cbess
Centre for Behavioural and Experimental Social Science

UEA
University of East Anglia

2018-01

THE PIZZA NIGHT GAME: EFFICIENCY, CONFLICT AND INEQUALITY IN TACIT BARGAINING GAMES WITH FOCAL POINTS

Andrea Isoni

Robert Sugden

Jiwei Zheng

www.uea.ac.uk/cbess

The Pizza Night Game:

Efficiency, Conflict and Inequality in Tacit Bargaining Games with Focal Points

Andrea Isoni[1]

Robert Sugden[2]

Jiwei Zheng[3]

May 2018

Abstract

We report the results of a new tacit bargaining experiment that provides two key insights on the effects of payoff inequality on coordination and cooperation towards mutually beneficial outcomes. The experiment features the novel Pizza Night game, which can disentangle the effects of payoff inequality from those of conflict of interest. When coordination relies on *focal points* based on labelling properties, payoff inequality does not interfere with the successful use of those properties. When coordination results in mutual benefit, payoff inequality is not an obstacle to the realisation of efficiency. Conflict of interest is the main barrier to successful coordination. [100 words]

Keywords: Pizza Night game, tacit bargaining, conflict of interest, payoff inequality, focal points.

JEL Classification: C72, C78, C91.

[1] Behavioural Science Group, Warwick Business School, Coventry CV4 7AL, UK. University of Cagliari, Italy. Email: a.isoni@warwick.ac.uk.

[2] School of Economics and Centre for Behavioural and Experimental Social Science, University of East Anglia, Norwich NR4 7TJ, UK. Email: r.sugden@uea.ac.uk.

[3] School of Economics and Centre for Behavioural and Experimental Social Science, University of East Anglia, Norwich NR4 7TJ, UK. Email: j.zheng@uea.ac.uk.

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme, grant agreement No. 670103. Approval for the experiment reported in this paper was obtained from the University of East Anglia's School of Economics Research Ethics Committee. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

1. Introduction

We present two major insights about the effects of payoff inequality on coordination and cooperation towards mutually beneficial outcomes. These are the highlights of an experiment investigating the role of conflict of interest, efficiency, inequality and labelling in a wide variety of tacit coordination games framed as bargaining problems without communication.

Coordination problems are ubiquitous in economic and social life. In many cases, such as driving on the roads and setting prices in illegal cartels, solutions have to be found *tacitly*, without communication. Models of tacit coordination may also isolate significant features of real-world coordination problems in which communication is possible but takes the form of cheap talk.[4] In this paper, we consider a simple class of models of tacit coordination. These are 2×2 *diagonal coordination games* in which two players each choose one of two uniquely-labelled strategies which can be arranged so as to produce a payoff matrix in which two pure-strategy Nash equilibria appear in the main diagonal with positive payoffs to both players and all off-diagonal payoffs are normalised to zero.

The presence of two coordination equilibria is challenging for classical game theory, because the analysis of best-response reasoning that identifies Nash equilibria cannot single out one of them as the unique solution to the coordination problem facing the players. This is most obvious in *Pure Coordination Games*, in which all the positive payoffs are identical, and the same for both players. But it is also true in *HiLo games*, in which one of the equilibria strictly Pareto dominates the other, or in *Battle of the Sexes* games, in which each player has a strict preference for a different equilibrium and the equilibrium payoffs are symmetrical.

In *The Strategy of Conflict*, Schelling (1960) proposed that, recognising the challenge of equilibrium selection, 'rational' players will look for *cues* available to both of them that make one strategy stand out and identify one equilibrium as the *focal point* of the game. Useful cues can be found in the payoffs (as in HiLo games, in which one equilibrium is Pareto dominant; e.g., Harsanyi and Selten, 1988) or in aspects of *labelling*. A label is a feature of a game, attached to a strategy or a player and known to one or both players, which is irrelevant for the players' payoffs. We will be concerned with the effects of labels attached to individual strategies and commonly known by the players.

[4] Schelling (1960: 267–272) offers a theoretical argument, based on backward induction, in support of this claim.

Labelling cues are key to coordination when no other cues are available. This has been studied extensively in the laboratory, by translating payoffs into some form of *material* reward (usually money) that participants receive if they successfully coordinate. Labelling cues dramatically increase coordination success in Pure Coordination games, independently of how these are framed (e.g., Schelling, 1960; Mehta et al., 1994; Bacharach and Bernasconi, 1997; Crawford et al., 2008; Bardsley et al., 2010; Isoni et al., 2013, 2018). However, when the same cues feature in Battle of the Sexes games, coordination success is typically less than in Pure Coordination games and, in some frames, is less than would result from random strategy choice (e.g., Crawford et al., 2008; Isoni et al., 2013, 2018; Sitzia and Zheng, 2018). Since many of the coordination and tacit bargaining problems that people face in real life bear more resemblance to Battle of the Sexes than Pure Coordination games, understanding the source of these coordination failures may have vital implications for the real-world relevance of Schelling's hypothesis.

Relative to Pure Coordination games, Battle of the Sexes games have two key features which may be responsible for the less effective use of labelling cues: *conflict of interest* – i.e., the two players rank the two equilibria differently – and *payoff inequality* – i.e., conditional on coordinating, the two players receive different material payoffs. The importance of this distinction has so far been overlooked in the literature, possibly because Schelling's analysis treated payoffs as utilities, which cannot be legitimately compared between players, making payoff inequality irrelevant. However, if payoffs are material, as in virtually all experiments, they *can* be legitimately compared between players, and experimental participants may have attitudes which depend on such comparisons (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000).

From a theoretical viewpoint, conflict of interest and payoff inequality both have the potential to disrupt the process of 'reasoning together' that Schelling envisages as the key to solve coordination problems (Sugden and Zamarrón, 2006). Conflict of interest may detract attention from the common goal of coordinating, if it leads players to construe the game as one in which, depending on who gets its way, there are winners and losers (Zizzo and Tan, 2011). Payoff inequality may decrease the likelihood that players think of themselves as a cohesive group, as assumed in some of the theories of *team reasoning* (e.g., Bacharach; 2006) developed to explain focal points.[5]

The relative strength of these two mechanisms is a matter of real economic significance. Conflict of interest and payoff inequality are potential obstacles to the realisation of mutual benefit. A salient outcome that benefits both parties may not be achieved because it requires one party to sacrifice their own personal interest, and/or because it requires them to accept to be worse off than the other. If the presence of unavoidable payoff inequality were sufficient to prevent the realisation of mutual benefit, it would be bad news for market economies: many profitable transactions would not take place. If stoicism about unavoidable inequalities in reward (Bruni and Sugden, 2013) prevailed, inefficiencies would be confined to cases in which there are obvious conflicts of interest between the parties.

To analyse the separate effects of conflict of interest and payoff inequality, we devise a new game, which we call the *Pizza Night game*. Consider a variant of the usual Battle of the Sexes story. An Italian couple are meeting for a meal downtown in the evening. They cannot communicate, and the choice is between a curry place and a pizza place. The husband prefers curry to pizza, the wife pizza to curry, but both prefer a meal together to a meal on their own. Pizza is label-salient, because the couple are Italian. Suppose also that husband and wife know each other so well that they both know that she enjoys pizza as much as he enjoys curry, and he enjoys pizza as much she enjoys curry. Thus, their payoffs become interpersonally comparable, like material payoffs in experimental Battle of the Sexes games. This game has conflict of interest – each spouse strictly prefers a different equilibrium – and payoff inequality – whenever they meet, one is better off than the other.

The Pizza Night game is obtained by removing conflict of interest from the Battle of the Sexes game.[6] Suppose the same couple has the convention to have pizza on a Saturday night. It is pizza night, and the two spouses have to meet, but cannot communicate. There are two pizzerias, where both spouses find pizza equally good. One is Italian, hence label-salient.

[5] One of the prerequisites of team reasoning assumed by Bacharach is 'group identification', which is thought to be facilitated by factors such as being members of the same pre-existing social group, belonging to an ad-hoc category (Tajfel, 1970), exposure to the pronouns 'we', 'our' and so on (Perdue et al., 1990), having common interest, being subject to a common fate (Rabbie and Horwitz, 1969), shared experience (Prentice and Miller, 1992), face-to-face contact (Dawes, van de Kragt and Orbell, 1988), and interdependence (Sherif et al., 1961).

[6] Note that it is not possible to have conflict of interest if inequality is removed.

It is common knowledge that she will enjoy food more in either place, so there is payoff inequality, like in Battle of the Sexes. However, neither spouse has a strict preference, so there is not conflict of interest, like in Pure Coordination. If coordination success in the Pizza Night game is as high as in Pure Coordination games, then the cause of coordination failure in Battle of the Sexes is conflict of interest. If it is as low as in Battle of the Sexes, the cause is payoff inequality. If it is intermediate, both factors are important.

If payoff inequality turns out to impede the successful use of payoff-irrelevant cues when these are the only cues available, it is possible that its disruptive effects extend to cases in which coordination results in a cooperative outcome which benefits both parties. A prototype case of such situations is represented by the HiLo game, in which one equilibrium ('Hi') assigns a higher material payoff to both players than the other ('Lo'). We investigate whether introducing payoff inequality in either the 'Hi' or the 'Lo' equilibrium has any impact in such games when we keep the presence or absence of labelling cues constant.

The remainder of this paper is organised as follows. In Sections 2 and 3, we describe our experimental design and its implementation. We present our hypotheses in Section 4. Section 5 reports our main results. Our two key insights are discussed in Section 6.

2. Experimental design

We study a number of 2×2 diagonal coordination games with and without labelling cues. We will say that a game has *labelling cues* when one strategy has a salient label and the other has not. Consider the games with labelling cues first. Their payoff matrix has the following general structure.

		Player 2	
		Strategy A*	Strategy B
Player 1	Strategy A*	a_1, a_2	0,0
	Strategy B	0,0	b_1, b_2

Each Player $i = 1, 2$ chooses between two strategies, A and B, with commonly known labels. Strategy A's label is salient, as denoted by the '*'. Coordination occurs if both players choose A – in which case the equilibrium payoff pair is $[a_1, a_2]$ – or if they both choose B, which results in equilibrium payoffs $[b_1, b_2]$, $a_i, b_i > 0$.[7] We will denote Player *i*'s *view* of the game as $\langle[a_i, a_j]^*, [b_i, b_j]\rangle$. So, for the game above, Player 1's view is $\langle[a_1, a_2]^*, [b_1, b_2]\rangle$ and Player 2's view is $\langle[a_2, a_1]^*, [b_2, b_1]\rangle$. In a player's view, the payoffs of the label-salient equilibrium are listed first and, within each payoff pair, the player's own payoff is shown first, followed by their co-player's payoff.

We study all the games that can be obtained by independently assigning one of two positive values – a *small* value S and *large* value L, $0 < S < L$ – to each of a_i, a_j, b_i and b_j in Player *i*'s view. There are sixteen possible views, which can be matched to form a total of ten games with labelling cues, listed on the left-hand side of Table 1.

