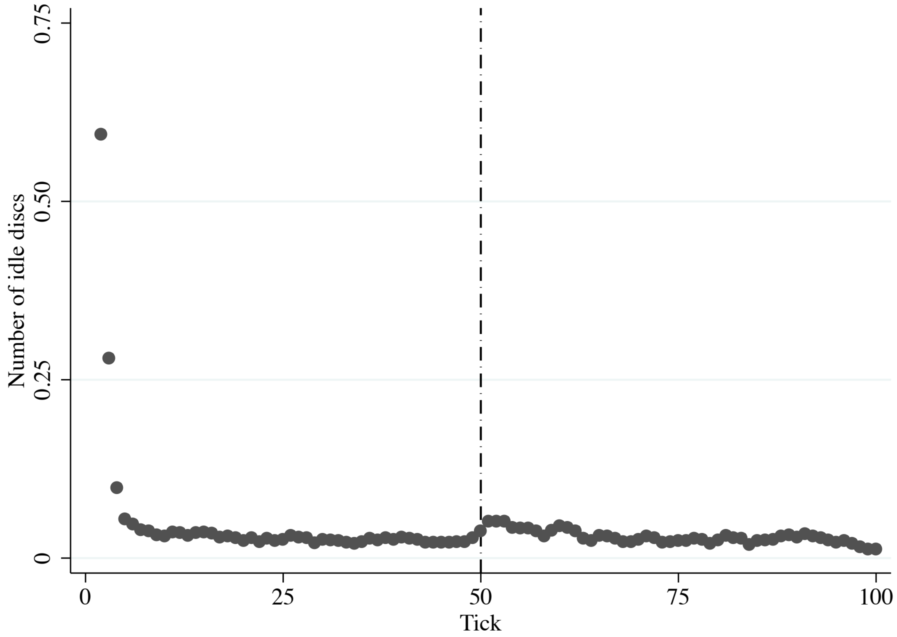


Figure 4.7: Average idleness over time

The proportion of discs as a percentage of all discs (9 discs) that no one claimed (idleness) over the 100 ticks.

studies using the bargaining table (Isoni et al., 2013), in which the situation of a disc going entirely unclaimed is rare.

In addition, we find that around 2% (21 observations) of all choices have consistently maintained idleness above 5% (ranging from 5% to 17%) of total assets in 100 ticks.[8] We propose that these pairs maintain consistent idleness to avoid higher costs of conflict. The average costs of conflict among these pairs (35.0) are much lower than the average of other pairs (126.3). Earnings difference, on the other hand, do not have large difference. □

[8]We use 5% as a benchmark to examine non-negligible idleness. 5% of total assets can be that idleness of 1 disc for 45 ticks; or idleness of more than 1 discs for less than 45 ticks. The findings are similar is we set the standard above 5% or slightly below 5%.

Result 2. *The layout of the discs (Central and Imbalance) has little influence on magnitude of the costs of conflict. These findings reject **Hypothesis 2** and **Hypothesis 3**. However the layout has significant influence on distributive outcomes of the bargaining.*

Support. To examine the influence of *Central* and *Imbalance* on competitive behaviour, we first check whether participants' costs of conflict differ across scenarios. It can be seen from Table 4.3 that the average costs of conflict do not have consistent correlation with *Central* or *Imbalance*. For a robustness check, we use a panel data regression with random individual effect, and to control for interactions within a session, robust standard errors are clustered at session level (see in Appendices C Table 4.10). The results shown that overall, *Central* and *Imbalance* do not have significant influence on costs. While after putting restriction of *Central* $= 0$, *Imbalance* has a weakly positive significant (at 10%) influence on costs. Therefore, layout of the discs do not have significant influence on the efficiency of bargaining outcomes.

However, the layout of the discs has significant impact on the distributive bargaining outcomes. In specific, conditional on *Central* > 0, participants are more likely to have conflict in the central zone (Zone C) than the other zones (Zone A and Zone B); moreover if *Imbalance* is high, conflicts are more likely to happen in zone A than zone B (recall that zone A has more discs than zone B).

Table 4.4 reports the average proportion of conflict in each zone across the 100 ticks. For example, in the top left cell, (*Central* $= 0$ & *Imbalance* $= 1$), Zone A has 5 discs and Zone B has 4 discs. A disc in Zone A is in conflict 5.1% of the time; that is, out of the potential 500 ($5\ discs \times\ 100\ ticks$) of conflicts, participants in average have conflict at 5.1% (25.5 ticks) of the time. It can be seen from the figure that, in scenarios with positive number of discs in Zone C, a majority of them (12 out of 16) have a higher proportion of conflict in Zone C than in Zone A and Zone B. Moreover, when the layout is unbalanced *Imbalance* > 0, in 11 out of 16 scenarios there are higher proportions of conflict in Zone A than in Zone B.

□

4.5.3 Cooperative behaviour in games

Result 3. *Participants are more likely to claim discs from own zone than from the other participant's zone. Favored participants (in asymmetric scenarios) on average claim more and possess more discs than un-favored participants. These findings are in favor of* ***Hypothesis 4****, showing an "own side effect".*

Support. First we look at the proportion of claims for each disc based on its location. Recall that there are four possible outcomes for each disc at each tick: claimed by Participant A only, claimed by participant B only, claimed by both, and claimed by none. Figure 4.8 reports the proportion of the 4 status in each disc in selected scenarios. In each pie, the lightest gray area represents the proportion of time the disc is claimed by participant A only, i.e. possessed by A, and the darkest gray area represents the proportion of time the discs is possessed by B. The two colours in middle represent conflict and idleness respectively (conflict has darker colour than idleness). Since the proportion of idleness in each individual disc is very small, thus in most pies, there seems to have only three colours. The allocation of the pies mirror the allocation of discs in the bargaining table. Figure 4.8 in total presents 8 scenarios where *Central* $= 0$ *or* *Imbalance* $= 0$; the figures from other scenarios can be seen in Appendix C.

It can be seen from Figure 4.8 that, discs in zone A (left side) are more likely to be possessed by participant A (larger light area), and discs in zone B (right side) are more likely to be possessed by participant B (larger dark area). Discs in Zone C are most likely to have relatively equal distribution of the two possession statuses.

Table 4.4: Average proportion of conflicts in Zone A, Zone B and Zone C by scenario.

		Imbalance							
Central		0	1	2	3	4	5	6	7
0	*Zone A*		5.10		6.79		8.85		7.11
	Zone B		4.65		3.21		6.85		4.73
1	*Zone A*	6.91		7.55		5.48		7.13	
	Zone C	14.54		8.40		8.02		7.83	
	Zone B	5.40		6.47		3.99		2.46	
2	*Zone A*		7.38		5.06		6.23		
	Zone C		10.28		8.31		7.97		
	Zone B		7.18		6.49		4.17		
3	*Zone A*	4.37		10.79		5.89			
	Zone C	8.97		13.10		7.70			
	Zone B	4.17		9.72		4.58			
4	*Zone A*		6.78		5.45				
	Zone C		9.23		6.74				
	Zone B		8.04		7.29				
5	*Zone A*	10.20		5.45					
	Zone C	11.02		6.46					
	Zone B	9.32		3.75					
6	*Zone A*		3.83						
	Zone C		7.95						
	Zone B		6.12						
7	*Zone A*	6.44							
	Zone C	5.84							
	Zone B	4.17							

The average proportion of conflict status in each zone across all scenarios. Scenarios are separated by *Imbalance* and *Central*. Each number in the cell represents the average proportion of status conflict, as compared with idleness and possession by A/B, in the corresponding zones (*Zone A*, *Zone B* or *Zone C*).

