Focal Points in Tacit Bargaining Problems: Experimental Evidence

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Abstract

We use a new experimental design to test Schelling's hypotheses about the nature and effectiveness of focal points in tacit bargaining games. In our design, as in many real-world bargaining problems, each player's strategies are framed as proposals about what part of a stock of valuable objects she is to take, and there are payoff-irrelevant cues which define relations between players and objects. In line with Schelling's hypotheses, we find that such cues serve as powerful focal points. Their presence increases efficiency even in games in which equal and efficient divisions are infeasible, and induces systematically unequal payoff distributions. [99 words]

Keywords: tacit bargaining, relational cue, payoff-irrelevant cue, focal point

JEL classification: C72, C78, C91

> Suppose a *German*, a *Frenchman*, and a *Spaniard* to come into a room, where there are plac'd upon the table three bottles of wine, *Rheinish*, *Burgundy* and *Port*; and suppose they shou'd fall a quarrelling about the division of them; a person, who was chosen for umpire, wou'd naturally, to shew his impartiality, give every one the product of his own country: And this from a principle, which, in some measure, is the source of those laws of nature, that ascribe property to occupation, prescription and accession. (David Hume, *A Treatise of Human Nature*, 1739-40, 509–10)

Thomas Schelling's *Strategy of Conflict* is universally recognised as the foundation of the theory of focal points. Many of Schelling's best-known examples of focal points are Nash equilibria in *matching games* – that is, games in which each of (usually) two players independently chooses one label (for example, 'heads' or 'tails') from the same set of options, and each receives a positive payoff if and only if both choose the same label. There is now a substantial body of experimental evidence about such games.[1] However, as Schelling (1960, 53–54) makes clear, one of the main intended applications of his theory is to bargaining problems in which communication is incomplete or impossible – in his terminology, problems of *tacit bargaining*. Although his particular interest is in tacit bargaining between opposing military strategists seeking to avoid or limit warfare, he envisages important economic applications for the theory – for example, the problem faced by competing firms that have common interests in collusive practices but are legally debarred from negotiating these explicitly. Schelling proposes the hypothesis that the outcomes of tacit bargaining games can be influenced by focal points. Given its potential relevance for economics, this hypothesis has been subjected to surprisingly few direct experimental tests. This paper reports such a test.

Schelling's approach differs from that of most other economic theories of bargaining by proposing that the outcome of a bargaining game can be affected by features that provide no information about payoffs, but merely attach apparently arbitrary labels to players, strategies or strategy profiles in what (as viewed by conventional game theory) is already a

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[1] These experiments have found strong evidence that, in matching games in which players' interests are completely aligned, players are able to achieve high degrees of coordination by using salient properties of the labels (e.g. Schelling 1960, 54–58; Judith Mehta, Chris Starmer and Robert Sugden 1994a, 1994b; Michael Bacharach and Michele Bernasconi 1997; Vincent Crawford, Uri Gneezy, and Yuval Rottenstreich 2008; Nicholas Bardsley et al. 2010). However, there is some evidence that salient labels are less effective when the payoffs conditional on matching have a Battle of the Sexes structure, so that players have conflicting preferences over the set of Nash equilibria (Crawford et al. 2008). We discuss this result further in Section V.

fully-specified game. In Schelling's theory, such labels – which we will call *payoff-irrelevant cues* – may prime mental associations with players' experiences outside the game, and players' perceptions of focal points may be influenced by their attitudes to those experiences. Crucially, however, players are assumed to have common knowledge of the *actual* payoffs of the game and to recognise that the cues that identify a particular equilibrium as focal provide no additional information about those payoffs. Our experiment is designed to test whether tacit bargaining is influenced by cues that are payoff-irrelevant in this sense.[2]

Specifically, we consider games that possess two features that are often found in real-world bargaining situations, but that are not present in matching games. First, there is a stock of value (or disvalue) that has to be divided between the players, and the alternative strategies for each player are framed as proposals about what part or share of that stock the proposer is to take. Second, potential focal points are identified by what we call *relational* cues – that is, by salient but payoff-irrelevant relations between particular players and particular parts or shares of the stock.

These features are prominent in a famous game that Schelling (1960, 58–67) uses as a model of tacit bargaining, and on which he reports 'informal' experimental evidence of the power of payoff-irrelevant cues. In this game, the players act as opposing army commanders, each of whom has the objective of occupying as much as possible of a certain territory but without his troops coming into conflict with the other's. Each player sees a map on which the current locations of the armies are shown, along with various geographical features. The two players simultaneously choose the limits of their troops' advances. A substantial majority of Schelling's respondents recognised a river on the map as the most obvious limit to their respective advances, even though this divided the territory unequally. The relevant relation

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[2] To ensure control in such a test, payoff irrelevance must hold, not only with respect to traditional game-theoretic assumptions about players' utility functions, but also with respect to other recognised theories of utility. For example, our objectives would not be served by adapting the design developed by Alvin E. Roth and J. Keith Murnighan (1982), which investigates the effects on the outcomes of bargaining games of varying information about the distribution of material payoffs, even though that information is irrelevant from the perspective of axiomatic bargaining theory under the assumption of self-interest. Nor would it be appropriate to use a design such as that of Simon Gächter and Arno Riedl (2005), which tests whether bargaining outcomes are influenced by players' perceptions of 'moral property rights', induced by relative performance in a general knowledge quiz. Since attitudes to the distribution of material payoffs and attitudes to rewards for real effort and talent might reasonably be modelled as social preferences, the information content of the cues used in these designs is potentially payoff-*relevant*.

in this case is spatial: each commander stands in a salient but payoff-irrelevant relationship to the territory on the side of the river where his army is located.