(Insert Table 1 here)

When all payoffs are S, each player faces view C1. When they are all L, each faces C2. Both cases constitute Pure Coordination games with labelling cues, PC* S and PC* L. The combination of C5 and C6 creates a Battle of the Sexes game with a salient equilibrium (BS*). Together, C3 and C4 constitute a Pizza Night game with a salient equilibrium (PN*).

The next two games are HiLo games. When both players face C7, the 'Hi' equilibrium is label-salient (Hi*Lo) – labelling and payoff cues are *congruent* with each other. When both face C8, the 'Lo' equilibrium is label-salient (HiLo*), and the cues are *incongruent*. The remaining four games modify Hi*Lo and HiLo* by making either the 'Lo' or the 'Hi' equilibrium unequal. This results in two *Lo-Unequal* games, in which the inefficient equilibrium is unequal (Hi*Lo≠, views C9 and C10, in which the efficient equilibrium is label-salient; and HiLo≠*, views C11 and C12, in which the inefficient equilibrium is label-salient); and two *Hi-Unequal* games, in which the efficient equilibrium is unequal (Hi≠*Lo, views C13 and C14, in which the efficient equilibrium is label-salient; and Hi≠Lo*, views C15 and C16, in which the inefficient equilibrium is label-salient).

[7] There is also a mixed strategy equilibrium in which Player 1 chooses A with probability $b_2/(a_2 + b_2)$ and Player 2 chooses A with probability $b_1/(a_1 + b_1)$.

The games on the right-hand side of Table 1 are obtained by removing the salient labels from the games just described.[8] In the corresponding views, the order of the two payoff pairs has no significance. This produces a total of seven games without labelling cues, because three pairs of games with salient labels (Hi*Lo and HiLo*; Hi*Lo≠ and HiLo≠*; and Hi≠*Lo and Hi≠Lo*) differ only in terms of which equilibrium is label-salient, and removing the salient label produces a single game without labelling cues.

3. Implementation

Diagonal coordination games like the ones in our experiment have been studied in the literature using a variety of different frames. We adopt the *bargaining table* frame developed by Isoni et al. (2013, 2018), which reliably produces lower coordination success in Battle of the Sexes than Pure Coordination and HiLo games. The frame is also appealing for its bargaining-like features and its intuitive setup.

An example of the bargaining table version of the Pizza Night game is shown in Figure 1.

(Insert Figure 1 here)

Tables (i) and (ii) represent views C3 and C4 respectively, with S = 8 and L = 13, and make up a Pizza Night game in which one equilibrium is label-salient. The game is presented as a 9x9 grid of squares – the *bargaining table* – in which a player ('You') is assigned to the red *base* at the bottom, and faces an 'Other' player who sees the game from the grey base at the top. The 'Other' player in table (i) is the 'You' player in table (ii), and vice versa. Players can easily work out how the table looks like from their co-player's perspective.

The players' objective is to tacitly agree on a division of the *discs* – the two round objects scattered on the table. Each disc has a value (in UK pounds) to each player, represented by the number shown on the half of the disc facing the player's own base. All values, as well as the location of the discs on the table, are common knowledge between the players. Each player separately indicates which disc(s) they propose to take, *claiming* either

[8] Note that, in games without payoff cues, every strategy must have a distinct label (if not, players could not distinguish the two strategies and it would not be possible to determine the outcome of the game based on their undistinguishable choices). Whenever there are commonly known labels, it is not possible to completely eliminate all possible cues that players may find in them. To isolate the effects of labelling, we need to study games that differ with respect to the *comparative* salience of their labels. See Section 3.

none, one, or both discs, without knowledge of their co-player's claims. Discs are claimed by clicking on them, and claims can be cancelled with a further click. Claims are visualised by colouring the claimed disc in red and connecting it to the red base with a red line,[9] and can be freely changed until they are submitted. There is an agreement on the division of the discs whenever no disc is claimed by both players. In that case, each player earns a payoff equal to the value *to them* of the disc(s) they claimed. If *any* disc is claimed by both players, there is no agreement and both players earn a payoff of zero.

Because claiming no discs ensures a payoff of zero, it is a weakly dominated strategy. Once this is eliminated, it makes no sense to claim both discs. When each player claims exactly one disc, the game reduces to a 2×2 diagonal coordination game with two pure-strategy Nash equilibria, whose payoff matrix is identical to that of a Pizza Night game.[10] In tables (i) and (ii), the two strategies available to each player can be labelled *Close* (i.e., claim the disc closest to your base) and *Far* (i.e., claim the disc farthest from your base). Close is label-salient (see Isoni et al., 2013, 2014, 2018). Tables (iii) and (iv) produce an identical payoff matrix, except that now the strategies can be labelled *Left* (i.e., claim the disc more to the left as seen from your base) and *Right* (i.e., claim the disc more to the right). Since neither Left nor Right is salient (see Isoni et al., 2013, 2014, 2018), tables (iii) and (iv) produce views N3 and N4 respectively, with $S = 8$ and $L = 13$, and so constitute a Pizza Night game without labelling cues.

By independently assigning the two values in an $\{S, L\}$ payoff pair to the two sides of each disc, we can produce bargaining table versions of all the games listed in Table 1. In the experiment, each participant faced an independently determined sequence of twenty-six 'scenarios', corresponding to views C1–C16 and N1–N10. All scenarios had just two discs, but differed with respect to the degree of inequality in the payoff pair (we counterbalanced the four pairs {10, 11}, {8, 13}, {6, 15}, and {4, 17}) and in the positions of the two discs for each pair of matched game views.[11] Changing the difference between S and L allows us to investigate whether, if inequality matters, its size is also important. We did not expect

[9] Some screenshots of the experiment can be found in the Appendix.

[10] Allowing players to claim none or both discs enhances the bargaining feel of the game. Isoni et al. (2013) also show that it results in more effective use of salient labels. Weakly dominated claims are rare (see Isoni et al., 2013; 2018).

[11] More details on these aspects of the design can be found in the Appendix.

different disc layouts to have systematic effects,[12] but making each task more novel reduced the potential spill-overs between games.

There was no feedback between scenarios, so each of them can be effectively considered a one-shot game. Participants were told that they had been matched to another person for the duration of the experiment. At the end of the experiment, one game was selected for each pair of participants, and they were paid on the basis of the claims they made in the selected game. In addition, they received a participation fee of £5.

4. Hypotheses

In this section, we state explicit hypotheses regarding conflict of interest and payoff inequality in our games. There are other factors that can be investigated with our design (i.e., the effect of salient labels in different payoff structures, the relative strength of labelling and payoff cues, trade-offs between efficiency and equality), which we will only mention briefly in the overview of our results. Readers interested in these other aspects are referred to the Appendix.

All our hypotheses are about *coordination success* – the probability that, in a given game, randomly chosen pairs of players select strategies leading to one of the two pure-strategy Nash equilibria. We begin from the finding that, for labelling cues of given salience, coordination success tends to be systematically lower in Battle of the Sexes games than in Pure Coordination games. Our first hypothesis is that our experiment replicates this finding.

Hypothesis 1 – Validation. *In the presence of labelling cues, coordination success is lower in Battle of the Sexes games than in Pure Coordination games*.

As we have explained, our new Pizza Night game with labelling cues allows us to disentangle the effects of conflict of interest and payoff inequality. We can do this by comparing coordination success in this game with that in Battle of the Sexes and that in Pure Coordination games with the same labelling cues. The first comparison isolates the effect of conflict of interest, the second the effect of payoff inequality. These are our next two hypotheses.

[12] This expectation was confirmed. See details in the Appendix.

Hypothesis 2 – Effect of conflict of interest. *In the presence of labelling cues, coordination success is lower in Battle of the Sexes games than in Pizza Night games.*

Hypothesis 3 – Effect of payoff inequality. *In the presence of labelling cues, coordination success is lower in Pizza Night games than in Pure Coordination games*.

If we find support for both hypotheses, it means that both factors have a disruptive effect on coordination. If we find support for Hypothesis 2 but not for Hypothesis 3, it means that the only disruptive factor is conflict of interest. If only Hypothesis 3 is supported, the only source of disruption is payoff inequality.

Hypothesis 3 focuses on the possible disruptive effect of payoff inequality in situations in which salient labels provide the only commonly available cues for coordinating. We investigate also whether such effects extend to cases in which there are payoff cues that can assist coordination. The neatest case of this kind is represented by a HiLo game without labelling cues. The presence of a Pareto dominant equilibrium is the only available cue, and is normally used effectively to achieve coordination (e.g., Bacharach, 2006; Bardsley et al., 2010; Isoni et al., 2018). If strategies leading to an unequal equilibrium are less likely to be chosen, making the 'Hi' equilibrium unequal (as in Hi-Unequal games) will obstruct coordination, while making the 'Lo' equilibrium unequal (as in Lo-Unequal games) may increase coordination (if not already maximal), but will certainly not decrease it. If labelling cues have effects which are independent of payoff inequality, similar effects may arise in games in which those cues are present. On these bases, we can state our final two hypotheses.

Hypothesis 4 – Inequality of the efficient equilibrium. *Coordination success is lower in Hi-Unequal games than in HiLo games, both (a) in the absence and (b) in the presence of labelling cues.*

Hypothesis 5 – Inequality of the inefficient equilibrium. *Coordination success is not lower in Lo-Unequal games than in HiLo games, both (a) in the absence and (b) in the presence of labelling cues*

5. Experimental results

We recruited 200 participants from the general student population of the University of East Anglia (UK), using the hRoot online recruitment system (Bock et al., 2012) in the Autumn of 2016. Sessions took on average sixty minutes and resulted in an average payment of £13.46, including the £5 participation fee. The experiment was programmed in zTree (Fischbacher, 2007).

5.1 Overview

We begin with a brief summary of the claims made by the participants in the games with labelling cues. These are summarised in Table 2. Because participants could not tell the difference between Pure Coordination games in which all payoffs where *S* and those in which they were all *L*, these two cases are pooled. Table 2 aggregates the data across different payoff pairs. A breakdown is presented in the Appendix.

(Insert Table 2 here)

The first aspect to notice is that weakly dominated claims were rare. The percentage of cases in which no disc was claimed is always lower than 1 percent. Both discs were claimed on average in just 2.8 percent of the cases.

The single-disc claims reveal that the close disc was claimed by the majority of participants in Pure Coordination, Pizza Night, and Battle of the Sexes. However, this was much less often the case in Battle of the Sexes than in Pizza Night and Pure Coordination. In Battle of the Sexes, the pattern of claims changed with the size of the payoff difference. In C5, the close (more valuable) disc was claimed less often for small payoff differences (the {10, 11} pair) than for large ({4, 17}),[13] in line with the findings of Crawford et al. (2008) and Isoni et al. (2013, 2018). Interestingly, single-disc close claims were less frequent in Pizza Night when the player was on the disadvantageous side of inequality.