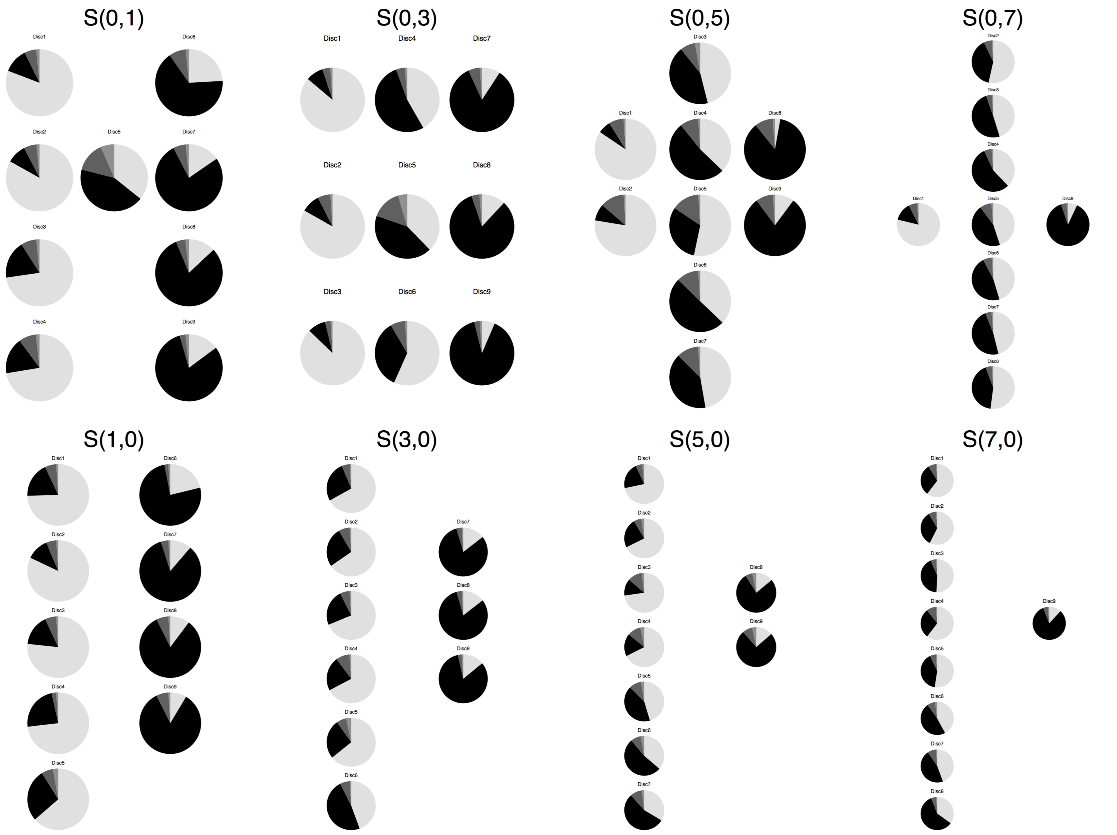


Figure 4.8: Distribution of participants' claims among 9 discs: top row: *Imbalance* $= 0$; bottom row: *Central* $= 0$. In each pie: the lightest colour represents possessed by A, darkest colour represents possessed by B, two colours in middle represent conflict and idleness (conflict darker than idleness).

In asymmetric scenarios, the number of discs in zone A is always higher than that in zone B. If participants make their claims following focal point cues, we would observe a higher number of claims by participant A than participant B.

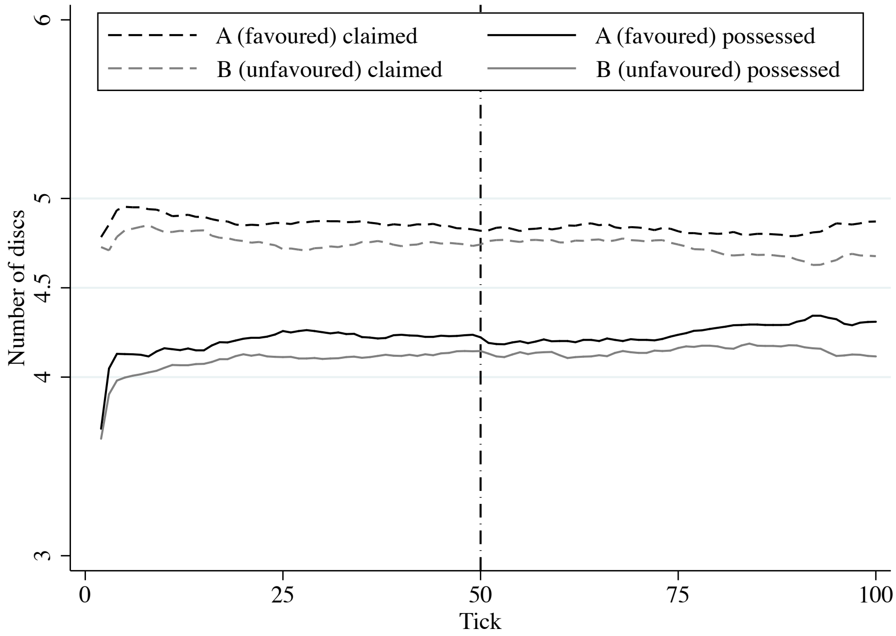


Figure 4.9: Average numbers of discs claimed/possessed by participant A/B over time (asymmetric scenarios).

In Figure 4.9, we present the numbers of discs claimed and owned by favored players and unfavored players in asymmetric scenarios across the 100 ticks. It can be seen from the figure than, favoured players consistently have higher numbers of claimed and possessed discs than that of unfavoured players. The result are consistent with Figure 4.8.

It is noteworthy that the trend of consistent difference in claims and possession does not exist when the scenarios are symmetric. The graph of average numbers of discs claimed/possessed by participants overtime in symmetric scenarios can be seen in Figure 4.11 in Appendices C. □

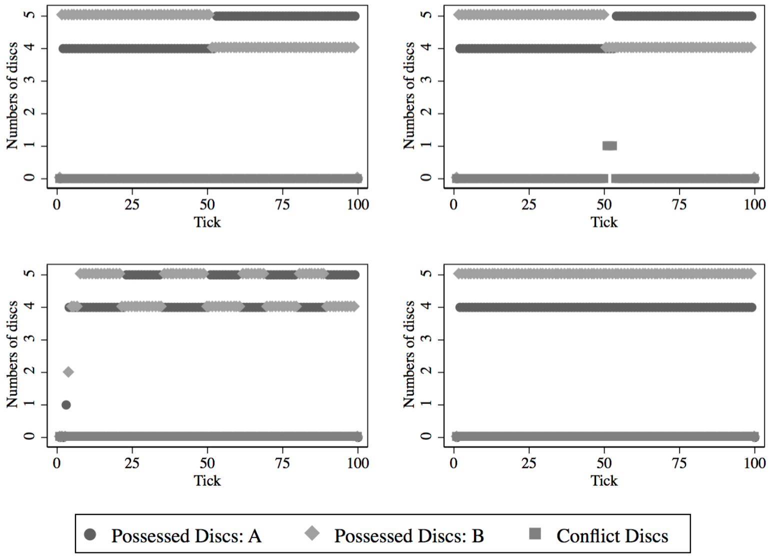


Figure 4.10: Examples of turn takings in games.

Result 4. *Pairs who do not have conflict have the tendency to use turn-taking strategies to achieve more equal and efficient bargaining outcomes.*

Support. Across all scenarios, 16% of all observations have zero costs of conflict throughout the 100 ticks. Around 9% of the observations have very small cost ($Cost = 2$). In these cases, bargainers adopt a cooperation bargaining strategy.

Conditional on participants having no conflict or very few conflicts, we found several common forms of bargaining strategies as shown in Figure 4.10.

Each sub-figure in Figure 4.10 represents one bargaining pair: vertical axis shows possessed or conflict value at each tick; horizontal axis shows tick number from 1 to 100. Circle and diamond dots represent participant A and B's revenues at each tick. The gray square represents conflict at each tick. The four sub-figures show 4 representative bargaining pairs that having a cooperative bargaining strategy. The top-left subfigure represents participants take turns claiming 5 discs/4 discs for 50 ticks each at no switching costs; the top-right subfigure represents participants take turns claiming 5 discs/4 discs for less than (but close to) 50 ticks each at a few switching costs (conflict value=2 at the 50^{th} tick); the bottom-left subfigure represents a very sophisticated turn-taking strategy: participants take turns taking 5 discs/4 discs for a multiple number of times; and the bottom-right subfigure represents the non-turn taking cooperative strategy in which one participant claims 5 discs and the other claims 4 discs throughout the 100 ticks.

To measure the proportion of pairs who adopt turn-taking strategy in the game, we define the variable $TT45 = 1$ when two players possesses 5 discs/4 discs for no less than 45 ticks. This indicates that there are at least 90 ticks the two participants take turns holding 5 discs/4 discs. The results are reported in Table 4.5. The column *peace* indicates number of pairs who never have conflict. Among pairs with no conflict, 27 (16.9%) adopt turn-taking strategies. Table 4.5 also reports numbers of pairs adopting turn-taking strategies for no less than 50, 60, 70 and 80 ticks in total. □

4.5.4 Personal traits and bargaining stances

Result 5. *Female participants incur higher costs of conflict on average; pairs consisting of two males incur least costs of conflict.*

Support. At each tick, there are 9 discs in potential conflict. The average numbers of disc in conflict at each tick is 0.63 ($sd = 1.46$) across all observations ($100\ ticks \times 960$) in our experiment. To examine heterogeneity of bargaining stances across personal traits, we will list the break down of the average number of discs in conflict by individual and pair types in the following results.