The same features can be found in the bargaining problem described by Hume in the quotation at the beginning of our paper. Prior to the intervention of the umpire, the three individuals are in dispute about how to divide a stock of objects of value (the bottles of wine); presumably each is claiming some part of this stock. A salient relation of nationality associates particular individuals with particular objects. This identifies a resolution to their dispute that all parties can perceive as 'natural'. Hume uses this example to illustrate his theory of the origin of property, in which property rights are conventions founded on mental associations 'betwixt the idea of the person and that of the object'. In this theory, the most important such relation is possession. The salience of possession is embedded in conventions which give de facto property rights to first possessors of the relevant objects (in Hume's language, the principle of 'occupation'), or to individuals who have possessed them for a long time ('prescription'). Hume also explains how property conventions can be based on two-step relations of mental association: if an individual already has a de facto right in one object, a convention may give him similar rights in other objects that are saliently related to the first one ('accession').[3]

There are obvious analogies between Schelling's abstract game and many real-world bargaining problems. For example, consider the case of duopolists dividing up a market. Much as in Schelling's game, spatial cues (such as the locations of the firms' factories and the configuration of international boundaries) may make a particular geographical division of the market highly salient. Alternatively, existing patterns of supply may provide precedent-based cues linking particular firms to particular markets: each firm might take those markets in which it currently has the greater market share, or there might be a tacit understanding that neither firm tries to sell to the other's previous customers. In all these cases, the relevant cues are relations between particular claimants (firms) and particular *parts* of the stock of value that is to be divided (markets or customers). As a slightly different example, consider a dispute between a multinational oil company and a national government over the division of mineral royalties. Schelling (1960, 67–68) suggests that if it is common knowledge that a recent similar dispute between a different company and a different government ended in

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[3] See Hume (1739–40, 501–13). Sugden (1989; 2004, 91–107) discusses the connections between Hume's theory of property and Schelling's theory of focal points.

agreement on a particular proportional division, that division may provide a focal point for the later bargaining problem. In this case, the relevant cue takes the form of relations between particular claimants and particular *shares* of the stock of value.

Our experimental design is based on a new representation of tacit bargaining. This representation is a class of abstract games with the same essential features as Schelling's game. In each game there is a stock of valuable objects; the two players make independent claims on these objects, with the aim of claiming as much value as possible without trespassing on one another's claims; specific players are associated with specific objects by payoff-irrelevant relational cues. We investigate how far the outcomes of these games are influenced by those cues. Our focus is mainly on tacit bargaining games in which there is no exhaustive division of the objects that equalises the players' payoffs, and in which relational cues single out a particular unequal division. As Schelling (1960, 286) points out, such an outcome 'quite arbitrarily condemns one of the players to a smaller gain than the other for reasons that may seem purely accidental or incidental'. But, he says, 'we have to suppose that a rational player can discipline himself to accept the lesser share if the clue points that way'. We test whether real players live up to this standard of rationality.

In Section I, we describe our design. Section II describes the specific games used in the experiment, while Section III gives details about how the experiment was conducted. Section IV reports our main findings. Section V concludes with a discussion of the general implications of our findings.

I. The Bargaining Table Design

Our experiment builds on a design used by Mehta et al. (1994a, 1994b) to investigate the effects of relational cues in matching games. In their experiments, two players each see the same diagram of a grid, on which two squares and a number of circles are located. Each player is instructed to assign each circle to exactly one square. Each player receives a positive payoff (the same for both players and for all assignments) if and only if they both choose exactly the same assignment. Mehta et al. find high rates of coordination in these games. The principles by which players choose assignments include the rule of *closeness*, which assigns each circle to the square (if there is one) to which it is closer, and the rule of *accession*, which identifies coherent groups of circles and assigns all the circles in such a group to the square that is closer to the group as a whole. These findings suggest that people can recognise certain types of salient relations, and that they can use these relations to identify focal points in matching games. Our experiment was designed to investigate whether the focal points suggested by these payoff-irrelevant relations might also be used to resolve tacit bargaining problems.

In our experiment, each subject played 24 one-shot simultaneous-move games with no communication or feedback. To explain the principles of our design, we focus on four *basic games*. The first of these games ('game G1') is shown on the left side of Figure 1. This diagram was described to subjects as a 'table'; we will call it a *bargaining table*. The square on the left side of the table was coloured red, the square on the right blue. The numbers on the disc represent amounts of money, in UK pounds.[4]

[Figure 1 near here]

The instructions were phrased so that they could apply to games ('scenarios') with different numbers of discs and different disc values. The basic rules were explained as follows:

> Each scenario is an interaction between a Red person and a Blue person. Each person has a **base**, represented by a red square for the Red person and a blue square for the Blue person. You will discover whether you are Red or Blue at the end of the instructions. ...
>
> The basic rules
>
> There are some discs on the table. Each disc has a money value. This is shown on the disc. 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 **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 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 value of these discs.
>
> 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.