The other games all have a payoff cue: one equilibrium (weakly) Pareto dominates the other. This cue was always very strong, as indicated by the fact that in all cases a large majority of single-disc claimants selected the more valuable disc. Labelling cues disrupted this tendency slightly (compare C7 and C8, C10 and C12, C13 and C15). Making one equilibrium unequal did not interfere with the use of the efficiency cue (single-disc close claims in Hi*Lo, Hi*Lo≠ and Hi≠*Lo are all around 90 percent; in HiLo* with HiLo≠* and Hi≠Lo all around 20 percent).

[13] See the breakdown in the Appendix.

The response time data reflect both how easy it was to process the information contained in the game display and how much deliberation took place. Our games differ in both respects. Arguably, Pure Coordination is easiest to read (there is just one payoff value), Battle of the Sexes is second (each disc has two identical values), followed by Pizza Night (each disc has the same two values in the same positions), and Hi*Lo and HiLo* have the most complicated displays (with different values in the two halves and opposite value positions in the two discs). Taking this relative difficulty into account, we can see how conflict of interest and payoff inequality affected deliberation. Not surprisingly, decisions were quickest in Pure Coordination games. In spite of their complicated displays, Hi*Lo and HiLo* were next quickest. In Pizza Night, response times were significantly longer than in Pure Coordination ($p < 0.01$). Because they were also longer than in the more complex HiLo games ($p < 0.01$ for both Hi*Lo and HiLo*), this must reflect the extra deliberation needed to deal with inequality. Decisions were slowest in Battle of the Sexes, where response times were significantly longer than in Pure Coordination and Pizza Night ($p < 0.01$). Because they were also longer than in HiLo games ($p < 0.01$ for both Hi*Lo and HiLo*), which have more complex displays, the effect must be attributable to deliberation. The longer time it took to respond to C5 than C6 ($p < 0.01$) indicates that it was particularly difficult to decide when one was favoured by the labelling cue.

5.2 Tests of our hypotheses

For the tests of our hypotheses, we will use *Mean Expected Coordination Success* (MECS) computed using the *legitimate matching procedure* (Isoni et al., 2013; 2018). For each game view, we match each participant, in turn, with all other participants who made decisions in a game view compatible with theirs with respect to the position of the discs and the disc values. (For example, for C3 in Figure 2, each player of C3 is matched with all players of C4 except themselves.) For all these legitimate matches, we check whether the claims made by the two players overlap – resulting in coordination failure – or not – resulting in successful coordination. For each participant, this produces a measure of expected coordination success equal to the proportion of matches in which they coordinated successfully. For each game, MECS is the average across participants of these proportions for the relevant game views.

Summaries of MECS in all our games are presented in Table 3. Again, we pool across different payoff pairs, and report a detailed decomposition in the Appendix.

(Insert Table 3 here)

All our hypotheses entail comparisons of MECS between pairs of games. Because MECS is obtained by repeatedly matching participants with each other, our statistical tests are based on bootstrapping the distribution of MECS of one of the games, and checking whether the actual MECS of the other falls in the relevant tail of the bootstrapped distribution.[14] We can now turn to the results of the tests of our Hypotheses.

Result 1 – Validation. *In the presence of labelling cues, coordination success is significantly lower in Battle of the Sexes than in Pure Coordination games.*

Support. MECS is 0.80 in PC*, and just 0.51 in BS*. This difference is statistically significant ($p < 0.01$) in our bootstrap test. In both cases labelling cues improve coordination substantially relative to the game without labelling cues. (In BS, MECS is just 0.38, indicating systematic *dis*coordination, which is possible in this game if the majority of players claim the disc more valuable to them, an effect that depends on the size of the payoff differences – see Appendix.) As we saw in Table 2, the close disc was claimed much more often in Pure Coordination than Battle of the Sexes. Hypothesis 1 is strongly supported.

Result 2 – Effect of Conflict of Interest. *In the presence of labelling cues, coordination success is significantly lower in Battle of the Sexes games than in Pizza Night games.*

Support. MECS is 0.51 in BS*, and 0.73 in PN*. This difference is statistically significant ($p < 0.01$). In PN*, the close disc was claimed overall by 91 percent of single-disc claimants, suggesting that closeness is used very effectively in that game. This provides strong support for Hypothesis 2: conflict of interest has a major disruptive effect on tacit coordination.

Result 3 – Effect of Payoff Inequality. *In the presence of labelling cues, coordination success is significantly lower in Pizza Night games than in Pure Coordination games*.

Support. MECS is 0.73 in PN*, and 0.80 in PC*. This difference is statistically significant ($p < 0.05$. This provides support for Hypothesis 3, and indicates that payoff inequality does impede coordination. However, this effect is rather small. Single-disc close claims go down only slightly, from 94 percent in PC* to 91 percent overall in PN*. Because so many claim the close disc in PC*, the bootstrapped distribution of MECS is very tight, and even small

[14] This approach follows Isoni et al. (2018). Details can be found in the Appendix.

differences end up being significant. The longer response times in PN* indicate that participants have to think longer when the outcome of coordination is unequal.

Result 4 – Inequality of the efficient equilibrium. *Coordination success is not significantly different in Hi-Unequal and HiLo games, both (a) in the absence and (b) in the presence of labelling cues.*

Support. MECS is 0.77 in HiLo, and 0.76 in Hi≠Lo. The comparison of MECS does not yield a significant difference at conventional levels, giving part (a) of the result. MECS is 0.78 in Hi*Lo, and 0.80 in Hi≠*Lo; it is 0.65 in HiLo*, and 0.66 in Hi≠Lo*. Neither difference is statistically significant, giving part (b) of the result. Regardless of which equilibrium is label-salient, making the efficient equilibrium unequal does not decrease coordination success.

Result 5 – Inequality of the inefficient equilibrium. *Coordination success is not significantly different in Lo-Unequal and HiLo games, both (a) in the absence and (b) in the presence of labelling cues.*

Support. MECS is 0.77 in HiLo, and 0.74 in HiLo≠. These values are not significantly different at conventional levels, giving part (a) of the result. MECS is 0.78 in Hi*Lo, and 0.80 in Hi*Lo≠; it is 0.65 in HiLo*, and 0.68 in HiLo≠*. Neither difference is statistically significant, giving part (b) of the result. Regardless of which equilibrium is label-salient, making the inefficient equilibrium unequal does not increase coordination success.

6. Two key insights about the effects of payoff inequality on coordination

Many real-world interactions pose coordination problems that need to be resolved without communication. Schelling (1960) suggested that players can coordinate by relying on commonly known cues about payoffs or labels, even when the players' preferences are not perfectly aligned. The evidence supports Schelling's hypothesis, but in games with a Battle of the Sexes structure, successful coordination is much harder to achieve.

We have identified two possible causes of such coordination failures: conflict of interest – players prefer different equilibria – and payoff inequality – conditional on coordinating, one player's payoff is higher – and devised a new game – the Pizza Night game – to isolate the effect of payoff inequality. We have also explored the effect of payoff inequality in situations in which coordination may result in mutual benefit. Our experimental results provide a clear picture about the effects of inequality on the likelihood that tacit bargaining games result in an agreement which produces positive payoffs for both players. These provide two key insights.

The first insight is that, when salient labels provide the only cues to solve a coordination problem, payoff inequality does not provide much of an obstacle. In the Pizza Night game coordination success is consistently high, irrespective of the size of the resulting differences in material payoffs. On average, two randomly chosen players are expected to coordinate 73 percent of the time, only slightly less often than the 80 percent observed in Pure Coordination games. This reveals a willingness by players to accept even very large payoff inequalities for the sake of coordination, which may seem surprising in the light of the emphasis that behavioural economists often put on aversion to inequality (e.g., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000).

The second insight is that payoff inequality is not able, on its own, to inhibit tacit agreements that result in efficient outcomes, irrespective of whether these are supported or opposed by labelling cues. This is an important result from the point of view of economics, because mutual benefit is a distinctive feature of most market transactions, many of which can result in surplus distributions that systematically favour one of the parties. The fact that a certain agreement results in an unequal outcome is not an obstacle to the realisation of mutual benefit.

The greatest challenge to tacit coordination is represented by overt conflicts of interest.

References

Bacharach, Michael and Michele Bernasconi (1997). The variable frame theory of focal points: an experimental study. *Games and Economic Behavior* 19(1): 1–45.

Bacharach, Michael (2006), edited by Natalie Gold and Robert Sugden. *Beyond Individual Choice: Teams and Frames in Game Theory*. Princeton University Press.

Bardsley, Nicholas, Judith Mehta, Chris Starmer and Robert Sugden (2010). Explaining focal points: cognitive hierarchy theory versus team reasoning. *Economic Journal* 20(March): 40–79.

Bock, Olaf, Ingmar Baetge and Andreas Nicklisch (2014). hroot: Hamburg registration and organization online tool. *European Economic Review* 71(1): 117–120.

Bolton, Gary E. and Axel Ockenfels (2000). ERC: A theory of equity, reciprocity, and competition. *American Economic Review* 90(1): 166–193.

Bruni, Luigino and Robert Sugden (2013). Reclaiming virtue ethics for economics. *Journal of Economic Perspectives* 27(4): 141–164.

Crawford, Vincent P., Uri Gneezy and Yuval Rottenstreich (2008). The power of focal points is limited: even minute payoff asymmetry may yield large coordination failures. *American Economic Review* 98(4): 1443–1458.

Dawes, Robym M., Alphons J. C. Van De Kragt and John M. Orbell (1988). Not me or thee but we: The importance of group identity in eliciting cooperation in dilemma situations: Experimental manipulations. *Acta Psychologica* 68(1–3): 83–97.

Fehr, Ernst and Klaus M. Schmidt (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114(3): 817–868.

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

Harsanyi, John C. and Reinhard Selten (1988). *A General Theory of Equilibrium Selection in Games*. Cambridge, MA: The MIT Press.

Isoni, Andrea, Anders Poulsen, Robert Sugden and Kei Tsutsui (2013). Focal points in tacit bargaining problems: experimental evidence. *European Economic Review* 59(April): 167–188.

Isoni, Andrea, Anders Poulsen, Robert Sugden and Kei Tsutsui (2014). Efficiency, equality and labelling: an experimental investigation of focal points in explicit bargaining. *American Economic Review* 104(10): 3256–3287.

Isoni, Andrea, Anders Poulsen, Robert Sugden and Kei Tsutsui (2018). Focal points and payoff information in tacit bargaining. Unpublished manuscript.

Mehta, Judith, Chris Starmer and Robert Sugden (1994). The nature of salience: an experimental investigation of pure coordination games. *American Economic Review* 84(3): 658–673.

Perdue, Charles W., John F. Dovidio, Michael B. Gurtman and Richard B. Tyler (1990). Us and them: Social categorization and the process of intergroup bias. *Journal of Personality and Social Psychology* 5(3): 475–186.

Prentice, Deborah A. and Dale T. Miller (1992). The psychology of ingroup attachment. Paper presented at conference on The Self and the Collective, Princeton University.

Rabbie, Jacob M. and Murray Horwitz (1969). Arousal of ingroup-outgroup bias by a chance win or loss. *Journal of Personality and Social Psychology* 13(3): 269–277.