In our experiment, 92 participants revealed their gender (4 chose the option "Prefer not to say") and among the 92 participants 47 are female. Pairs in which there is at least one female

Table 4.5: Numbers of pairs who adopt turn-taking strategies.

Scenario	*TT25*	*TT30*	*TT35*	*TT40*	*TT45*	*Peace*
S(1,0)	18	16	14	11	8	6
S(3,0)	9	9	9	7	4	11
S(5,0)	12	10	8	6	4	11
S(7,0)	12	12	12	8	4	6
S(0,1)	9	9	8	8	5	12
S(2,1)	6	5	4	3	1	11
S(4,1)	15	13	12	11	6	6
S(6,1)	12	12	11	8	7	5
S(1,2)	14	14	11	9	7	9
S(3,2)	10	7	6	5	2	14
S(5,2)	9	6	6	4	2	6
S(0,3)	8	8	8	5	3	8
S(2,3)	10	9	6	6	3	7
S(4,3)	4	3	3	3	2	7
S(1,4)	14	12	10	7	3	6
S(3,4)	7	6	6	4	3	8
S(0,5)	12	11	11	11	6	6
S(2,5)	13	13	13	11	7	8
S(1,6)	10	8	7	5	3	6
S(0,7)	6	6	6	4	2	6
Total	210	189	171	136	82	159

Numbers of pairs that adopt turn-taking strategies in each scenario. *TT45* is defined as each participant possesses 4 discs for at least 45 ticks and possesses 5 discs for at least 45 ticks. Same standard applies to *TT25-40*. *Peace* reports numbers of pairs who never have conflict.

Table 4.6: Average numbers of discs in conflict per tick by gender (asymmetric scenarios)

		B (unfavoured)	
		Female	Male
A (favoured)	Female	.625	.705
	Male	.605	.536

Table 4.7: Average numbers of discs in conflict per tick by gender (symmetric scenarios)

		B	
		Female	Male
A	Female	.787	.686
	Male	.687	.485

have higher conflict rates, an effect which is more pronounced in symmetric scenarios.

Table 4.6 presents the average numbers of discs in conflict per tick in asymmetric scenarios by gender types. If both participants are female, they have in average 0.625 discs in conflict at each tick; while if both participants are male, they have in average 0.536 discs in conflict. On average, females have a higher number of discs in conflict than males. The highest average conflict occurs when female is favoured and male is unfavoured participants ($mean = 0.705$); and the lowest conflict occurs when both participants are male.

Table 4.7 presents average numbers of discs in conflict per tick in symmetric scenarios. It can be seen from the table that, the gender difference follows the same direction as with Table 4.6, and the difference is more significant. In symmetric scenarios, if both participants are female, on average they have 0.787 discs in conflict at each tick; if both participants are male, they have 0.485 discs in conflict. The amount of conflict in mixed-gender pairs falls in between. □

Result 6. *Pairs with opposite LOC types (internal and external) have lowest costs of conflict which results in significantly higher payoffs than pairs with the same LOC types.*

Support. We define participants with LOC score higher than 6 as having internal LOC, and participants with LOC score lower than 6 as having external LOC.[9] Table 4.8 reports the average number of discs in conflict per tick by LOC pair types in asymmetric scenarios. The highest costs of conflict occur if both participants are internal LOC, followed by the cases where both are externals. Pairs with a combination of internal and external have the lowest rates of conflict.

Table 4.8: Numbers of discs in conflict by LOC pair types (asymmetric scenarios).

		B (unfavoured)	
		Internal	External
A (favoured)	Internal	.682	.542
	External	.588	.625

Table 4.9 reports the average numbers of discs in conflict per tick by LOC pair types in *symmetric* scenarios. It can be seen from the table that the findings of opposite LOC types have lower conflict from Table 4.8 is stronger in symmetric scenarios. In symmetric scenarios, External-External pairs average 1.128 discs in conflict per tick, while Internal-Internal pairs average 0.718. Both are much higher than the rates observed in mixed-type pairs ($0.307\&0.408$).

For a robustness check, we used a panel regression with random effect to examine the influence of pairs' LOC types on costs of conflict. The results are reported in Appendix C in Table 4.13. To control for interactions across scenarios, regressions include cluster random effect at session level. In sum, compared with the baseline pair type Internal-Internal, External-External, Internal-External and External-Internal have significantly lower costs of

[9]In our experiment, 21 out of 96 participants have LOC of 6. We omit these participants in this part of analysis.

Table 4.9: Numbers of discs in conflict by LOC pair types (symmetric scenarios).

		B	
		Internal	External
A	Internal	.718	.307
	External	.408	1.128

conflict. The results remain robust after controlling for all other demographic variables, including: gender, age, University status, field of study, country of origin, and years stay in UEA.

For a discussion, **Results 6** are not consistent with **Hypothesis 7**. The main difference of our findings with previous studies is that we found if both players are externals, their bargaining can become competitive. We propose that, because external players deem external forces as the major influence of their bargaining outcomes, when they find themselves in a conflict situation they are more inclined to feel powerless to resolve it, or that it is the other player's place to initiate the resolution.

Another possible explanation for our results is the compatibility of bargaining strategies. Due to the dynamic features of our experiment, participants have sufficient time to know their counterpart's bargaining stances. When internals meet externals, the internals are more likely to adjust their behaviour, and result in an accommodation. As a result, pairs with opposite LOC types have the most efficient bargaining outcomes.

□

4.6 Conclusion

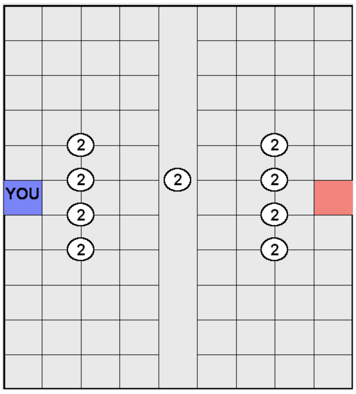
In this paper, we examined individuals' bargaining stances in a dynamic bargaining game with costly conflict. We found that some participants systematically enter costly conflicting situation despite the opportunity to cooperate. Many of the pairs who do not fight use strategies such as turn-taking to achieve relatively equal and efficient outcomes. The graphical structure of the game does not affect the overall amount of conflict, but it does influence where conflicts do take place. We found that females are more likely to bargain more competitively, and bargaining pairs with opposite LOC types have more efficient bargaining outcomes. Our findings parallel previous results on over-spending in conflict experiments, and for the influence of focal point cues in shaping outcomes of games.

The most novel result is on the interaction effects of individual characteristics, in particular in locus of control. The real-time interaction of our experiment gives a richer scope for players to attempt to come to a mutual accommodation (or not). The compatibility, or incompatibility, of personal traits can come into play in a dynamic interaction in a way that is not possible in one-shot, simultaneous-move games.

Games with continuous interaction are underexplored in the experimental literature. Our results suggest substantial scope for interesting future research. First, tacit communication or parallel thinking is manifested in our results as shown in various turn-taking strategies and the switching point at the 50^{th} tick. Though participants cannot communicate directly, many pairs are able to come to a mutual understanding on how to play the game in a coordinated way, which is worth exploring in more depth. Second, the compatibility of strategies can be important in bargaining situations. In common language, it is often said that some people "bring out the best (or worst)" of other people. The process of adaptability is worth examining in various strategic interactions. Finally, substantial loss of efficiency is very common in our experiment, and it will be interesting to explore the underlying reasons for participants' choice to fight against each other rather than cooperate and share the economic surplus.