Applied to game G1, these rules define a game in which each player has four pure strategies, corresponding with the four subsets of the set of discs on the table. In relation to

[4] In the actual display, the disc values were indicated using the £ symbol. In the figure, this symbol is omitted.

each player, we (as analysts) can describe the two discs in terms of their positions relative to that player's base. For Red (the player whose base is on the left), the £6 disc is 'near' and the £5 disc is 'far'; for Blue, the £6 disc is 'far' and the £5 disc is 'near'. Then, for each player, the four strategies are: choose *none* of the discs; choose the *near* disc; choose the *far* disc; and choose *both* discs. With payoffs represented in UK pounds, the payoff matrix is:

		Blue			
		none	*near*	*far*	*both*
	none	0, 0	0, 5	0, 6	0, 11
Red	*near*	6, 0	6, 5	0, 0	0, 0
	far	5, 0	0, 0	5, 6	0, 0
	both	11, 0	0, 0	0, 0	0, 0

This game has three pure-strategy Nash equilibria – (*near, near*), (*far, far*) and (*both, both*). The third of these is a weak equilibrium which would be removed by iterated elimination of weakly dominated strategies. We expected the logic of iterated elimination to be transparent to subjects when games were presented in the bargaining table format. (Put simply: there is no point in not claiming any discs; and if you expect the other player to realise this, claiming both discs guarantees that there will be no agreement.) As we will show in Section IV, this expectation was confirmed. Thus, the essential problem posed by this game is that of reaching a tacit agreement to play one of the two strict Nash equilibria.

The main objective of our experiment was to investigate how far players are able to resolve such tacit bargaining problems by using the relational cues provided by the spatial layout of discs and bases. Our background assumption, made in the light of Mehta et al.'s (1994a, 1994b) findings, was that players would perceive the relation of closeness between bases and discs as highly salient. Given this assumption, Schelling's theory implies that players in G1 will tend to claim the discs that are closer to their own bases, inducing a distribution of payoffs that favours Red.

We submit that the spatial cues of our design are payoff-irrelevant in the sense that is required for tests of Schelling's hypothesis. We recognise that the layout of discs on the table might prompt mental associations with real-world situations in which there are non-strategic reasons for preferring 'closer' objects – for example, transport costs which increase with distance. But, as we noted in the Introduction, mental associations are fundamental to

Schelling's theory. According to Schelling, what is perceived as the 'obvious' outcome of a bargaining problem depends 'on what analogies or precedents the definition of the bargaining issue calls to mind'; the mechanism that lies behind focality is 'the power of *suggestion*' (1960, 69, 73, italics in original). In matching games of the type discussed by Schelling, players often coordinate on labels that are perceived as 'favourites' – that is, labels that describe objects or ideas that are evaluated positively (Bardsley et al. 2010). A particularly relevant example is Schelling's famous matching game in which the players' objective was to name the same meeting place in New York City. Although his respondents clearly knew that they would not really have to go to the place they named, one factor in making Grand Central Station focal was presumably its convenience as an actual meeting place for residents of New Haven, Connecticut.

Since Schelling's theory is about how mental associations affect behaviour in games, a controlled test of the theory can legitimately use cues that have *associations with* real-world concepts of value or cost; indeed, a design that eliminated all such associations might be criticised for lacking external validity. Cues are payoff-irrelevant in the required sense if they do not provide information about the *actual* payoffs of the game that is being played, and if this fact is transparent to the players. We see no reason to doubt that our subjects knew how the payoffs of our bargaining table games were determined. The rules of these games were extremely simple; subjects' understanding of them was checked before the experiment began, and was reinforced by intuitive visual displays. And we have no reason to believe that subjects thought the spatial layout of discs on their computer screens conferred real moral entitlements.

To test our background assumption about the salience of the spatial cues in games like G1, our experiment included some games in which acting on those cues did *not* require the players to accept arbitrary inequality. Consider G2, shown on the right of Figure 1. G2 is exactly the same as G1 except that one of the disc values has been changed from 6 to 5; as a result, the two strict Nash equilibria of G2 both give payoffs of (5, 5). Intuitively, it seems that if spatial cues will work at all in bargaining table games, they will do so in a game like G2. We will say that a bargaining table game is *equality-compatible* if the discs can be exhaustively divided into two subsets with equal total value. (In other words, an equality-compatible game has an efficient Nash equilibrium in which the players' payoffs are equal.) We will investigate whether relational cues are as effective in facilitating agreement in equality-incompatible games (such as G1) as in otherwise similar equality-compatible games (such as G2).

To carry out a controlled test of the hypothesis that relational cues facilitate agreement, we need to compare behaviour in games in which such cues are present with games in which they are absent. Consider G3, shown in the left of Figure 2. The only difference between G3 and G1 is the positioning of the discs on the respective bargaining tables; the discs themselves are the same in terms of both number and value. Thus, any systematic difference in behaviour between the two games must be attributable to differences in labelling. Intuitively, G3 lacks salient cues that single out a specific division of discs.[5] Were G1 to induce more agreement than G3, that would be evidence in support of Schelling's hypothesis about the role of payoff-irrelevant cues in tacit bargaining games. A similar comparison can be made between the equality-compatible games G2 and G4 (the latter is shown on the right of Figure 2). G4 differs from G2 only with respect to the positions of the discs; the relational cue of closeness is present in G2 but absent in G4.

[Figure 2 near here]

When making such comparisons, our underlying null hypothesis is *label invariance* – that is, players' behaviour depends only on the formal properties of the payoff matrix and is independent of how players and strategies are labelled. Our alternative hypotheses specify deviations from label invariance in directions implied by Schelling's theory, given specific assumptions about the salience of certain kinds of relational cues.

For the purposes of our tests, we measure the *efficiency* of the outcome of a game as the sum of the players' payoffs as a proportion of the total payoff available in the game (11 in G1 and G3, 10 in G2 and G4). This measure can be applied to games with any number of discs. Where two games differ only with respect to the spatial layout of the discs, label invariance implies the null hypothesis that, apart from random noise, efficiency will be the same in both games. Our alternative hypothesis is that efficiency will be greater in games with salient relational cues than in games without, and thus greater in G1 than G3, and greater in G2 than G4. We will assess the power of a given relational cue in a given bargaining table

[5] Or at least, it lacks cues that are *as salient as* those of G1. It is a logically inescapable feature of the bargaining table design that each disc has a distinct location, known to both players. Thus, every bargaining table game has spatial cues *of some kind*. Similarly, in any genuine matching game in which each player receives the same payoff in every equilibrium, every strategy must have a distinct label (Bardsley et al., 2010, footnote 8).

game by comparing efficiency in that game with efficiency in an otherwise identical game in which that cue in absent.