Schelling, Thomas C. (1960). *The Strategy of Conflict*. Harvard University Press, Cambridge, MA.

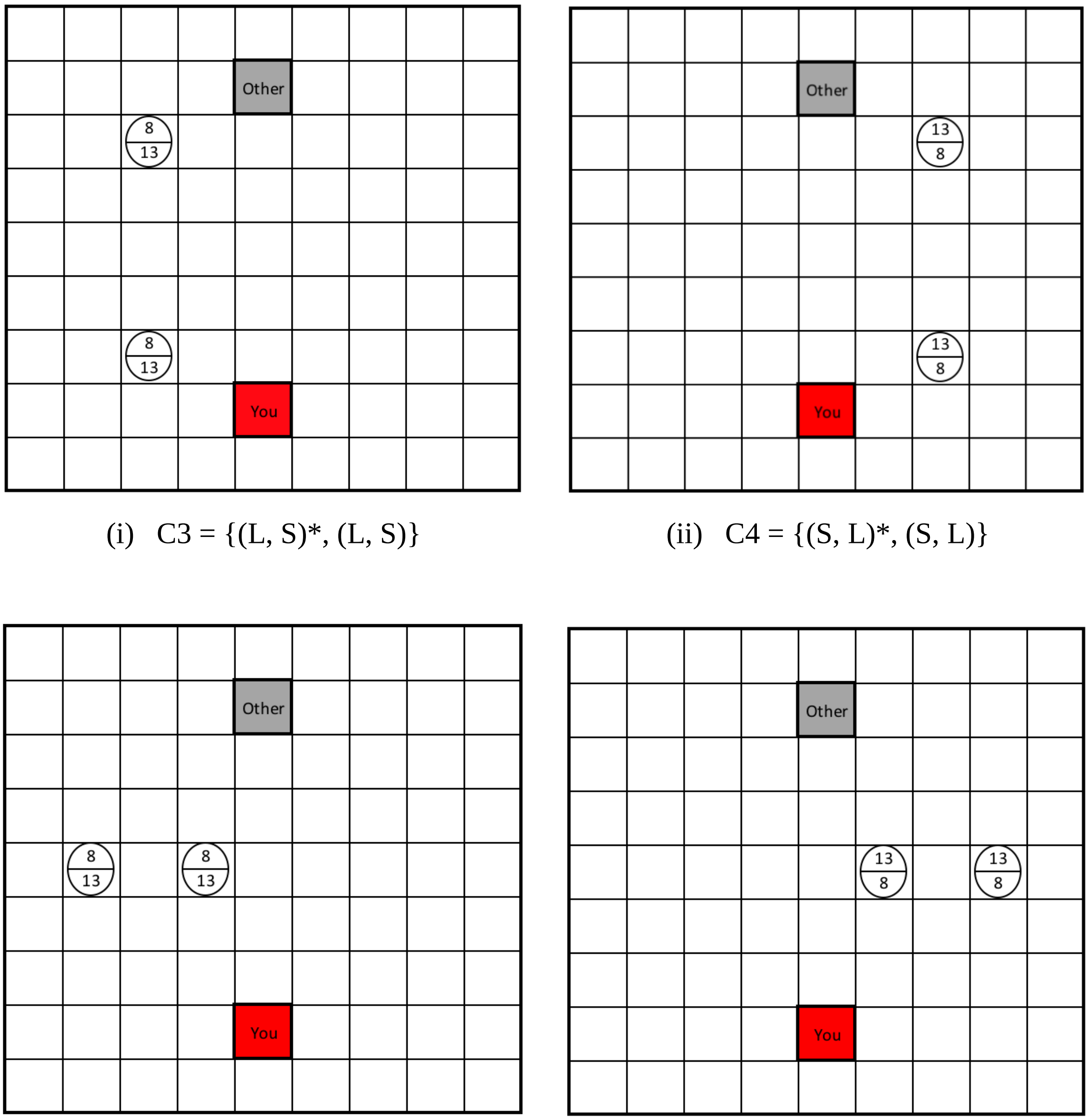
Sherif, Muzafer, O. J. Harvey, B. Jack White, William R. Hood and Carolyn W. Sherif (1961). *Intergroup Conflict and Cooperation: The Robbers Cave Experiment*. Norman: University of Oklahoma Book Exchange.

Sitzia, Stefania and Jiwei Zheng (2018). Group behaviour in tacit coordination games with focal points – An experimental investigation. *University of East Anglia Centre for Behavioural and Experimental Social Science Working Paper* 2017-02R.

Sugden, Robert and Ignacio Zamarrón (2006). Finding the key: the riddle of focal points. *Journal of Economic Psychology* 27 (2006): 609–621.

Tajfel, Henri (1970). Experiments in intergroup discrimination. *Scientific American* 223(5): 96–102.

Zizzo, Daniel J. and Jonathan H. W. Tan (2011). Game harmony: A behavioral approach to predicting cooperation in games. *American Behavioral Scientist* 55(8): 987–1013.



(i) C3 = {(L, S)*, (L, S)}

(ii) C4 = {(S, L)*, (S, L)}

(iii) N3 = {(L, S), (L, S)}

(iv) N4 = {(S, L), (S, L)}

Figure 1 – The Pizza Night game in the Bargaining Table frame

Table 1 – Games and views with and without labelling cues

Game with labelling cues			Game without labelling cues		
Game	**View of Player *i***	**View of Player *j***	**Game**	**View of Player *i***	**View of Player *j***
PC S*	C1 = {(S, S)*, (S, S)}	C1 = {(S, S)*, (S, S)}	PC S	N1 = {(S, S), (S, S)}	N1 = {(S, S), (S, S)}
PC L*	C2 = {(L, L)*, (L, L)}	C2 = {(L, L)*, (L, L)}	PC L	N2 = {(L, L), (L, L)}	N2 = {(L, L), (L, L)}
PN*	C3 = {(L, S)*, (L, S)}	C4 = {(S, L)*, (S, L)}	PN	N3 = {(L, S), (L, S)}	N4 = {(S, L), (S, L)}
BS*	C5 = {(L, S)*, (S, L)}	C6 = {(S, L)*, (L, S)}	BS	N5 = {(L, S), (S, L)}	N5 = {(L, S), (S, L)}
Hi*Lo	C7 = {(L, L)*, (S, S)}	C7 = {(L, L)*, (S, S)}	HiLo	N6 = {(L, L), (S, S)}	N6 = {(L, L), (S, S)}
HiLo*	C8 = {(S, S)*, (L, L)}	C8 = {(S, S)*, (L, L)}			
Hi*Lo≠	C9 = {(L, L)*, (L, S)}	C10 = {(L, L)*, (S, L)}	HiLo≠	N7 = {(L, L), (L, S)}	N8 = {(L, L), (S, L)}
HiLo≠*	C11 = {(L, S)*, (L, L)}	C12 = {(S, L)*, (L, L)}			
Hi≠*Lo	C13 = {(L, S)*, (S, S)}	C14 = {(S, L)*, (S, S)}	Hi≠Lo	N9 = {(L, S), (S, S)}	N10 = {(S, L), (S, S)}
Hi≠Lo*	C15 = {(S, S)*, (L, S)}	C16 = {(S, S)*, (S, L)}			

Table 2 – Summary of claims in games with labelling cues

Game	View	Claim frequencies				Single-disc Close claims (%)	Single-disc High-Value claims (%)	Median response time
		None	Close	Far	Both			
PC*	C1 = {(S, S)*, (S, S)} and C2 = {(L, L)*, (L, L)}	4	352	24	20	94%	n/a	4.06
PN*	C3 = {(L, S)*, (L, S)}	1	170	13	16	93%	n/a	6.52
	C4 = {(S, L)*, (S, L)}	2	167	22	9	88%	n/a	6.29
BS*	C5 = {(L, S)*, (S, L)}	2	110	83	5	57%	57%	7.90
	C6 = {(S, L)*, (L, S)}	2	137	59	2	70%	30%	6.67
Hi*Lo	C7 = {(L, L)*, (S, S)}	0	175	21	4	89%	89%	5.34
HiLo*	C8 = {(S, S)*, (L, L)}	0	40	157	3	20%	80%	6.14
Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0	176	20	4	90%	n/a	6.62
	C10 = {(L, L)*, (S, L)}	0	178	18	4	91%	91%	6.03
HiLo≠*	C11 = {(L, S)*, (L, L)}	1	31	164	4	16%	n/a	7.32
	C12 = {(S, L)*, (L, L)}	1	38	155	6	20%	80%	7.13
Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0	178	19	3	90%	90%	4.77
	C14 = {(S, L)*, (S, S)}	2	176	18	4	91%	n/a	5.31
Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0	39	158	3	20%	80%	6.10
	C16 = {(S, S)*, (S, L)}	1	36	156	7	19%	n/a	6.05

None = no disc claimed; Close = only close disc claimed; Far = only far disc claimed; Both = both discs claimed. Single-disc Close claims = percentage of close claims conditional on only one disc being claimed. Single-disc High-Value claims = percentage of claims on the more valuable disc conditional on only one disc being claimed. Response time = time elapsed between the moment the game was shown on the screen and the moment claims were submitted.

Table 3 – Summary of coordination success

Labelling cues		**No labelling cues**	
Game	**MECS**	**Game**	**MECS**
PC*	0.80	PC	0.46
PN*	0.73	PN	0.44
BS*	0.51	BS	0.38
Hi*Lo HiLo*	0.78 0.65	HiLo	0.77
Hi*Lo≠ HiLo≠*	0.80 0.68	HiLo≠	0.74
Hi≠*Lo Hi≠Lo*	0.80 0.66	Hi≠Lo	0.76

MECS = Mean Expected Coordination Success computed using the legitimate matching procedure.

Appendix (intended for online publication)

Appendix A – Experimental instruction

Introduction
Welcome and thank you for taking part in this experiment.

Please wait for instructions...

[oral: I will now take you through the instructions. These will appear on your screen, and I will read them out.]

[EXPERIMENTER CLICKS OK]

The scenarios
Everyone in the room is receiving exactly the same instructions.

You will be presented with **26** different scenarios, one after the other. Each scenario is an interaction between **you** and an **other** person.

You and the other person will face the same **26** scenarios (but not in the same order – the order in which you face them has been chosen randomly by the computer, separately for each person).

The real scenario
One of these scenarios is **real**. By this we mean that:

- The computer has randomly paired you with another person in the room. You will never be told who this person is.
- The computer has randomly picked a scenario for the two of you. You will not know which this is until the end of the session.
- The decisions that you and the other person make in this scenario determine how much money each of you will be paid at the end of the session.