4.7 Appendices C

All scenarios in the experiment



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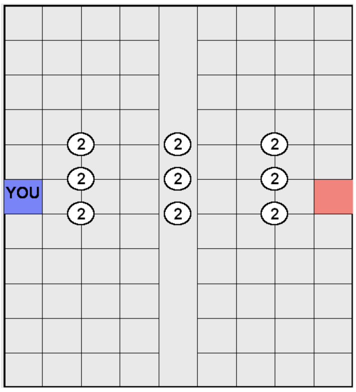

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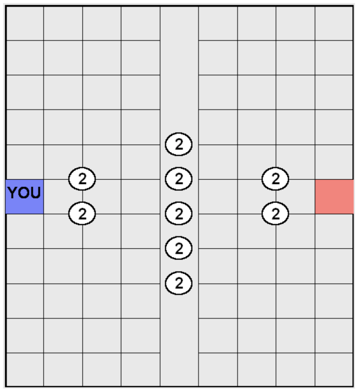

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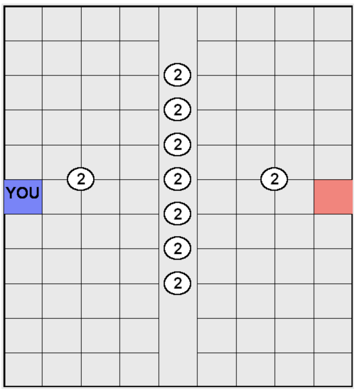

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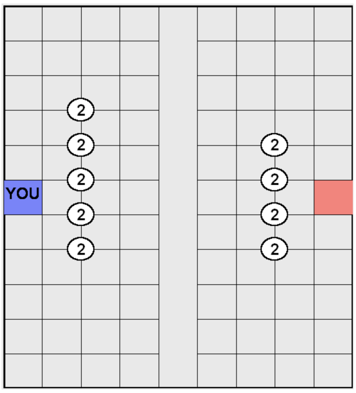
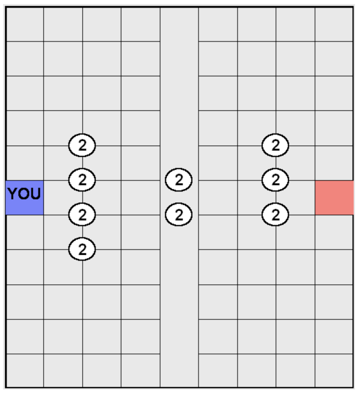
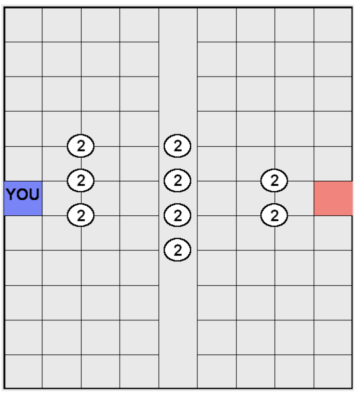


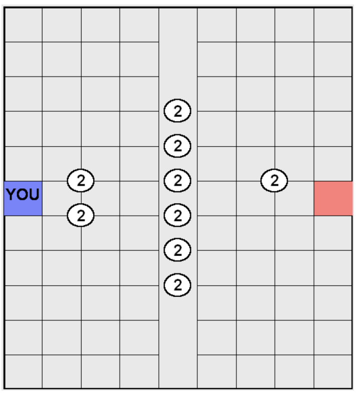
S(1,0)



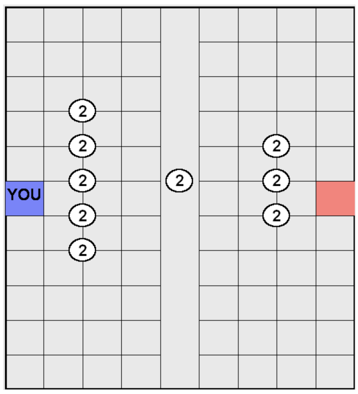
S(1,2)



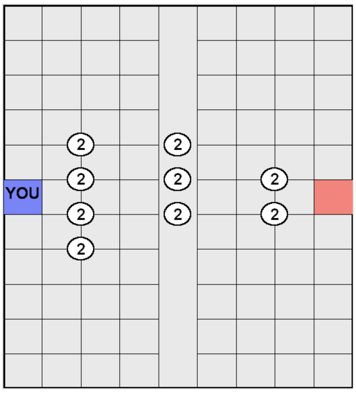
S(1,4)



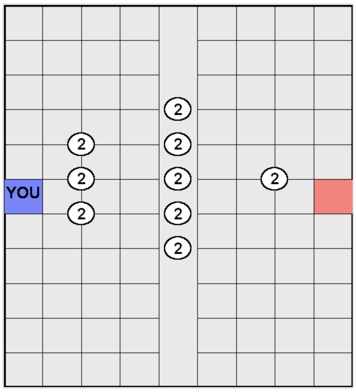
S(1,6)



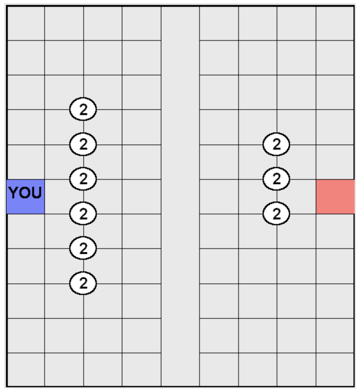
S(2,1)



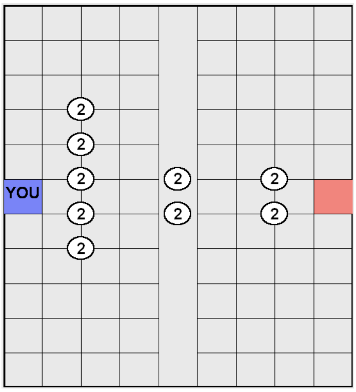
S(2,3)



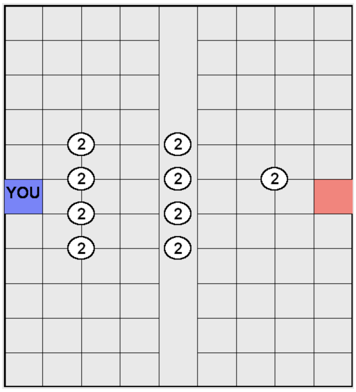
S(2,5)



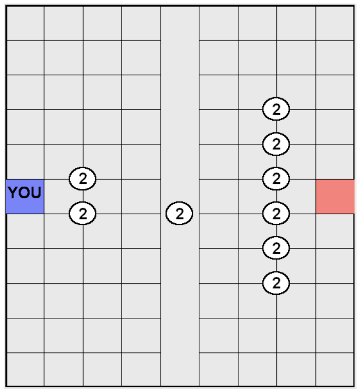
S(3,0)



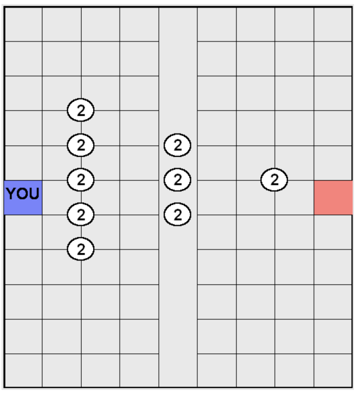
S(3,2)



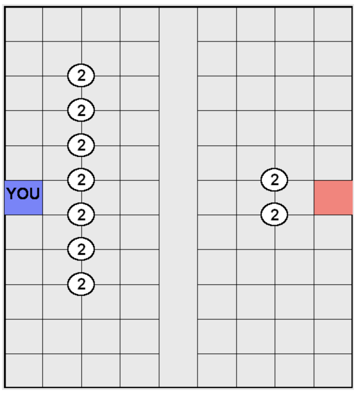
S(3,4)



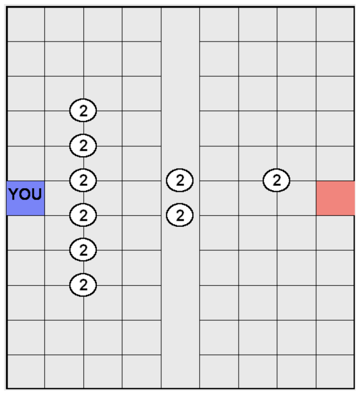
S(4,1)



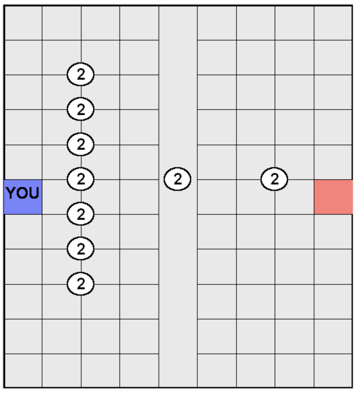
S(4,3)



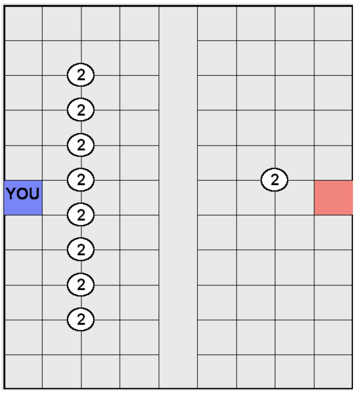
S(5,0)



S(5,2)



S(6,1)



S(7,0)

Proof of Proposition 4

Suppose there are $D = 9$ assets, $\{d_1, \ldots, d_9\}$, and two periods, $T = 2$.

It can be shown that it is possible to have conflict in the SPE. For example: $a_A^1 = \{d_1, d_2, d_3, d_4, d_5\}$ and $a_B^1 = \{d_5, d_6, d_7, d_8, d_9\}$ in the first period.

In dynamic games, the claims that are played in $T = 2$ can depend on the claims that are played in $T = 1$. In $T = 2$ all assets are claimed by exactly one player. To define a SPE, we specify how play in $T = 2$ will proceed as a function of the play in $T = 1$.