Label invariance has a further implication for games (such as G1) that are equality-incompatible and have salient cues. By making salient a particular division of the discs between the two players, these cues identify one of the players – the *favoured* player – as the one who (it is suggested) is to claim more than the other, and who is to receive the larger payoff. (In G1, as displayed in Figure 1, Red – the player on the left – is favoured.) Schelling's theory implies that, in such games, the money value of favoured players' claims will be greater than those of unfavoured players, and that favoured players will receive higher payoffs. But, since the definition of 'favoured' is a matter of labelling, label invariance implies that there will be no systematic difference between the claims made by the two players, or between their payoffs.

The four basic games are related to one another in a 2×2 classification scheme, defined by compatibility or incompatibility with equality and by the presence or absence of a salient relational cue. The 24 games used in the experiment are related to one another in similar ways. The principles investigated in the basic games are extended in three different ways.

First, we vary the minimum payoff inequality that is consistent with efficient agreements in equality-incompatible games. Recall that G1 and G3 use bargaining tables with two discs with the values £6 and £5. We also used two-disc games (G13 and G15) in which the disc values were £8 and £3, and two-disc games (G14 and G16) in which the values were £10 and £1. Our aim in using these games was to investigate whether the power of relational cues to affect behaviour declines as the suggested solutions become more unequal.

Second, we vary the number of discs on the table. This allows us to test the robustness of any findings to variation in the complexity of the tacit bargaining problems. If results were not robust in this sense, one might reasonably doubt their external validity in relation to real-world bargaining. In some games (G5–G12), there are four discs; in others (G17–G24), there are eight. As the number of discs increases, the size of the payoff matrix increases exponentially. Recall that, after iterated elimination of weakly dominated strategies, the two-disc games have 2×2 payoff matrices with two pure-strategy Nash equilibria. In four-disc games, the corresponding matrices are 14×14; in eight-disc games they are 254×254. Viewed in a perspective which takes no account of spatial cues, the equilibrium selection problem facing the players becomes vastly more difficult as the number of discs increases. Arguably, however, the rule of claiming the discs that are closer to one's own base is no less obvious when there are many discs than when there are few.

Third, we investigate the effect of accession as a spatial cue, as well as that of closeness. Since accession involves the recognition of distinct *groups* of discs, this cue can be investigated only in games with more than two discs.

II. The Games Used in the Experiment

We used 24 games, numbered G1–G24. For each game, we counterbalanced different displays to control for any systematic effects due to subjects' perception of the left/right and red/blue distinctions. Appendix A shows the *baseline* display of each game, from which the other displays are obtained, as explained later.

Each game is defined by a bargaining table with a 9×9 grid of squares. To describe locations on any table, we use a coordinate system in which columns are numbered –4 to 4 from left to right and rows are numbered –4 to 4 from top to bottom; a location is described by the ordered pair (column number, row number). These column and row numbers, which were not seen by subjects, are shown along the edges of the tables in Appendix A. To aid the description of the games, each disc is also given a number (d_1, d_2, ...); again, these were not seen by subjects. In the baseline display of every game, the Red base is located at (–3, 0) and the blue base at (3, 0).

Every game has two, four, or eight discs, with a total value of either £10 (equality-compatible games) or £11 (equality-incompatible games). The minimum inequality consistent with efficient agreement can be expressed in terms of the *least-unequal efficient* (LUE) distribution.[6] In every equality-compatible game, LUE = 5:5. In the equality-incompatible games, LUE = 10:1 (in G14 and G16), 8:3 (in G13 and G15), or 6:5 (in the other equality-incompatible games).

[6] For any given bargaining table game, the LUE distribution is defined as the pair of payoffs x_1: x_2 (where x_1 and x_2 are the payoffs to the two players in UK pounds, defined so that $x_1 \geq x_2$) that minimises the value of $x_1 - x_2$ subject to the constraint that every disc is claimed.

The 24 games can also be classified by the nature of their relational cues. In games with a *type C* cue (the 'closeness' games G1, G2, G5, G6, G13, G14, G17 and G18), half the discs are located on the left side of the table (in columns –4, –3, –2 and –1) and half on the right (in columns 1, 2, 3 and 4). This cue suggests the LUE division in which each player takes the discs on her side of the table. In equality-incompatible type C games, this division favours one of the players; in the baseline display, the favoured player is always Red and on the left.

In games with a *type A* cue (the 'accession' games G7, G8, G21 and G22), there are either four or eight discs. These discs form two distinct blocks comprising equal numbers of contiguous discs. In the 'left' block, the most rightward disc is in the central column; in the 'right' block, the most leftward disc is in the central column. This cue suggests the LUE division in which each player takes the block of discs on her side of the table. In equality-incompatible type A games, this division favours one of the players; in the baseline display, the favoured player is always Red and on the left.

For each game with a cue of type C or type A, there is a corresponding 'neutral' game with the same number of discs and the same array of disc values, but with a spatial layout which we call a *type N* cue. In these games, all the discs are in the central column; either there are no blocks of contiguous discs, or all the discs comprise a single block. The intention was that these games should lack salient spatial cues. For example, the type N game G11 corresponds with the type C game G5 and the type A game G7; the type N game G20 corresponds with the type C game G18 and the type A game G22.