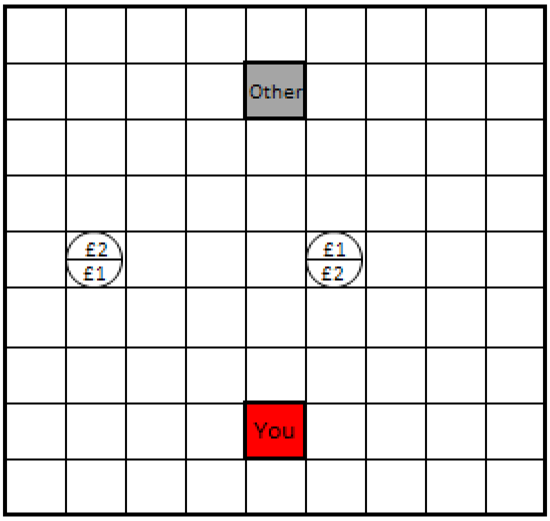
Because you will not know which scenario is the real one until you have responded to all of them, you should treat each scenario as if it was the real one. So, when thinking about each scenario, remember that it could be the real one and think about it in isolation from the others.

[EXPERIMENTER CLICKS OK]

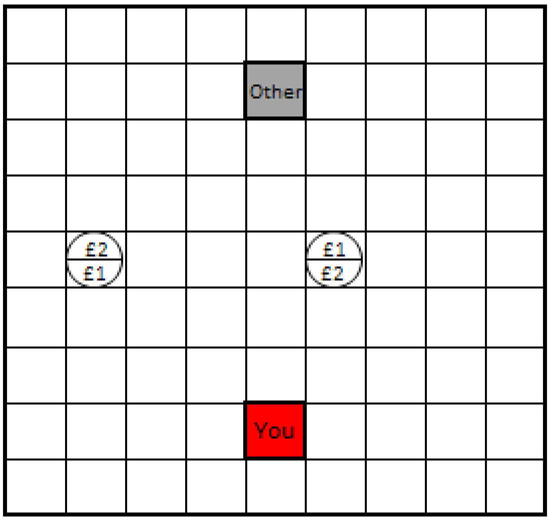
An example of a scenario
Each scenario is represented to you with a picture like the one displayed on the screen. We will call this picture a **table**.

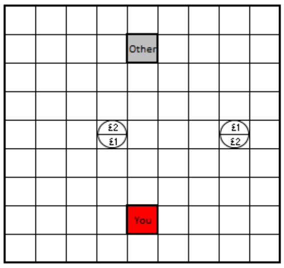
In this scenario you and the other person each have a **base**, represented by the red square (for you) and the grey square (for the other person).

There are some **discs** on the table. Each disc has a money value, which can be different for you and the other person. This is indicated by the horizontal line that divides the disc in two halves. The value to each person is contained in the half facing that person's base.
For example, on the table shown on your screen there are two discs, one disc (on the left) worth £1 to You and £2 to the Other person, and the other disc (on the right) worth £2 to You and £1 to the Other person.



[EXPERIMENTER CLICKS OK]
How the scenario is seen by each person…
Each person will see the scenario from a red base at the bottom of the screen. Therefore, each person can easily figure out what the other person will be seeing. In this example, this is shown in the picture below.





[EXPERIMENTER CLICKS OK]

<u>The basic rules</u>
You and the other person have the opportunity to agree on a division of the discs.

You and the other person separately record which discs you propose to take. We will say that you are **<u>claiming</u>** 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 person claimed. That is, you and the other person claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn <u>the total of the values of these discs to you</u> (regardless of how much they are worth to the other person).

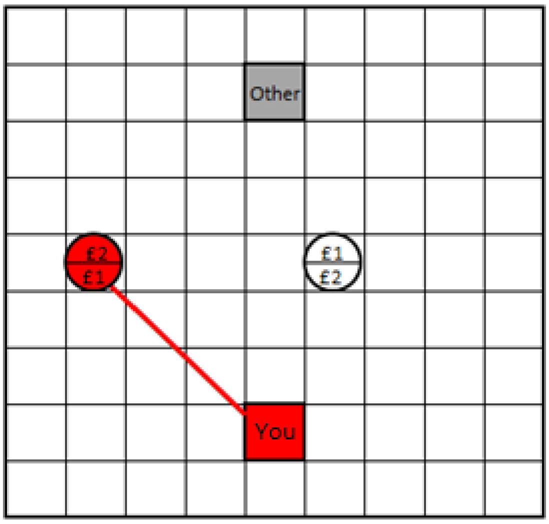
But if <u>any</u> disc has been claimed by both you and the other person, there is no agreement. In this case, you get no discs and so earn nothing.

[EXPERIMENTER CLICKS OK]

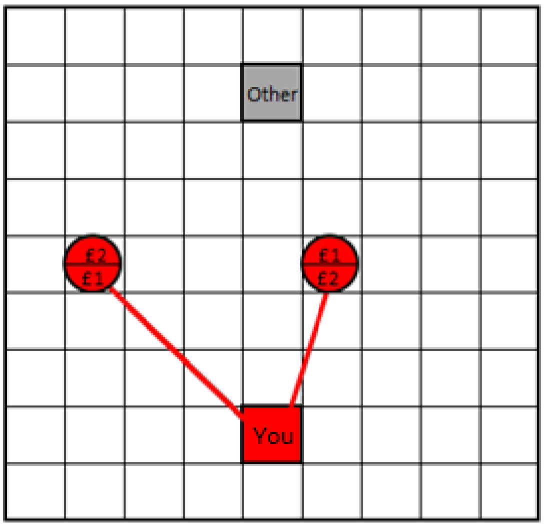
<u>Claiming discs</u>
Initially, all the discs are white. This indicates that you have not yet made any claims.

You claim a disc by clicking on it with your mouse. If you do this, the disc turns red, and a red line connecting the disk to your base appears on the table.

[oral: To see how this works, consider the scenario shown on your screen. Click on one of the discs to claim it.]

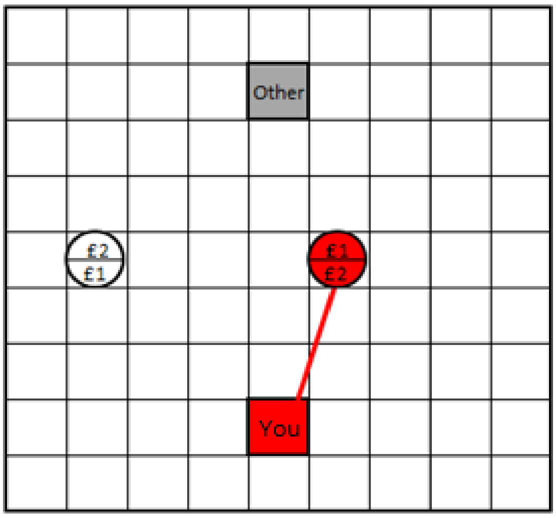


[oral: Now click on the other disc to claim that as well.]



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 red line connecting it to your base then disappears, and the disc turns white again.

[oral: To see how this works, click again on one of the discs you just claimed.]



[oral: Try this again a few times.]

Underneath the table, there will be a ‘SUBMIT’ button. Once you are happy with your claims, you will be able to press this button to confirm your decision and move to the next scenario in the series.

[oral: If you are satisfied that you understand how to claim and unclaim a disc, press on the OK button.]

[EXPERIMENTER CLICKS OK]

<u>Your earnings</u>
When you have finished all 26 scenarios, you will be told which of them was the real one. This scenario will appear on your screen again, and this time you will see both the claims you made and the claims made by the other person. You will not be able to change your claims at this stage.

How much you earn depends on the value of the discs to you, and on the claims made by you and the other person. Remember the rules that determine your earnings:

- There is an agreement if you have not claimed any disc that the other person claimed. That is, you and the other person claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total of the values of these discs to you (regardless of how much they are worth to the other person).

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

Your earnings will also include a £5 participation fee and will be paid to you in cash straight away.

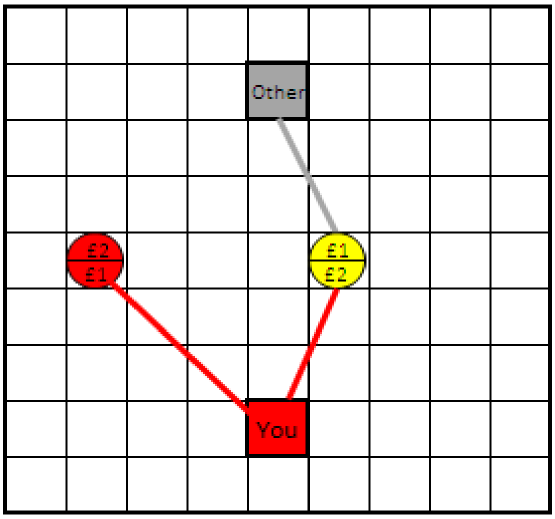
Receiving your earnings will end your participation in the experiment.

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

[EXPERIMENTER CLICKS OK]

Example 1

Suppose the real scenario is the one shown on the screen, and that your claims and the other person's are as shown.

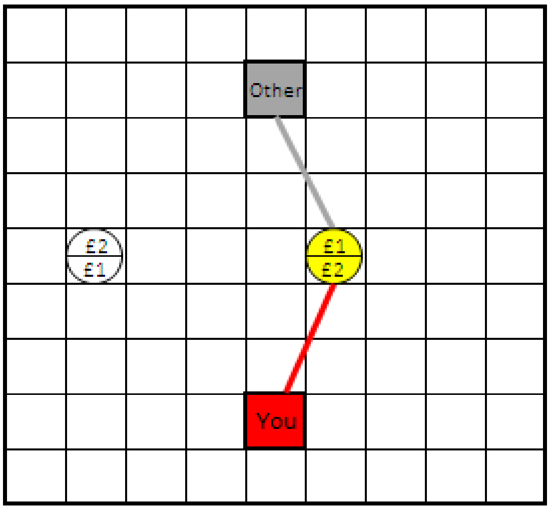


You claimed both discs and the other person claimed just one disc. In this case, because one disc has been claimed by both you and the other person, there is no agreement. So neither you nor the other person gets any discs, and so both earn nothing.

[EXPERIMENTER CLICKS OK]

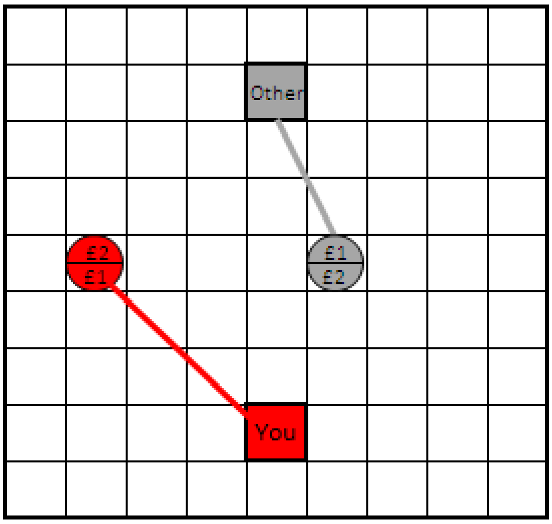
Example 2

Now suppose your claims and the other person's are as shown.



As in the previous example, because one disc has been claimed by both you and the other person, there is no agreement. So neither you nor the other person gets any discs, and so both earn nothing.
[EXPERIMENTER CLICKS OK]

Example 3
Now suppose your claims and the other person's are as shown.