- If $(a_A^1, a_B^1) = (\{d_1, d_2, d_3, d_4, d_5\}, \{d_5, d_6, d_7, d_8, d_9\})$, then in $T = 2$ we have $(a_A^2, a_B^2) = (\{d_1, d_2, d_3, d_4, d_5\}, \{d_6, d_7, d_8, d_9\})$.

- If $(a_A^1, a_B^1) = (\{d_1, d_2, d_3, d_4, d_5\}, x)$ for any set $x \neq \{d_5, d_6, d_7, d_8, d_9\}$, then in $T = 2$ players follow: $(a_A^2, a_B^2) = (\mathcal{D}, \emptyset)$ (that is, player A gets all the discs in $T = 2$).

- If $(a_A^1, a_B^1) = (y, \{d_5, d_6, d_7, d_8, d_9\})$ for any set $y \neq \{d_1, d_2, d_3, d_4, d_5\}$, then in $T = 2$ players follow: $(a_A^2, a_B^2) = (\emptyset, \mathcal{D})$ (that is, player B gets all the discs in $T = 2$)

The intuition is that if a player deviates from the prescribed claims:

$$(a_A^1, a_B^1) = (\{d_1, d_2, d_3, d_4, d_5\}, \{d_5, d_6, d_7, d_8, d_9\} \tag{4.4}$$

then they are “punished” in $T = 2$ by playing a (stage-game Nash) equilibrium which is extremely unfavourable to them.

To verify this is a SPE, we will focus on player A’s payoffs (the argument for player B is analogous). Suppose player A considers deviating from $\{d_1, d_2, d_3, d_4, d_5\}$. Any deviation from this in period $T = 1$ leads to a loss of $4V_e$ in $T = 2$. Meanwhile, the only deviation which leads to an increase in earnings at $T = 1$ is to deviate to $\{d_1, d_2, d_3, d_4\}$, which increases earnings by V_c. Because $4V_e > V_c$, this deviation leads to a net loss to player A. Therefore $\{d_1, d_2, d_3, d_4, d_5\}$ is a best-response at $T = 1$.

This argument can be generalised to any number of periods. If there are T periods, we can support $(a_A^t, a_B^t) = (\{d_1, d_2, d_3, d_4, d_5\}, \{d_5, d_6, d_7, d_8, d_9\})$ for all $t = 1, \ldots, T - 1$ by using a similar trigger strategy. As soon as either player deviates from this action, play reverts to the stage-game Nash equilibrium that is most favourable to the other player.

An intuitive (although not exactly precise) explanation of this is: In this sort of SPE, players must persist in the face of positive confict because, if they ever “blink,” the other player will respond by claiming all of the assets in all subsequent periods. So, as long as the earnings in each period are positive, it is better to suffer the conflict, than to deviate, because a deviation means earnings of zero in all future periods.

A similar argument can also be used to show that SPEs with idleness are possible. The argument there would again be that if either player deviated and claimed the “idle” disc, the other player would “retaliate” by claiming all discs in all subsequent periods.

Instructions

Introduction

Welcome and thank you for taking part in this experiment.

This is an experiment in the economics of decision-making. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. You will receive your earnings for today's session in cash before you leave the laboratory.

It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

We will now describe the session in more detail. Please follow along with these instructions as they are read aloud.

The scenarios

Everyone in the room is receiving exactly the same instructions.

You will be presented with 20 different scenarios, one after the other. Each scenario is an interaction between **You** and one **Other** person.

For each scenario, you will be matched with one other person in this room. You will never be matched with the same person for more than one scenario. You will never know who you are matched with.

The real scenarios

Two of these scenarios will be paid for real. By this we mean that:

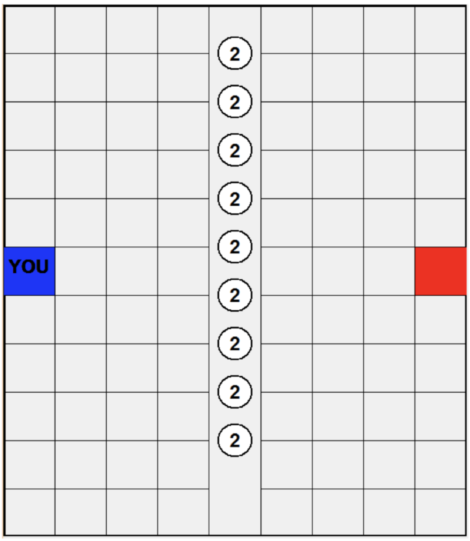
- At the end of the experiment, we will pick at random two of the 20 scenarios.
- The decisions made by you and the person you were matched with in each of these

two scenarios will determine how much money you are paid at the end of the session. You will receive the total of your earnings in these two scenarios.

I have a deck of cards with the numbers one through twenty written on them. At the end of the session, I will shuffle this deck, and ask two participants to select one card at random from the deck. The numbers on the selected cards will determine which two of the scenarios will be paid for real. Because you will not know which scenarios will be paid for real until you have completed all of them, you should treat each scenario as if it was going to be paid for real. So, when thinking about each scenario, remember that it could be real and think about it in isolation from the others.

An example of a scenario

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



Each scenario is an interaction between **you** and the **other person**. Each person has a **base**. Your base is represented by the blue square and will always be at the left side of the table. You will see the word "YOU" written on your base. The other person's base is represented by the red square and will always be at the right side of the table.

There will be nine (9) discs laid out on the table.

The basic rules

Each scenario lasts **a total of 100 seconds**.

You can propose which discs you would like to get by clicking on them. We will say that you are **claiming** those discs. Your claims and the other person's claims are displayed simultaneously on the screen. Both you and the other person can change your claims at any time.

On your screen will be a timer, which will count 100 ticks, one tick per second. At each tick of the clock, the current claims you and the other person are making determine the money you earn at that tick.

Your earnings are determined by two factors: your **revenue** and your **cost**.

At each tick:

- You receive 2p of **revenue** from each disc which you claim and the other person does not claim. Likewise, the other person receives 2p of revenue from each disc which they claim and you do not claim.

- You and the other person incur a **cost** of 2p each from each disc which both of you claim. Neither you nor the other person receive any revenue from discs which are claimed by both of you.

- You do not receive any revenue, nor incur any cost, from a disc that you do not claim.

Your earnings at each tick are determined by your revenue minus your cost. Your total earnings for the scenario are determined by adding up your earnings for the 100 ticks.

Claiming discs

We now explain how you claim discs, and how claims are shown on the screen.

Initially, all the discs are white. This indicates that neither you nor the other person have yet made any claims.

You can claim a disc by clicking on it. Each disc which you are currently claiming is shown with a blue flag, which indicates your claim. If you change your mind and no longer want to claim the disc, simply click on it again; this cancels your claim, and the blue flag will then disappear. Each disc which the other person is currently claiming is shown with a red flag. If the other person cancels their claim of that disc, the red flag will then disappear.

Your claims and the other person's claims together determine the colour of the discs and your earnings.

- If neither you nor the other person claim a given disc, there will be no flags on the disc, and the disc will be coloured white.
- If you claim a given disc but the other person does not, there will be only a blue flag on the disc, and the disc will be coloured blue. You receive revenue of 2p from each disc coloured blue at each tick.
- If the other person claims a given disc but you do not, there will be only a red flag on the disc, and the disc will be coloured red. The other person receives revenue of 2p from each disc coloured red at each tick.
- If both you and the other person claim a given disc, there will be both blue and red flags on the disc, and the disc will be coloured yellow. You and the other person each incur a cost of 2p each from each disc coloured yellow at each tick.

Your earnings are determined by the number of blue discs and yellow discs. At each tick, you receive revenue of 2p from each disc coloured blue, and you incur a cost of 2p from each disc coloured yellow.

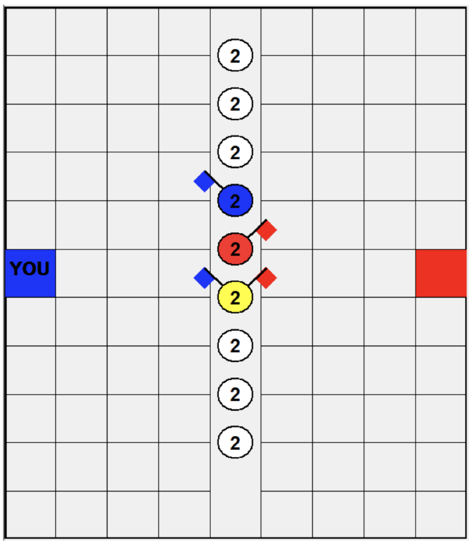
Changing your claims

You can change which discs you are claiming at any time. You change your claim on a disc by clicking on it. If you click on a disc you are currently claiming, you will cancel your claim, and the blue flag will disappear from the disc. If you click on a disc you are not currently claiming, you will claim that disc, and a blue flag will appear on the disc.