As an additional control, each game of type A also has a corresponding 'blocks' game with a *type B* cue. These games are intermediate between type A and type N. All the discs are in the central column, as in a type N game, but they are grouped into two distinct blocks, as in a type A game. For example, the type B game G24 corresponds with the type A game G22.

It will often be convenient to use a compact notation to describe the main features of the games. This notation is a list of the discs on the table, identified by value. Two vertical lines are used to partition this set of discs into those on the left of the table (i.e. to the left of the central column), those in the centre (i.e. in the central column), and those on the right. Thus, 'G5 = 3, 3| |2, 3' states that G5 is a type C game in which there are two discs on the left of the table (d_1 and d_2), each worth £3, and two discs on the right of the table (d_3 and d_4), one worth £2 and one worth £3. 'G12 = |3, 2, 2, 3|' states that G12 is a type N game in which there are four discs, all in the central column, two worth £3 (d_1 and d_4) and two worth £2 (d_2 and d_3). Blocks of contiguous discs are identified by brackets. Thus 'G8 = (3|2)(2|3)' states that G8 is a type A game in which there are two blocks of two discs each; one block has a disc worth £3 on the left of the table and a disc worth £2 in the centre; the other block has a disc worth £2 in the centre and a disc worth £3 on the right.

Table 1 uses this notation to summarise the main features of the experimental design. The 24 games are classified by LUE (5:5, 6:5, 8:3 or 10:1), by the number of discs (2, 4 or 8), and by the type of spatial cue (N, B, C or A). Our design is factorial with respect to these three characteristics, subject to the constraint that not all 4×3×4 = 48 combinations of these characteristics are feasible. Cues of types B and A are not possible in 2-disc games; there cannot be a 4-disc or 8-disc game with LUE = 10:1; there cannot be an 8-disc game with LUE = 8:3; and a 4-disc game with LUE = 8:3 would not be compatible with our system of 'twinning' discs, explained below.[7]

[Table 1 near here]

In every equality-compatible game, the layout of discs has a property that ensures that it 'looks the same' when viewed from either base. Our aim in using such layouts was to avoid introducing spatial cues other than closeness and accession that might induce the players to make unequal claims. Formally, the bargaining table for each equality-compatible game has two-fold rotational symmetry. Equivalently, let us say that two discs are *twins* if their locations are (x, y) and ($-x$, $-y$); they are *identical twins* if in addition they have the same value. In equality-compatible games, every disc has an identical twin.[8]

Each equality-incompatible game can be constructed from a corresponding equality-compatible game by maintaining the number and spatial layout of the discs and by changing the value either of one disc (when LUE = 6:5) or of two twinned discs (when LUE = 8:3 or 10:1). Thus, each disc in an equality-incompatible game has a twin, but one pair of twins is not identical. In Appendix A, each equality-compatible game is shown alongside the corresponding equality-incompatible game for which LUE = 6:5.

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[7] A 4-disc game with LUE = 8:3 and a type C cue must take the form 8| |1, 1, 1 or 1, 1, 1| |8. Since there are more discs on one side of the table than on the other, this is incompatible with twinning.

[8] This characterisation is not completely true of G20. (This minor anomaly arises because we had to fit a block of eight contiguous discs into the nine rows of the central column.) In this case, and in the corresponding equality-incompatible game G19, we treat the pairs of discs (d_1, d_8), (d_2, d_7), (d_3, d_6) and (d_4, d_5) as twins.

To control for any effects due to the left/right and red/blue distinctions, we used four different displays of the set of 24 games. These were constructed by permutations of the baseline display. The *red/blue* permutation transposes the colours of the two bases, leaving everything else unchanged. The *twin/twin* permutation transposes each disc with its twin, leaving everything else unchanged; in equality-incompatible games with cues of type C or A, this changes which player is favoured from Left to Right and from Red to Blue, or vice versa. In any given session, each game was displayed in the same way for all participants.[9] Notice that for any given subject, her status as the favoured or unfavoured player was the same in all games in which there was a favoured/unfavoured distinction. This feature of the design ensures that the use of relational cues in equality-incompatible games has systematic distributional consequences for each subject, rather than being beneficial in some games and costly in others.

III. The Implementation of the Experiment

The experiment was conducted in six sessions at *[deleted for anonymity]*. The 100 subjects were recruited from the general student population using the ORSEE system (Ben Greiner, 2004).

Before the start of the experiment, the instructions were read aloud by an experimenter.[10] Participants could follow the instructions on their screens and could ask questions at any time. The bargaining table, the bases and the discs were introduced as detailed in Section I. Participants were told that half of them would play all games as Red and half as Blue; each Red player had been randomly matched with a Blue player, and this matching would remain anonymous. They were also told that, for each pair of subjects, the computer had randomly picked one of the 24 games as the one that would determine those subjects' earnings, but which game this was would not be revealed until the experiment was over. Whether a participant was Red or Blue was revealed at the end of the instructions. Bases kept the same colour and position on the table for all the games.

In each game, the bargaining table was displayed on each player's screen. Each player could claim discs by clicking on them with her mouse; at any time, the player's screen

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[9] The favoured player was Red in three of the six sessions and Blue in the others, and similarly for Left and Right. These permutations are described in more detail in Appendix B, Section B1.

[10] The full text of the instructions can be found in Appendix B, Section B.3.

showed the claims she had made, but no information was given about the other player's claims. As soon as a player claimed a disc, that disc, originally white, took the same colour as her base, and a solid line of the same colour connecting the disc to the base appeared on the screen. Any claim could be cancelled by re-clicking on the relevant disc. Players could change their claims as many times as they wanted until they pressed a 'submit' button. While this procedure was being explained, participants could try it on a practice game P = |4,2,1|.[11]

After the rules for determining players' earnings had been presented, game P was used to illustrate their implications in three examples depicting an efficient agreement, a failure to agree, and an inefficient agreement respectively. Before the start of the experiment, participants answered a series of questions to check their understanding of the experimental procedures. After any remaining questions had been answered, the first game appeared on the screen. Participants proceeded through the 24 games at their own speed, without any feedback between one game and the next.