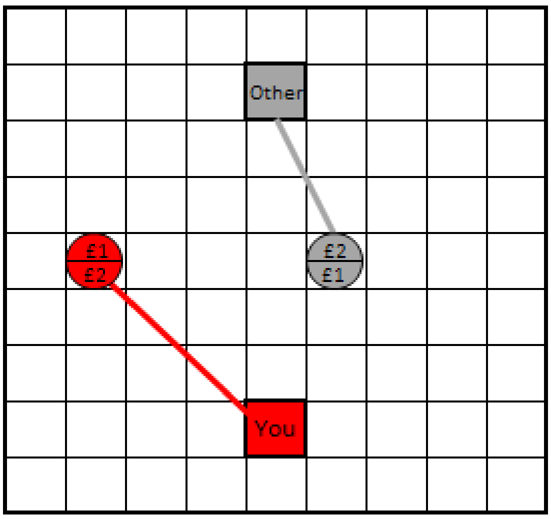


In this case, no disc has been claimed by both you and the other person, so there is an agreement. You get the disc that is worth £1 to you (and £2 to the other person), and the other person gets the disc worth £1 to them (and £2 to you). Therefore, you each earn £1.

[oral: The following questions are designed to check your understanding of these rules and other important aspects of the instructions. Please raise your hand if anything is unclear.]

[EXPERIMENTER CLICKS OK]

Question 1 of 6
Consider the scenario and claims shown on the screen. Your claims and the other person's are as shown. How much do you and the other person earn?



Choose your answer by selecting the appropriate option below.

1. You earn £1 and the other person earns £1

2. You earn nothing and the other person earns nothing
3. You earn £2 and the other person earns £2
4. You earn nothing and the other person earns £2
5. You earn £2 and the other person earns £1

Then press SUBMIT to enter your answer...

Answer to question 1
Your answer is correct.

Press NEXT to proceed...

OR:

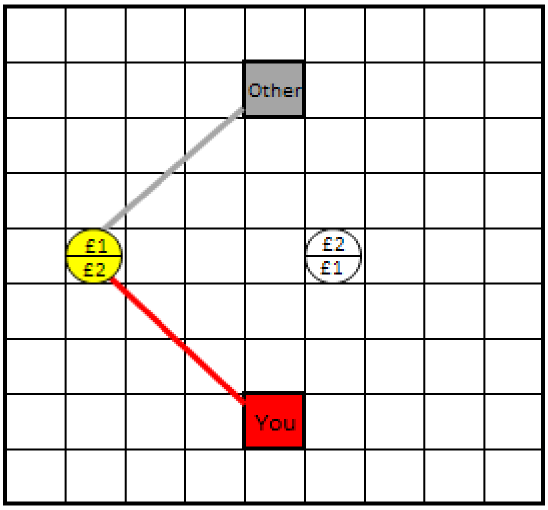
Your answer is incorrect. Remember the rules that determine your earnings:

- There is an agreement if you have not claimed any disc that the other person claimed. That is, you and the other person claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total of the values of these discs to you (regardless of how much they are worth to the other person).

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

Press BACK to try again...

Question 2 of 6
Consider the scenario and claims shown on the screen. Your claims and the other person's are as shown. How much do you and the other person earn?



Choose your answer by selecting the appropriate option below.

1. You earn £1 and the other person earns £1
2. You earn nothing and the other person earns nothing
3. You earn £2 and the other person earns £2

4. You earn nothing and the other person earns £2
5. You earn £2 and the other person earns £1

Then press SUBMIT to enter your answer...

<u>Answer to question 2</u>
Your answer is correct.

Press NEXT to proceed...

OR:

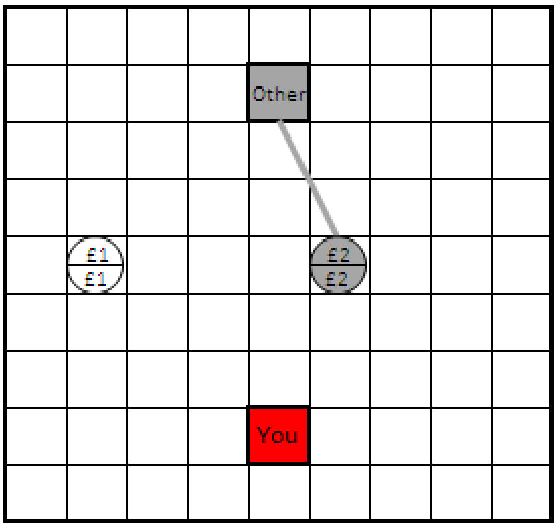
Your answer is incorrect. Remember the rules that determine your earnings:

- There is an agreement if you have not claimed any disc that the other person claimed. That is, you and the other person claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total of the values of these discs to you (regardless of how much they are worth to the other person).

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

Press BACK to try again...

<u>Question 3 of 6</u>
Consider the scenario and claims shown on the screen. Your claims and the other person's are as shown. How much do you and the other person earn?



Choose your answer by selecting the appropriate option below.

1. You earn £1 and the other person earns £1
2. You earn nothing and the other person earns nothing
3. You earn £2 and the other person earns £2
4. You earn nothing and the other person earns £2
5. You earn £2 and the other person earns £1

Then press SUBMIT to enter your answer...

Answer to question 3

Your answer is correct.

Press NEXT to proceed...

OR:

Your answer is incorrect. Remember the rules that determine your earnings:

- There is an agreement if you have not claimed any disc that the other person claimed. That is, you and the other person claimed different discs. In this case, you get all the discs that are yours according to the agreement. You then earn the total of the values of these discs to you (regardless of how much they are worth to the other person).

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

Press BACK to try again...

Question 4 of 6

Your earnings from the experiment will be:

1. The sum of your earnings from all the scenarios
2. The sum of your earnings from all the scenarios, plus the participation fee of £5
3. The amount you earn in the real scenario, plus the participation fee of £5
4. The amount you earn in the real scenario

Click on the correct answer, then press SUBMIT…

Answer to Question 4

Your answer is correct.

Press NEXT to proceed...

OR

Your answer is incorrect.

You will be paid your earnings in the real scenario plus the participation fee.

Press BACK to try again...

Question 5 of 6

For the real scenario, you will see the other person's claims:

1. While you are deciding on your claims
2. Immediately after submitting your claims for that scenario
3. At the end of the experiment

Click on the correct answer, then press SUBMIT…

Answer to question 5
Your answer is correct.

Press NEXT to proceed...

OR
Your answer is incorrect.

You will only see the other person’s claims at the end of the experiment.

Press BACK to try again...

Question 6 of 6
The order of the scenarios for the person you have been matched with will be:

1. Chosen randomly by the computer
2. The same order as yours
3. The opposite order to yours

Click on the correct answer, then press SUBMIT…

Answer to question 6
Your answer is correct.

Please wait...

OR

Your answer is incorrect.

The order in which you face the scenarios has been chosen randomly by the computer, separately for each person.

Press BACK to try again...

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

Remember that from now on any of the scenarios you encounter could be the one on which your payment depends. We ask you that you do not communicate with anyone in the room. If you have any problems with your computer, or if you want to ask any questions, please raise your hand and we will come to your desk to assist you.

[EXPERIMENTER CLICKS OK]

Appendix B – Consent Form

Information about the experiment

If you volunteer to do so, you will participate in an experiment which investigates economic decision making. The experiment will last approximately 60 minutes. During this time you will be seated at a computer terminal and will be asked to make various decisions. You will not be subjected to any risks other than those normally associated with working at a computer terminal.

At the end of the experiment you will receive a participation fee of £5. Depending on the decisions you have made, on chance and on decisions that other participants have made, you may receive a payment in addition to the participation fee. There is no possibility that you will lose money. Additional payments in studies like this one have varied from zero to £22.

At the start of the experiment, you will be asked to provide some basic information about yourself (e.g. age, gender, nationality) which can be used anonymously to investigate whether, for example, male and female participants behave differently. However, you will not be asked to provide any sensitive personal data (e.g. about your health, sexual lifestyle, ethnicity, political opinions, religious or philosophical beliefs, trade union membership, illegal activity, or criminal record). Each participant will be assigned an arbitrary identification number, specific to this experiment, which will be used in storing, analysing and reporting the data. The data will be used only for research purposes and may be reported in research publications and made available to other researchers. These data will be entirely anonymous.

When you signed up to the online database of the Centre for Behavioural and Experimental Social Science, you gave us your name, gender, and campus card number. We will keep a record on this database of the fact that you took part in this experiment. For accounting purposes, we will also need to ask you to sign a receipt for any money that we pay you. This information, which may be kept indefinitely, will be stored securely and used only for administrative and auditing purposes. Your participation in the experiment, and the decisions you take in it, will have no effect on your relationship with the University of East Anglia as a student or employee.

Please read the following paragraph taken from the instructions for today's study:

> 'It is important that you remain silent and do not look at what other participants are doing. 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 may be asked to leave and you will not be paid. We expect and appreciate your cooperation.'

Participation in the experiment is voluntary. We ask you to stay to the end of the session, out of consideration for the experimenters and for other participants. You will receive a payment only if you complete the experiment. However, you have the right to leave at any time without giving any reason.

This experiment has been approved by the Research Ethics Committee of the School of Economics, following principles that harmonise with policies of the University of East Anglia, the Economic and Social Research Council (ESRC), and the European Research Council, as well as with best practices in the profession. Our procedures for protecting personal information are in accordance with approved practice at the University of East Anglia and meet the University's obligations under the Data Protection Act 1998.

Consent to participate

I have read and understood the ‘Information about the experiment’ document and agree to participate in the experiment.

Full name:

Signature:

Date:

Appendix C - Detailed experimental design

Payoff pair

In our experiment, 200 subjects were equally divided into four subsamples. Table C.1 reports the way the payoff pairs were counterbalanced among game types for both the versions with labelling cues and the versions without.

Table C.1

Game	Subsample 1	Subsample 2	Subsample 3	Subsample 4
Pure Coordination and Pizza Night	{10, 11}	{4, 17}	{6, 15}	{8, 13}
Battle of the Sexes and HiLo	{8, 13}	{10, 11}	{4, 17}	{6, 15}
Hi-Unequal	{6, 15}	{8, 13}	{10, 11}	{4, 17}
Lo-Unequal	{4, 17}	{6, 15}	{8, 13}	{10, 11}

Layout

As in Isoni et al. (2018), each scenario could be presented in a number of different layouts (i.e. with the two discs in different positions). The differences between layouts did not affect the presence or absence of labelling cues. Figure C.1 shows an example of a layout for a game with labelling cues in which both the close and the far discs appear to the left of the 'You' base. The numbers next to the bargaining table are coordinates (not seen by subjects), which will be used to define the layouts used in the experiment. These layouts are reported in Table C.2, where L and R are used to indicate whether a disc appears to the left or to the right relative to the 'You' base. Figure C.1 is an LL layout. Each layout has a logical match, which is also listed in Table C.2.