Likewise, you will know when the other person changes their claim on a disc. If the other person removes their claim on a disc, the red flag will disappear from that disc. If the other person claims a disc, the red flag will appear on that disc.

Whenever someone changes their claim on a disc, the colour of that disc will be updated, as well as the revenues each of you receive and the costs each of you incur.

You can change your claims as many times as you like over the course of the 100 ticks. You can now practice changing your claims using the table at the left side of this screen.



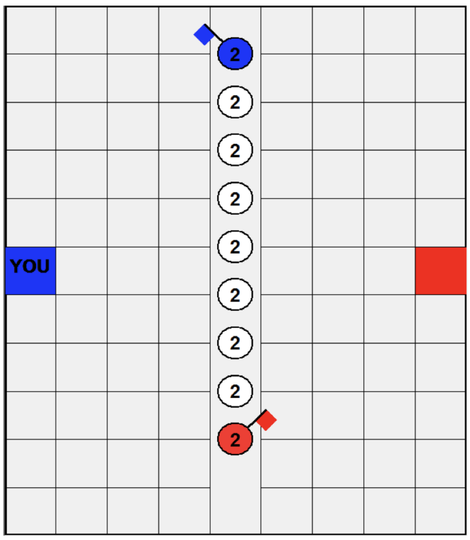
Example 1

Suppose at a tick the claims are as now shown on the screen.

The top disc has a blue flag and is coloured blue. The blue flag indicates it is claimed by you, and the blue disc indicates that you receive revenue of 2p from that disc at this tick. The bottom disc has a red flag and is coloured red. The red flag indicates it is claimed by the other person, and the red disc indicates that the other person receives revenue of 2p from that disc at this tick.

The other seven discs are white. This indicates that they are claimed neither by you nor by the other person; therefore, neither of you receive revenue or incur costs from any of these discs at this tick.

Therefore, you would earn 2p at this tick, computed as your revenue of 2p minus your cost of 0p. The other person would likewise earn 2p at this tick, computed as their revenue of 2p minus their cost of 0p.

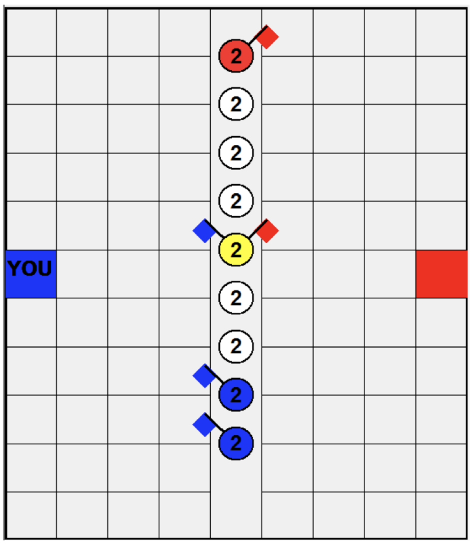


Example 2

Now suppose at a tick the claims are as now shown on the screen.

The bottom two discs have a blue flag and are coloured blue. The blue flags indicate these discs are claimed by you, and the blue discs indicate that you receive revenue of 4p (2p times 2 discs) at this tick. The top disc has a red flag and is coloured red. The red flag indicates it is claimed by the other person, and the red disc indicates that the other person receives revenue of 2p from that disc at this tick. The middle disc has both a blue flag and a red flag, and is coloured yellow. The two flags indicate the disc is being claimed by both you and the other person. The yellow colour indicates that both you and the other person each incur a cost of 2p at this tick from this disc. The other five discs are white. This indicates that they are claimed neither by you nor by the other person; therefore, neither of you receive revenue or incur costs from any of these discs at this tick.

Therefore, you would earn 2p at this tick, computed as your revenue of 4p minus your cost of 2p. The other person would earn 0p at this tick, computed as their revenue of 2p minus their cost of 2p.



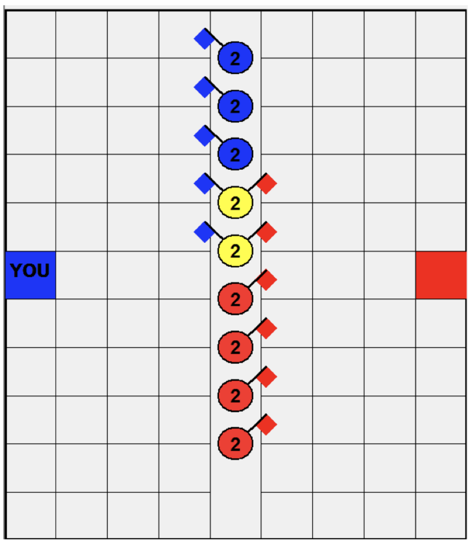
Example 3

Now suppose at a tick the claims are as now shown on the screen.

The top three discs have a blue flag and are coloured blue. The blue flags indicate these discs are claimed by you, and the blue discs indicate that you receive revenue of 6p (2p times 3 discs) at this tick. The bottom four discs have a red flag and are coloured red. The red flag indicates these discs are claimed by the other person, and the red discs indicate that the other person receives revenue of 8p (2p times 4 discs) from those discs at this tick.

The remaining two discs have both a blue flag and a red flag, and are coloured yellow. The two flags indicate the discs are being claimed both by you and by the other person. The yellow colour indicates that both you and the other person each incur a cost of 4p (2p times 2 discs) at this tick from these discs.

Therefore, you would earn 2p at this tick, computed as your revenue of 6p minus your cost of 4p. The other person would earn 4p at this tick, computed as their revenue of 8p minus their cost of 4p.



Moving from one scenario to the next

After completing each scenario, your earnings from that scenario will be displayed on your screen. Once everyone has completed the current scenario and had a chance to review the results of the scenario, you will be paired with another person, and the next scenario will begin. Remember you will never be paired with a given person more than one time in the experiment.

Your earnings

After everyone has finished all 20 scenarios, we will pick at random two of the 20 scenarios to be paid for real.

Your total earnings will be the sum of your earnings in these two scenarios plus a 9 participation payment. Your total earnings will be paid to you in cash straight away.

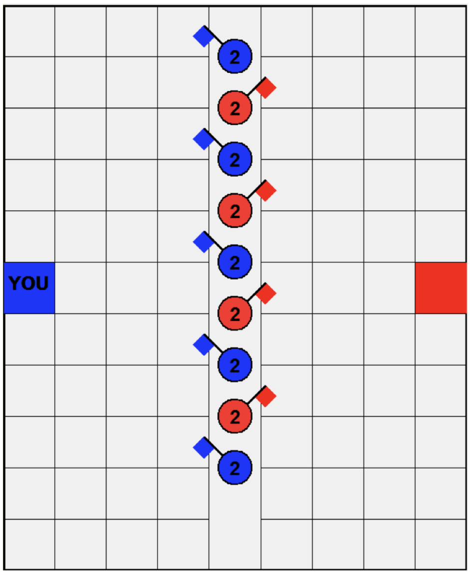
Receiving your earnings will end your participation in the experiment.

Before starting the experiment, we would like you to answer the following questions. Do not hesitate to raise your hand and seek assistance if anything is unclear.

Practical questions

Question 1

Now suppose at a tick in Stage 2 the claims are as now shown on the screen.



Part a.

1. How many discs are you claiming? _____
2. How many discs do you earn revenue from? _____
3. What is your total revenue (in pence) from these discs? _____
4. How many discs do you incur loss from ? _____
5. What is your total cost (in pence) from these discs? _____
6. What are your total earnings (in pence) at this tick? _____

Part b.

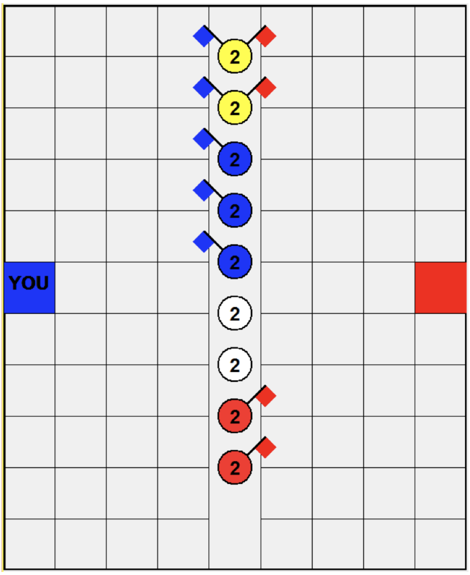
1. How many discs is the other person claiming? _____
2. How many discs does the other person earn revenue from? _____
3. What is the other persons total revenue (in pence) from these discs? _____
4. How many discs does the other person incur loss from ?_____

5. What is the other persons total cost (in pence) from these discs? _____

6. What are the other persons total earnings (in pence) at this tick? _____

Question 2

Suppose the claims in Stage 2 are as now shown.