Each participant played all of the games G1–G24 described in Table 1. The games were presented in a random sequence, which was determined separately for each individual. Since there was no feedback between games and since the game that would determine earnings for any given pair of subjects had been selected by the computer before any games were played, the question of how subjects were matched in the other 23 games has no relevance (and indeed no determinate answer). Subjects were simply advised to 'treat each scenario [i.e. game] as if it was the real one' and to 'think about it in isolation from the others'. This matching protocol and incentive system ensures that our scenarios are effectively one-shot games, while eliminating redundant complexity from the instructions.

After every participant had completed all the games, payments were determined according to the decisions made by each pair of subjects in the 'real' scenario. In addition, subjects received a £5 show-up fee. The average earning was £6.93.

IV. Results

[11] According to the classification of spatial layouts presented in the previous section, P is an N game. Before the start of the experiment proper, when we needed to illustrate the rules of the game or test participants' understanding of those rules, we only used N games with an *odd* number of discs. This was done in order to avoid inadvertently suggesting the use of the spatial cues we were interested in studying.

In our discussion of bargaining table games, we have assumed that most players do not play iteratively dominated strategies. We begin by asking whether that assumption was confirmed. Table 2 shows the distribution of claims by total value in each game. For equality-incompatible games of types C and A, distributions are reported separately for favoured and unfavoured players. It is immediately obvious that it is extremely rare for players to claim either none of the discs (averaging over all 24 games, this occurs in 0.3 per cent of cases) or all of them (0.6 per cent of cases).

[Table 2 near here]

A. The Spatial Distribution of Claims

We now consider whether the relational cues provided by the spatial layout of discs on the bargaining table had any influence on the claims that participants made.

Tables 3 and 4 describe subjects' claims in terms of disc location. Table 3 refers to C and A games. In each C game, there is no more than one disc in each column of the bargaining table, and so each disc location is uniquely identified by the number (–4, ..., –1, 1, ..., 4) of the column in which it appears. In A games, there are two discs in the central column, but all discs are either in row –2 or in row 2. In order to ensure that no more than one disc is assigned to any cell of the table, claims are reported separately for these rows. In each cell there are two proportions, expressed as percentages – the proportion of Left players who claimed that disc, followed by the corresponding proportion of Right players. For example, the entry for 'column coordinate –3' for game G1 reports that, aggregating over the 50 cases in which this game was played, the disc located at (–3, –2) was claimed by the Left player in 38 cases (76 per cent) and by the Right player in 10 cases (20 per cent). In equality-incompatible games, these proportions aggregate over cases in which Left was favoured and in which Right was favoured; because of counterbalancing, a significant difference between the two proportions indicates an effect of disc location. Table 4 provides analogous information for N and B games. In each of these games, all discs are in the central column of the bargaining table, and so each disc location is uniquely identified by the number (–4, ..., 4) of the *row* in which it appears.

[Tables 3 and 4 near here]

Table 3 reveals a very strong spatial pattern which tends to facilitate agreement: the *own side effect*. We define the *left side* of the table as columns –4, ... –1 and the *right side* as columns 1, ..., 4. The own side effect is a tendency for both Left and Right players to claim the discs that are located on their side of the table more frequently than the discs located on the other side. On the left side of the table, Left players claim discs with average frequencies ranging from 69 to 82 per cent, while Right players claim the same discs in just 13 to 21 per cent of the cases. The pattern is reversed on the right side, where average frequencies are between 7 and 16 per cent for Left players and between 64 and 81 per cent for Right players. The sharp discontinuity in these frequencies at the centre of the table – a discontinuity that occurs in every game in which there are discs on both sides of the table – suggests that the central column was perceived as a *boundary*, analogous with the river in Schelling's game. That is, players were not merely revealing an unconscious bias towards choosing closer objects; they were using the distinction between the left and right sides of the table as a coordinating device.

We conduct a statistical test for the own side effect in the following way. For each player, we compute a new variable, $diff_{\mathrm{LR}}$, defined as the difference between the total number of claims the player made on the left side and the total number of claims they made on the right side, aggregating over all C and A games. In the absence of an own side effect (or its opposite), the distribution of $diff_{\mathrm{LR}}$ should not differ systematically between Left and Right players. To the contrary, the average for the 50 Left players is 15.22, while that for the 50 Right players is –12.88. This difference is overwhelmingly significant ($p < 0.001$) in a one-tail Mann-Whitney test.

Table 3 also shows an *accession effect* in A games. In each of these games, the disc in row –2 of the central column is part of the 'left' block, while the disc in row 2 is part of the 'right' block. There is a clear tendency for the former disc to be chosen more frequently by Left players than by Right players, and conversely for the latter. This effect is significant ($p < 0.05$) in six of the eight cases, with $p < 0.001$ in all cases involving eight-disc games.

Table 4 reveals two spatial patterns in the claims made in N and B games. The *top-left/bottom-right effect* is a tendency for Left players to choose discs in the top four cells of the central column more frequently than Right players, and an opposite tendency for discs in the bottom four cells (see the last two rows of Table 4).[12] We conduct a test which is similar in spirit to our test of the own side effect. Summing over all B and N games, let $diff_{\mathrm{TB}}$ indicate the difference between the total number of claims that a player made in the top rows

[12] An analogous but relatively weak effect in assignment games is reported by Mehta et al. (1994b: 182).

of the central column and the total number of claims they made in the bottom rows.[13] Absent any top-left/bottom-right effect (or its opposite), the distribution of $diff_{TB}$ should not differ systematically between Left and Right players. We find that the average is –1.28 for Left players and –8.14 for Right players. The difference is significant ($p < 0.05$) in a two-tail Mann-Whitney test.