Figure C.1

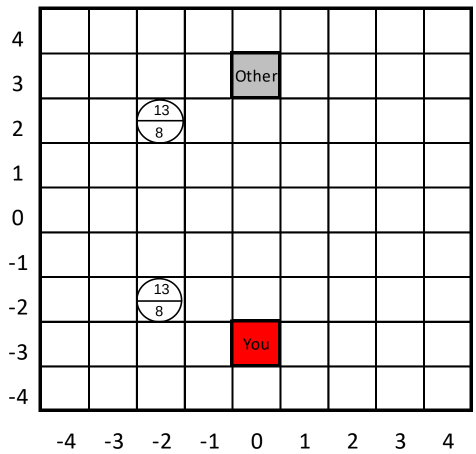


Table C.2

Layouts for games with labelling cues	Close disc		Far disc		Match
	Col	Row	Col	Row	
LL	–2	–2	–2	2	RR
RR	2	–2	2	2	LL
LR	–2	–2	2	2	LR
RL	2	–2	–2	2	RL

Layouts for games without labelling cues	Leftmost disc		Rightmost disc		Match
	Col	Row	Col	Row	
LL	–3	0	–1	0	LL
RR	1	0	3	0	RR
LR	–2	0	2	0	LR

Correspondence of games with and without labelling cues

As noted at the end of Section 2 of the paper, three pairs of games with salient labels (Hi*Lo and HiLo*; Hi*Lo≠ and HiLo≠*; and Hi≠*Lo and Hi≠Lo*) differ only in terms of which equilibrium is label-salient, and removing the salient label produces a single game without labelling cues. In our implementation of the games without labelling cues, we counterbalanced which disc appeared to the left of the 'You' base.

Appendix D – Summary of claims in games without labelling cues

Table D.1

Game	View	Claim Frequencies				Single-disc Left claims (%)	Single-disc High-Value claims (%)	Median response time
		None	Left	Right	Both			
PC S	N1 = {(S, S), (S, S)}	2	79	106	13	43%	n/a	5.55
PC L	N2 = {(L, L), (L, L)}	4	79	107	10	42%	n/a	6.07
PN	N3 = {(L, S), (L, S)}	2	68	107	23	39%	n/a	7.11
	N4 = {(S, L), (S, L)}	7	76	103	14	42%	n/a	7.57
BS	N5 = {(L, S), (S, L)}	2	95	91	12	51%	48%	7.41
HiLo	N6 = {(L, L), (S, S)}	0	99	93	8	52%	91%	5.09
HiLo≠	N7 = {(L, L), (L, S)}	1	98	97	4	50%	89%	6.32
	N8 = {(L, L), (S, L)}	0	98	97	5	50%	85%	5.83
Hi≠Lo	N9 = {(L, S), (S, S)}	0	86	108	6	44%	87%	5.56
	N10 = {(S, L), (S, S)}	0	86	108	6	44%	90%	5.07

Appendix E – Summary of claims in games with and without labelling cues, broken down by payoff pairs

Table E.1

Payoff pair	Game	View	Claim Frequencies				Single-disc Close claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{10, 11}	PC S*	C1 = {(S, S)*, (S, S)}	0	47	2	1	96%	n/a	3.53
	PC L*	C2 = {(L, L)*, (L, L)}	0	39	7	4	85%	n/a	4.19
	PN*	C3 = {(L, S)*, (L, S)}	0	46	2	2	96%	n/a	6.58
		C4 = {(S, L)*, (S, L)}	0	41	6	3	87%	n/a	5.73
	BS*	C5 = {(L, S)*, (S, L)}	0	22	28	0	44%	44%	7.90
		C6 = {(S, L)*, (L, S)}	0	40	9	1	82%	18%	6.29
	Hi*Lo	C7 = {(L, L)*, (S, S)}	0	41	9	0	82%	82%	6.27
	HiLo*	C8 = {(S, S)*, (L, L)}	0	10	40	0	20%	80%	6.38
	Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0	40	7	3	85%	85%	6.00
		C10 = {(L, L)*, (S, L)}	0	44	5	1	90%	90%	5.18
	HiLo≠*	C11 = {(L, S)*, (L, L)}	0	12	37	1	24%	76%	6.60
		C12 = {(S, L)*, (L, L)}	0	11	37	2	23%	77%	6.35
	Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0	47	3	0	94%	94%	4.20
		C14 = {(S, L)*, (S, S)}	0	46	4	0	92%	92%	5.16
	Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0	14	35	1	29%	71%	6.18
		C16 = {(S, S)*, (S, L)}	0	13	37	0	26%	74%	5.61

Table E.2

Payoff pair	Game	View	Claim Frequencies				Single-disc Close claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{8, 13}	PC S*	C1 = {(S, S)*, (S, S)}	0	44	3	3	94%	n/a	3.71
	PC L*	C2 = {(L, L)*, (L, L)}	2	43	1	4	98%	n/a	4.24
	PN*	C3 = {(L, S)*, (L, S)}	1	41	4	4	91%	n/a	6.07
		C4 = {(S, L)*, (S, L)}	0	44	5	1	90%	n/a	6.31
	BS*	C5 = {(L, S)*, (S, L)}	0	27	20	3	57%	57%	7.27
		C6 = {(S, L)*, (L, S)}	0	34	16	0	68%	32%	6.74
	Hi*Lo	C7 = {(L, L)*, (S, S)}	0	42	6	2	88%	88%	5.62
	HiLo*	C8 = {(S, S)*, (L, L)}	0	12	38	0	24%	76%	6.11
	Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0	46	4	0	92%	92%	6.74
		C10 = {(L, L)*, (S, L)}	0	47	3	0	94%	94%	6.14
	HiLo≠*	C11 = {(L, S)*, (L, L)}	1	7	42	0	14%	86%	6.89
		C12 = {(S, L)*, (L, L)}	1	11	36	2	23%	77%	6.22
	Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0	44	5	1	90%	90%	5.43
		C14 = {(S, L)*, (S, S)}	0	45	4	1	92%	92%	6.08
	Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0	5	45	0	10%	90%	7.24
		C16 = {(S, S)*, (S, L)}	0	7	41	2	15%	85%	6.28

Table E.3

Payoff pair	Game	View	Claim Frequencies				Single-disc Close claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{6, 15}	PC S*	C1 = {(S, S)*, (S, S)}	1	47	2	0	96%	n/a	3.64
	PC L*	C2 = {(L, L)*, (L, L)}	1	43	5	1	90%	n/a	3.94
	PN*	C3 = {(L, S)*, (L, S)}	0	45	3	2	94%	n/a	6.45
		C4 = {(S, L)*, (S, L)}	1	41	8	0	84%	n/a	6.36
	BS*	C5 = {(L, S)*, (S, L)}	1	22	25	2	47%	47%	7.36
		C6 = {(S, L)*, (L, S)}	1	34	14	1	71%	29%	6.30
	Hi*Lo	C7 = {(L, L)*, (S, S)}	0	44	4	2	92%	92%	5.25
	HiLo*	C8 = {(S, S)*, (L, L)}	0	8	40	2	17%	83%	6.55
	Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0	44	6	0	88%	88%	7.08
		C10 = {(L, L)*, (S, L)}	0	42	6	2	88%	88%	7.05
	HiLo≠*	C11 = {(L, S)*, (L, L)}	0	4	44	2	8%	92%	7.55
		C12 = {(S, L)*, (L, L)}	0	7	41	2	15%	85%	8.24
	Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0	44	5	1	90%	90%	5.35
		C14 = {(S, L)*, (S, S)}	0	41	7	2	85%	85%	5.59
	Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0	11	37	2	23%	77%	6.17
		C16 = {(S, S)*, (S, L)}	0	7	40	3	15%	85%	6.05

Table E.4

Payoff pair	Game	View	Claim Frequencies				Single-disc Close claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{4, 17}	PC S*	C1 = {(S, S)*, (S, S)}	0	45	1	4	98%	n/a	4.58
	PC L*	C2 = {(L, L)*, (L, L)}	0	44	3	3	94%	n/a	4.38
	PN*	C3 = {(L, S)*, (L, S)}	0	38	4	8	90%	n/a	7.28
		C4 = {(S, L)*, (S, L)}	1	41	3	5	93%	n/a	7.26
	BS*	C5 = {(L, S)*, (S, L)}	1	39	10	0	80%	80%	8.31
		C6 = {(S, L)*, (L, S)}	1	29	20	0	59%	41%	7.70
	Hi*Lo	C7 = {(L, L)*, (S, S)}	0	48	2	0	96%	96%	4.45
	HiLo*	C8 = {(S, S)*, (L, L)}	0	10	39	1	20%	80%	5.82
	Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0	46	3	1	94%	94%	6.90
		C10 = {(L, L)*, (S, L)}	0	45	4	1	92%	92%	5.64
	HiLo≠*	C11 = {(L, S)*, (L, L)}	0	8	41	1	16%	84%	7.45
		C12 = {(S, L)*, (L, L)}	0	9	41	0	18%	82%	7.58
	Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0	43	6	1	88%	88%	4.25
		C14 = {(S, L)*, (S, S)}	2	44	3	1	94%	94%	5.01
	Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0	9	41	0	18%	82%	5.91
		C16 = {(S, S)*, (S, L)}	1	9	38	2	19%	81%	6.05

Table E.5

Payoff pair	Game	View	Claim Frequencies				Single-disc Left claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{10, 11}	PC S	N1 = {(S, S), (S, S)}	0	18	30	2	38%	n/a	4.87
	PC L	N2 = {(L, L), (L, L)}	0	23	26	1	47%	n/a	5.55
	PN	N3 = {(L, S), (L, S)}	1	16	30	3	35%	n/a	6.47
		N4 = {(S, L), (S, L)}	0	17	29	4	37%	n/a	7.50
	BS	N5 = {(L, S), (S, L)}	0	23	24	3	49%	21%	8.61
	HiLo	N6 = {(L, L), (S, S)}	0	23	25	2	48%	90%	4.94
	HiLo≠	N7 = {(L, L), (L, S)}	1	27	19	3	59%	87%	6.34
		N8 = {(L, L), (S, L)}	0	23	25	2	48%	79%	5.75
	Hi≠Lo	N9 = {(L, S), (S, S)}	0	17	32	1	35%	92%	4.98
		N10 = {(S, L), (S, S)}	0	18	32	0	36%	88%	5.11

Table E.6

Payoff pair	Game	View	Claim Frequencies				Single-disc Left claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{8, 13}	PC S	N1 = {(S, S), (S, S)}	1	21	26	2	45%	n/a	4.98
	PC L	N2 = {(L, L), (L, L)}	1	12	32	5	27%	n/a	5.72
	PN	N3 = {(L, S), (L, S)}	1	20	25	4	44%	n/a	7.09
		N4 = {(S, L), (S, L)}	1	22	25	2	47%	n/a	8.28
	BS	N5 = {(L, S), (S, L)}	0	23	24	3	49%	49%	5.92
	HiLo	N6 = {(L, L), (S, S)}	0	20	28	2	42%	94%	4.84
	HiLo≠	N7 = {(L, L), (L, S)}	0	25	25	0	50%	82%	5.71
		N8 = {(L, L), (S, L)}	0	27	23	0	54%	82%	5.48
	Hi≠Lo	N9 = {(L, S), (S, S)}	0	23	25	2	48%	90%	6.07
		N10 = {(S, L), (S, S)}	0	22	27	1	45%	90%	4.97