Part a.

1.How many discs are you claiming? _____

2. How many discs do you earn revenue from? _____

3. What is your total revenue (in pence) from these discs? _____

4. How many discs do you incur loss from ?_____

5. What is your total cost (in pence) from these discs? _____

6. What are your total earnings (in pence) at this tick? _____

Part b.

1. How many discs is the other person claiming? _____

2. How many discs does the other person earn revenue from? _____

3. What is the other persons total revenue (in pence) from these discs? _____
4. How many discs does the other person incur loss from ?_____
5. What is the other persons total cost (in pence) from these discs? _____
6. What are the other persons total earnings (in pence) at this tick? _____

Question 3

The other person will be:

a. A different person in each scenario.

b. The same person in all scenarios.

c. The same person in two different scenarios.

d. The same person in two consecutive scenarios.

Question 4

Your earnings from the experiment will be:

a. The sum of your earnings from all the scenarios.

b. The sum of your earnings from all the scenarios, plus a £5 participation payment.

c. The sum of your earnings from the two real scenarios.

d. The sum of your earnings from the two real scenarios, plus a £5 participation payment.

Oral: Now everyone has finished their practice question, we are about to start the experiment. Are there any questions before we start?... The first scenario will appear on your screen shortly.

Locus of Control survey questions

Click on the button next to the one statement that best describes how you feel.

You can always go back to a question and change your answer.

Question 1

- ⊙ Many of the unhappy things in people's lives are partly due to bad luck.
- ⊙ People's misfortunes result from the mistakes they make.

Question 2

- ⊙ One of the major reasons why we have wars is because people don't take enough interest in politics.
- ⊙ There will always be wars, no matter how hard people try to prevent them.

Question 3

- ⊙ In the long run, people get the respect they deserve in this world.
- ⊙ Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

Question 4

- ⊙ The idea that teachers are unfair to students is nonsense.
- ⊙ Most students don't realize the extent to which their grades are influenced by accidental happenings.

Question 5

- ⊙ Without the right breaks, one cannot be an effective leader.
- ⊙ Capable people who fail to became leaders have not taken advantage of their opportunities.

Question 6

- ⊙ No matter how hard you try, some people just don't like you.
- ⊙ People who can't get others to like them don't understand how to get along with others.

Question 7

- ⊙ I have often found that what is going to happen will happen.
- ⊙ Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

Question 8

- ⊙ In the case of the well prepared student, there is rarely, if ever, such a thing as an unfair test.
- ⊙ Many times exam questions tend to be so unrelated to course work that studying is really useless.

Question 9

- ⊙ Becoming a success is a matter of hard work; luck has little or nothing to do with it.
- ⊙ Getting a good job depends mainly on being in the right place at the right time.

Question 10

- ⊙ The average citizen can have an influence in government decisions.
- ⊙ This world is run by the few people in power, and there is not much the little guy can do about it.

<u>Question 11</u>

- ⊙ When I make plans, I am almost certain that I can make them work.
- ⊙ It is not always wise to plan too far ahead because many things turn out to be a matter of luck anyway.

<u>Question 12</u>

- ⊙ In my case, getting what I want has little or nothing to do with luck.
- ⊙ Many times we might just as well decide what to do by flipping a coin.

<u>Question 13</u>

- ⊙ What happens to me is my own doing.
- ⊙ Sometimes I feel that I don't have enough control over the direction my life is taking.

Additional data analysis

Results 2: Competitive behaviour and focality

Table 4.10: Panel data regression on determinants of costs of conflict

VARIABLES	(1) Costs$\|C=0$	(2) Earnings$\|C=0$	(3) Costs$\|I=0$	(4) Earnings$\|I=0$
Imbalance	7.496*	-12.04*		
	(4.433)	(7.277)		
Int-Ext	-21.38	50.36	-123.3	220.2*
	(25.87)	(40.20)	(77.85)	(123.6)
Ext-Int	-16.49	-1.956	-121.1	168.1
	(29.25)	(49.16)	(75.11)	(115.9)
Int-Int	1.161	-2.691	-81.03	124.4
	(30.99)	(46.79)	(59.03)	(90.36)
Central			0.0481	1.452
			(4.564)	(5.823)
Constant	92.93***	750.8***	218.2***	547.4***
	(26.55)	(42.12)	(65.39)	(97.02)
Observations	384	384	384	384
Number of SubjectID	96	96	96	96
R-squared overall	0.00783	0.00908	0.0304	0.0300
R-squared between	0.0123	0.0142	0.0750	0.0975
R-squared within	0.0170	0.0204	0.0158	0.0123

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results 3: Cooperate behaviour in games

Average numbers of discs claimed/possessed by participants overtime in symmetric scenarios:

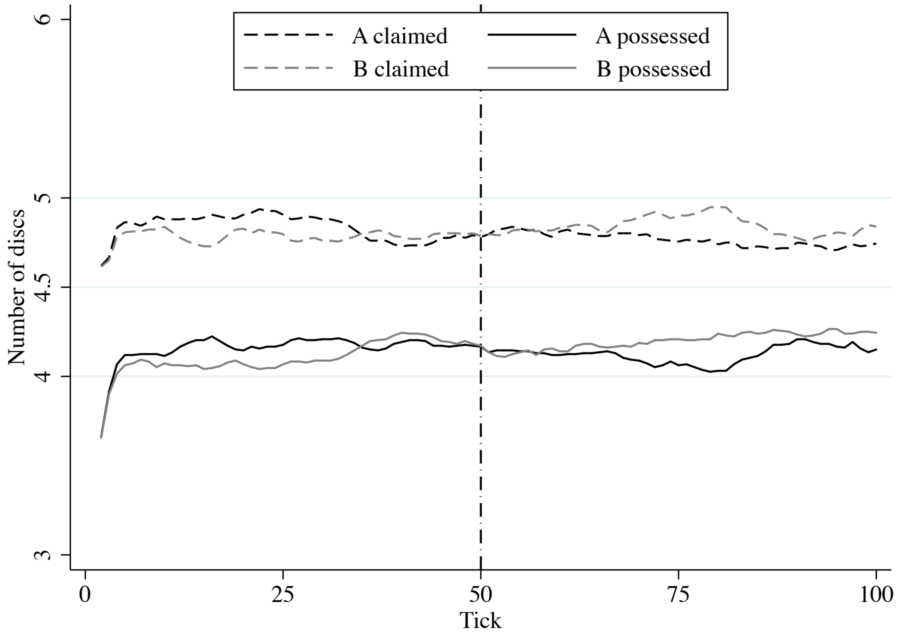


Figure 4.11: Average numbers of discs claimed/possessed by participant A/B over time (symmetric scenarios).

Proportion of 4 status of claims in other scenarios:

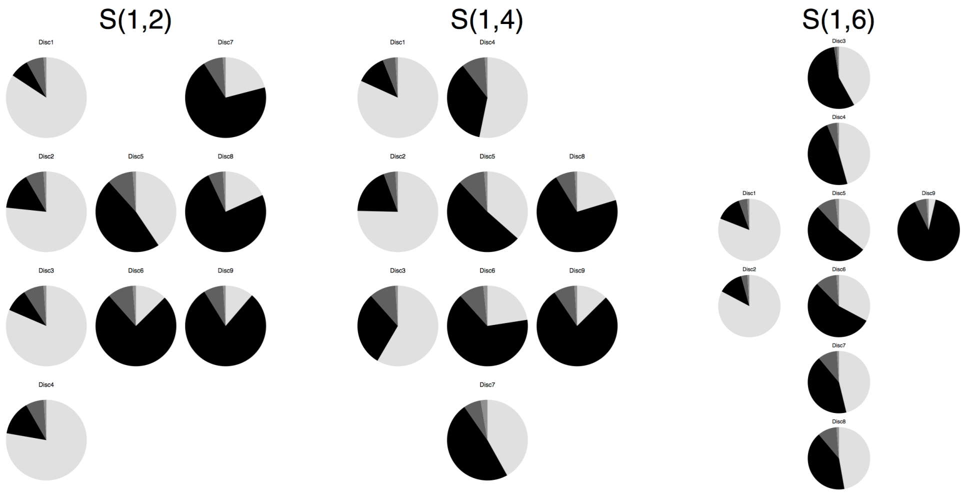


Figure 4.12: Proportion of 4 status of claims in each disc: *Imbalance* $= 1$.