That the average of $diff_{TB}$ is negative for both Left and Right players is indicative of the second spatial pattern in N and B claims: *bottom bias*. This is the tendency, other things being equal, for *both* players to make more claims in the bottom cells of the central column than in the top cells. Aggregating over Left and Right players, discs in the top four cells of that column are claimed in 33.9 per cent of cases, while the corresponding figure for the bottom four cells is 51.5 per cent. Our statistical test compares the proportion of subjects making the majority of their claims in the top cells with the corresponding proportion for the bottom cells. There are 36 subjects who make more claims at the top and 59 who make more at the bottom. The difference is significant ($p < 0.05$) in a binomial test.[14]

The top-left/bottom-right and bottom bias effects are contrary to our prior expectation that type N games would lack salient spatial cues. However, as will emerge later, the spatial cues in these games generally did not do much to facilitate agreement. This is probably because the two effects (which in any case are weaker than the own-side effect) tend to offset one another: the top-left/bottom-right effect facilitates agreement, while bottom bias works in the opposite direction.

At this point it is convenient to mention two other cues that are present in all our games. In every game, one player has the role of Left and the other that of Right; and one has the role of Red and the other that of Blue. It is conceivable that, quite apart from the three spatial effects we have considered, subjects might perceive these cues as suggesting that one role had priority over the other in the division of the discs. We therefore investigated whether, after controlling for the difference between favoured and unfavoured players, the position or colour of players' bases affected either the total value of the claims they made or

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[13] This aggregation is legitimate because the discs in the top and bottom of the central column are twins. (Because of counterbalancing, the anomalous features of G19 and G20 do not compromise the aggregation.)

[14] Again, this aggregation is legitimate because the relevant discs are twins.

their expected payoffs from the game. We found no systematic effects of any of these kinds.[15]

B. The Power of Relational Cues in the Basic Games

In this subsection we look at behaviour in the four games (G1–G4) that we discussed in detail in Section II. Recall that this is a set of two-disc games in which LUE is either 5:5 or 6:5. Cues are of types C and N.

When testing hypotheses about efficiency, we will use a measure of *standardised efficiency*, computed in a way that abstracts from the arbitrariness of the actual pairing of co-players. For each Left (Right) player, we compute an expected payoff as the average of the earnings the player would receive if paired, in turn, with each of the Right (Left) players who encountered the games in exactly the same display (i.e. those for whom the red/blue and twin/twin permutations were the same). We will refer to these pairings as *legitimate matching*.[16] For any game, standardised efficiency is the average of these expected payoffs computed across all participants in both roles, divided by the total value of the discs in the game (10 in equality-compatible games, 11 in equality-incompatible games). Table 5 reports efficiency measures for all two-disc games; for the purposes of this subsection, only the first two columns are relevant. The first two rows of the table describe the relevant games C and N games in our compact notation. The third row reports, as a benchmark, the *Nash efficiency* of the game – that is, the proportion of the total value of the discs that players would earn by using the mixed-strategy Nash equilibrium. Notice that Nash efficiency is independent of spatial cues.

[Table 5 near here]

The fourth row reports another benchmark. Given our unexpected finding that players responded to spatial cues even in the N games that were intended as 'neutral', it is useful to have some idea of how far (if at all) efficiency in those games was attributable to such cues. For each player in any given N game, we can construct a counterfactual mixed strategy in which she claims the same total value of discs as she actually claimed, but

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[15] The regression analyses we carried out are reported in Appendix B, Tables B.2 and B.3. Expected payoffs were calculated using the method of 'legitimate matching' explained in Section V.C below.

[16] The only information that a participant was given about her co-player was that the latter was seeing exactly the same display but was taking the other role (i.e. Left if the first player was Right, and vice versa). Any pairing of Left and Right players who saw the same display is consistent with this information.

randomises over the different sets of discs that sum to that value (as if she were unable to see any spatial cues). *Blind efficiency* is the expected value of efficiency that would result from such play if every subject were matched with every other. Intuitively, this measure is an attempt to remove any residual effects of spatial cues from N-game data.[17]

The fifth and sixth rows of the table report standardised efficiency in N and C games. The seventh row shows efficiency in each C game as a proportion of that in the corresponding N game: this is our measure of the *power* of the closeness cue. The asterisks against these measures report tests of the null hypothesis that expected earnings are equal in the two versions of the game, against the alternative that earnings are higher in C games. These comparisons are based on one-tail Wilcoxon signed-rank tests.

First, notice that in every two-disc N game, the difference between standardised efficiency and blind efficiency is very small. The implication is that subjects' use of spatial cues in these games had at most only a marginal effect on efficiency.

As can be seen from the data in the first column, the rule of closeness works as a powerful focal point when equal divisions are possible. Comparing the two equality-compatible games, standardised efficiency is 46.7 per cent in the N game (G4), just less than the Nash efficiency benchmark, but is 84.4 per cent in the C game (G2); the difference is strongly significant ($p < 0.01$).

Do closeness cues retain their power in the 6:5 equality-incompatible game? In the N game (G3), efficiency is 48.6 per cent, again very close to the Nash benchmark. In the C game (G1), it is significantly greater ($p < 0.01$) at 64.8 per cent. The power of closeness cues is not as dramatic as in the equality-compatible games, but the degree of coordination in the C game is still substantial (36 out of 50 favoured players, and 41 out of 50 unfavoured players, claimed just the disc closer to them – see Table 2).