Table E.7

Payoff pair	Game	View	Claim Frequencies				Single-disc Left claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{6, 15}	PC S	N1 = {(S, S), (S, S)}	1	19	26	4	42%	n/a	6.12
	PC L	N2 = {(L, L), (L, L)}	3	20	24	3	45%	n/a	6.41
	PN	N3 = {(L, S), (L, S)}	0	16	27	7	37%	n/a	7.82
		N4 = {(S, L), (S, L)}	3	16	28	3	36%	n/a	7.40
	BS	N5 = {(L, S), (S, L)}	0	27	20	3	57%	49%	7.71
	HiLo	N6 = {(L, L), (S, S)}	0	33	14	3	70%	91%	5.57
	HiLo≠	N7 = {(L, L), (L, S)}	0	22	27	1	45%	94%	6.81
		N8 = {(L, L), (S, L)}	0	20	28	2	42%	88%	7.15
	Hi≠Lo	N9 = {(L, S), (S, S)}	0	21	27	2	44%	88%	5.37
		N10 = {(S, L), (S, S)}	0	22	25	3	47%	87%	5.03

Table E.8

Payoff pair	Game	View	Claim Frequencies				Single-disc Left claims (%)	Single-disc High-Value claims (%)	Median response time
			None	Left	Right	Both			
{4, 17}	PC S	N1 = {(S, S), (S, S)}	0	21	24	5	47%	n/a	5.48
	PC L	N2 = {(L, L), (L, L)}	0	24	25	1	49%	n/a	6.33
	PN	N3 = {(L, S), (L, S)}	0	16	25	9	39%	n/a	6.70
		N4 = {(S, L), (S, L)}	3	21	21	5	50%	n/a	7.42
	BS	N5 = {(L, S), (S, L)}	2	22	23	3	49%	73%	8.32
	HiLo	N6 = {(L, L), (S, S)}	0	23	26	1	47%	88%	5.27
	HiLo≠	N7 = {(L, L), (L, S)}	0	24	26	0	48%	94%	6.21
		N8 = {(L, L), (S, L)}	0	28	21	1	57%	90%	5.37
	Hi≠Lo	N9 = {(L, S), (S, S)}	0	25	24	1	51%	80%	6.05
		N10 = {(S, L), (S, S)}	0	24	24	2	50%	94%	5.05

Appendix F – Summary of coordination success, broken down by payoff pairs

Table F.1

Payoff pair	Labelling cues		No labelling cues	
	Game	MECS	Game	MECS
{10, 11}	PC*	0.74	PC	0.44
	PN*	0.76	PN	0.44
	BS*	0.46	BS	0.27
	Hi*Lo	0.70	HiLo	0.74
	HiLo*	0.67		
	Hi*Lo≠	0.72	HiLo≠	0.66
	HiLo≠*	0.59		
	Hi≠*Lo	0.87	Hi≠Lo	0.81
	Hi≠Lo*	0.58		

Table F.2

Payoff pair	Labelling cues		No labelling cues	
	Game	MECS	Game	MECS
{8, 13}	PC*	0.80	PC	0.48
	PN*	0.75	PN	0.45
	BS*	0.50	BS	0.45
	Hi*Lo	0.71	HiLo	0.80
	HiLo*	0.63		
	Hi*Lo≠	0.87	HiLo≠	0.72
	HiLo≠*	0.68		
	Hi≠*Lo	0.80	Hi≠Lo	0.79
	Hi≠Lo*	0.75		

Table F.3

Payoff pair	Labelling cues		No labelling cues	
	Game	MECS	Game	MECS
{6, 15}	PC*	0.85	PC	0.47
	PN*	0.76	PN	0.47
	BS*	0.48	BS	0.42
	Hi*Lo	0.78	HiLo	0.75
	HiLo*	0.66		
	Hi*Lo≠	0.77	HiLo≠	0.76
	HiLo≠*	0.75		
	Hi≠*Lo	0.73	Hi≠Lo	0.71
	Hi≠Lo*	0.62		

Table F.4

Payoff pair	Labelling cues		No labelling cues	
	Game	MECS	Game	MECS
{4, 17}	PC*	0.78	PC	0.44
	PN*	0.64	PN	0.39
	BS*	0.60	BS	0.37
	Hi*Lo	0.92	HiLo	0.78
	HiLo*	0.65		
	Hi*Lo≠	0.83	HiLo≠	0.83
	HiLo≠*	0.71		
	Hi≠*Lo	0.80	Hi≠Lo	0.72
	Hi≠Lo*	0.68		

Appendix G – Single disc (close or left) claim proportions, broken down by layouts

Table G.1

Game	View	LL	LR	LR	RL	Chi square test
PC*	C1 = {(S, S)*, (S, S)} and C2 = {(L, L)*, (L, L)}	0.95	0.91	0.94	0.94	p=0.567
PN*	C3 = {(L, S)*, (L, S)}	0.97	0.91	0.92	0.92	p=0.724
	C4 = {(S, L)*, (S, L)}	0.88	0.81	0.94	0.88	p=0.299
BS*	C5 = {(L, S)*, (S, L)}	0.52	0.59	0.50	0.66	p=0.370
	C6 = {(S, L)*, (L, S)}	0.75	0.76	0.64	0.65	p=0.464
Hi*Lo	C7 = {(L, L)*, (S, S)}	0.89	0.86	0.91	0.90	p=0.895
HiLo*	C8 = {(S, S)*, (L, L)}	0.27	0.18	0.21	0.13	p=0.425
Hi*Lo≠	C9 = {(L, L)*, (L, S)}	0.91	0.87	0.96	0.86	p=0.280
	C10 = {(L, L)*, (S, L)}	0.94	0.91	0.92	0.87	p=0.681
HiLo≠*	C11 = {(L, S)*, (L, L)}	0.18	0.16	0.17	0.12	p=0.874
	C12 = {(S, L)*, (L, L)}	0.21	0.17	0.23	0.17	p=0.848
Hi≠*Lo	C13 = {(L, S)*, (S, S)}	0.90	0.93	0.86	0.94	p=0.570
	C14 = {(S, L)*, (S, S)}	0.90	0.95	0.90	0.86	p=0.551
Hi≠Lo*	C15 = {(S, S)*, (L, S)}	0.21	0.20	0.22	0.15	p=0.822
	C16 = {(S, S)*, (S, L)}	0.21	0.23	0.18	0.10	p=0.442

Note: Fisher's exact test gives similar results

Table G.2

Game	View	LL	RR	LR	Chi square test
PC	N1 = {(S, S), (S, S)} and N2 = {(L, L), (L, L)}	0.57	0.34	0.38	p=0.001
PN	N3 = {(L, S), (L, S)}	0.45	0.33	0.40	p=0.360
	N4 = {(S, L), (S, L)}	0.60	0.28	0.41	p=0.001
BS	N5 = {(L, S), (S, L)}	0.49	0.56	0.47	p=0.579
HiLo	N6 = {(L, L), (S, S)}	0.53	0.52	0.49	p=0.906
HiLo≠	N7 = {(L, L), (L, S)}	0.53	0.53	0.46	p=0.638
	N8 = {(L, L), (S, L)}	0.57	0.47	0.46	p=0.418
Hi≠Lo	N9 = {(L, S), (S, S)}	0.40	0.50	0.43	p=0.518
	N10 = {(S, L), (S, S)}	0.53	0.36	0.44	p=0.158

Note: Fisher's exact test gives similar results

Appendix H – Bootstrap test

We adopted a bootstrap method to compare the MECS between two games, Game 1 and Game 2. The bootstrap method is as follows. For each scenario in Game 1, we repeatedly take random samples with replacement from the actual decisions (stratified over scenarios, layouts, and payoff pairs, and with the sample size equal to the number of participants in the experiments). By doing so, we generate a new sample of the same size as in the experiment. We compute MECS for this new sample, using the legitimate matching procedure. By repeating this process 10,000 times, we derive a distribution of MECS for Game 1. Our test consists in checking whether the MECS for Game 2 falls in the tails of this bootstrapped distribution. If the MECS for Game 2 is above the 90th, 95th, or 99th percentile (or below the 10th, 5th, or 1st), we conclude that it is significantly higher (or lower) than the MECS for Game 1 at the 10, 5, or 1 percent level. When comparing MECS between two games with labelling cues or between two games without labelling cues, the bootstrap distribution is derived from the game which is listed first in Table 3 of the paper.

Appendix I – Screenshots for games with and without labelling cues

Figure I.1

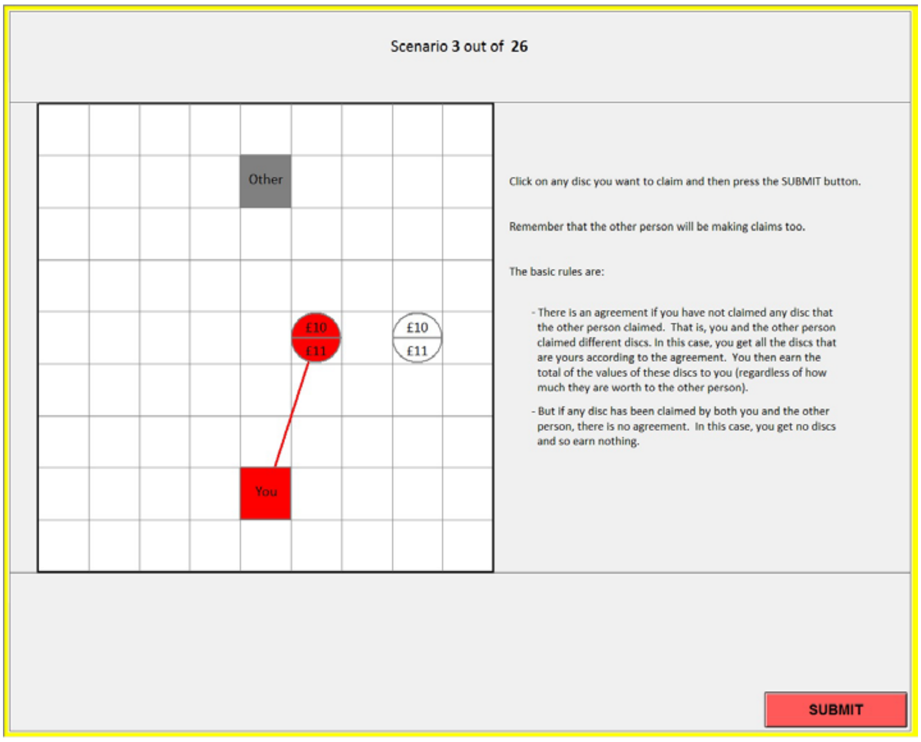


Figure I.2