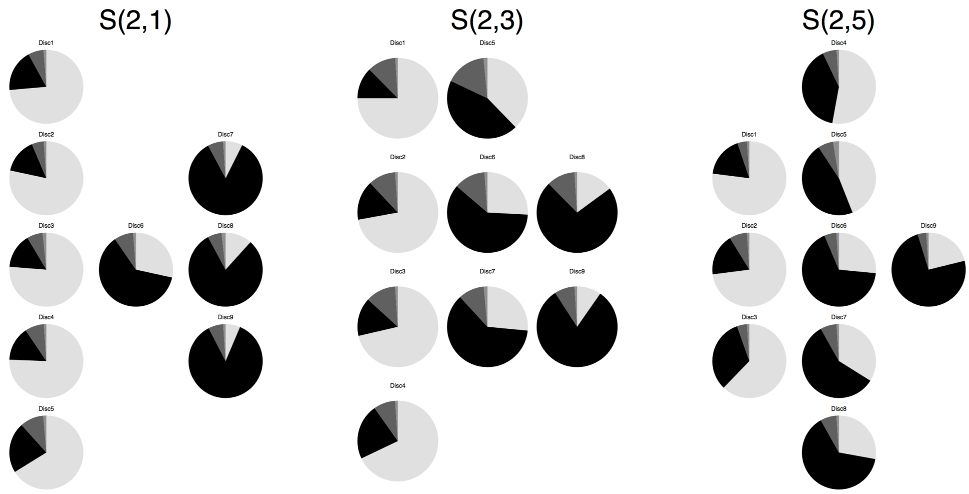


Figure 4.13: Proportion of 4 status of claims in each disc: *Imbalance* $= 2$.

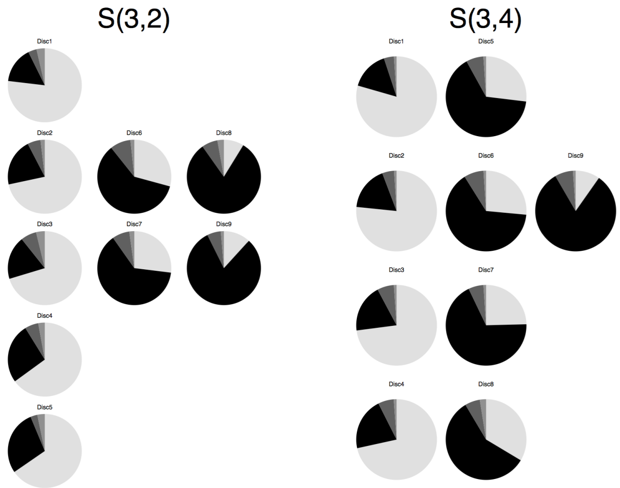


Figure 4.14: Proportion of 4 status of claims in each disc: *Imbalance* $= 3$.

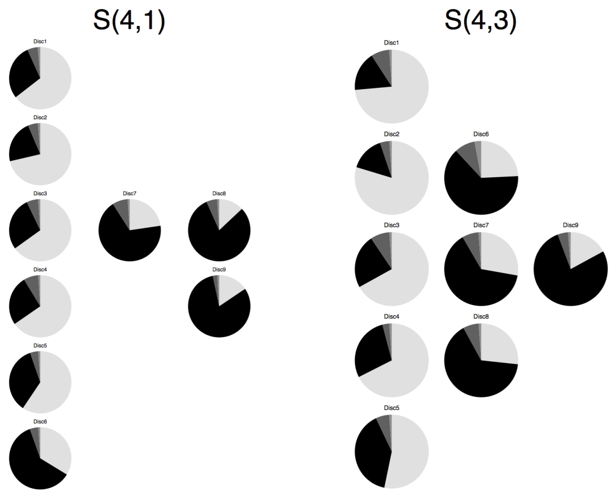


Figure 4.15: Proportion of 4 status of claims in each disc: *Imbalance* $= 4$.

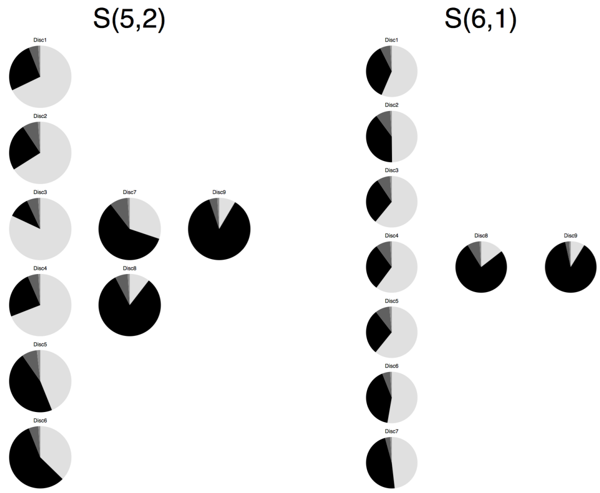


Figure 4.16: Proportion of 4 status of claims in each disc: *Imbalance* $= 5/6$.

Result 6: LOC and bargaining stances:

Average numbers of discs possessed by Participants by LOC types:

Table 4.11: Numbers of discs possessed by Participant A by LOC pair types. (asymmetric scenarios).

		B (unfavoured)	
		Internal	External
A (favoured)	Internal	4.205	4.350
	External	4.173	4.264

Table 4.12: Numbers of discs possessed by Participant A by LOC pair types (symmetric scenarios).

		B	
		Internal	External
A	Internal	4.227	4.326
	External	4.021	4.096

Robustness check for the effect of LOC on costs of conflict:

It can be seen from Table 4.13 that Pairs with opposite LOC types (Int-Ext and Ext-Int) have significantly lower costs (conditional or unconditional) than that of same LOC types (Ext-Ext), ceteris paribus. The results remain robust after controlling for other demographic variable (specification 4-6). As a result of lowers costs of conflict with opposite LOC types, earnings of Int-Ext is significantly higher than Ext-Ext.

Table 4.13: Random effect Panel data regressions examine LOC types.

VARIABLES	(1) Cost(UnCon)	(2) Cost(Con)	(3) Earnings	(4) Cost(UnCon)	(5) Cost(Con)	(6) Earnings
Imbalance	-1.921	-2.171	2.719	-1.872	-2.137	2.660
	(2.191)	(4.058)	(3.664)	(2.177)	(4.062)	(3.659)
Int-Ext	-33.51*	-41.48**	69.49***	-37.99*	-47.51**	77.77***
	(19.39)	(19.60)	(22.57)	(20.24)	(20.63)	(22.56)
Ext-Int	-33.74**	-45.55**	35.81	-34.09**	-45.79***	37.37
	(16.68)	(18.62)	(28.56)	(15.96)	(17.45)	(26.13)
Int-Int	-8.898	-17.62	14.10	-13.06	-22.11	22.02
	(20.58)	(19.19)	(30.21)	(21.96)	(20.66)	(28.22)
Male				-12.32	-8.900	16.09
				(20.32)	(20.43)	(16.97)
Age				16.86**	15.82*	-17.20
				(8.370)	(9.464)	(12.85)
University_status				6.630	7.501**	-6.057
				(4.162)	(3.282)	(5.802)
Econ				36.59	32.08	-32.87
				(32.02)	(29.48)	(26.61)
Year				-13.09	-9.471	14.44
				(14.00)	(15.57)	(17.78)
Brit				-6.775	-6.132	19.24*
				(13.44)	(16.10)	(10.80)
Constant	148.3***	178.1***	663.8***	-158.9	-121.8	958.3***
	(10.58)	(11.00)	(15.36)	(138.9)	(152.8)	(215.8)
Observations	1,920	1,609	1,920	1,900	1,593	1,900
Number of SubjectID	96	96	96	95	95	95
R-squared overall	0.00499	0.00579	0.00541	0.0203	0.0204	0.0122
R-squared between	0.0111	0.00955	0.0280	0.0920	0.0782	0.102
R-squared within	0.00410	0.00490	0.00407	0.00400	0.00486	0.00390

Robust standard errors in parentheses;*** $p<0.01$, ** $p<0.05$, * $p<0.1$. To control for interactions within a session, robust standard errors are clustered at session level. Independent variable: Pair types by LOC; we define External as participants with $LOC \geqslant 7$; "Int-Ext": A is internal, B is external; "Ext-Int": A is external, B is internal; "Int-Int": both participants are internals; "Ext-Ext" is the baseline group where both are externals. University status measures whether participants are bachelor, master, Mphil/PhD or Staff. Dependent variable: "Cost(Uncon)" is the unconditional costs of conflict; "Cost(Con)" is the conditional costs of conflict conditional on $Cost > 0$; "Earnings" measure the final payoff.

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