We now consider whether, in the equality-incompatible C game, favoured players made larger claims than unfavoured, and whether the former received higher payoffs. In relation to two-disc games, these questions are almost equivalent (they would be exactly

[17] Because this measure is intended to remove all visual effects, it does not use the 'legitimate matching' procedure. Thus, its definition differs from that of standardised efficiency even in a game in which no two discs have the same value. In G3, for example, if every Left player claimed the top disc and every Right player claimed the bottom disc, standardised efficiency would be 100%, but blind efficiency would be only 50% (since the 5 and 6 discs would have been chosen with equal overall frequency).

equivalent if every player claimed exactly one disc); but they have distinct content in relation to four- and eight-disc games.

The relevant data are presented in Table 6. For each of the seven equality-incompatible games with relational cues, the table reports the mean and median value of the claims made by favoured and unfavoured players, and their expected earnings computed using the legitimate matching method described above. For both variables, the table also reports the results of a one-tail Mann-Whitney test of the null hypothesis that there is no difference between favoured and unfavoured players, against the alternative that favoured players claim more or do better. For the purposes of this subsection, only the first row (reporting data for game G1) is relevant. Here the evidence of distributional effects is very clear. Favoured players make larger claims than unfavoured players, and the difference is strongly significant ($p < 0.01$).[18] Correspondingly, expected payoffs are significantly higher for favoured players.

[Table 6 near here]

C. Increasing the Inequality of the LUE Distribution

As Table 5 shows, the power of closeness cues declines as the LUE distribution becomes more unequal. When LUE = 8:3, the increase in efficiency attributable to closeness cues is modest, although still significant at the 10 per cent level. When LUE = 10:1, closeness cues have no significant effect. Interestingly, in the N versions of the equality-incompatible 8:3 and 10:1 games, efficiency is markedly greater than the corresponding Nash benchmarks. The blind efficiency measures show that this is not due to the use of spatial cues in the N games. The explanation is that subjects claimed the less valuable disc more frequently than Nash equilibrium prescribes. If each player claims exactly one disc, randomising between the higher- and lower-valued discs without taking account of their spatial positions, efficiency is maximised if each disc is claimed with equal probability. It can be calculated from Table 2 that the proportion of subjects claiming only the less valuable disc was 0.41 in G15 and 0.22 in G16, compared with Nash equilibrium probabilities of 0.27 and 0.09.[19]

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[18] These findings are confirmed by a regression analysis which controls for the effects of the colour and position of players' bases, and for colour/position interactions (see Appendix B, Table B.3).

[19] These probabilities are calculated assuming risk neutrality. If players are sufficiently risk-averse, observed behaviour in G15 and G16 may be consistent with Nash equilibrium.

However, closeness cues have strongly significant *distributional* effects ($p < 0.01$) in both the 8:3 and 10:1 games (see Table 6). These effects become stronger as asymmetry increases: the ratio between the expected payoffs of favoured and unfavoured players increases from 1.1 in the 6:5 game to 2.4 in the 10:1 game. The implication is that relational cues have some significant effect in *all* the 2-disc games; as the inequality of the LUE distribution increases, efficiency effects become weaker but distributional effects become stronger.

D. Increasing the number of discs

Efficiency data for four- and eight-disc games are reported in Table 7. The format is similar to that of Table 5, but as these games have many mixed-strategy Nash equilibria, no Nash efficiency benchmark is shown. Table 7 also reports the *standardised agreement rate* for each game. Recall that two players are deemed to reach an agreement if no disc is claimed by both of them. The standardised agreement rate is the expected proportion of games that end in agreement; it is calculated by averaging over legitimate pairings of subjects, in the same way as in the calculation of standardised efficiency. Since a game can lead to positive payoffs only if there is an agreement, the agreement rate cannot be less than the efficiency measure. However, there can be agreements in which some discs are claimed by neither player; in four- and eight-disc games, such inefficient agreements can give positive payoffs to both players and do not require the use of iteratively dominated strategies.

In these games, there are four types of spatial layout (N, B, C and A); LUE is either 5:5 or 6:5. Recall that the difference between B games and N games is that, in the former, the discs (all of which are in the central column in both cases) are grouped into two blocks. In principle, this could facilitate agreement by inducing players to make all their claims from one block. In fact, we found a slight tendency in this direction for equality-incompatible games, but not for equality-compatible games.[20] As Table 7 shows, except in the equality-incompatible four-disc game, efficiency was only slightly greater in B games than in N games. From now on, in the interests of brevity and clarity, we will focus on N, C and A games.

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[20] In one pair of corresponding B and N games (G9, G11), we found that B cues had a strong effect in inducing players to make all claims from one block; we found an analogous, but weaker, effect in the same direction in another pair (G23, G19) and no effect in either direction in the pairs (G10, G12) and (G24, G20): see Appendix B, Table B.1.

In all four N games, efficiency was relatively low (between 18.5 and 32.0 per cent), and was lower in eight-disc games than in four-disc games. This is perhaps not surprising, given the difficulty of avoiding disagreement when there are many discs on the table. Indeed, one might be surprised that efficiency in these games was as high as it was. For example, in the equality-compatible eight-disc game (G20), if both players claimed discs worth £5, and if each player randomised between the 52 different sets of claims that have this property, standardised efficiency would be only 1.9 per cent. The main reason why such extreme inefficiency did not materialise was that many subjects played safe by claiming less than £5. That subjects behaved in this way is indicated by the fact that agreement rates are higher than corresponding efficiency measures; more direct evidence can be found in Table 2. In the eight-disc N games, an additional causal factor may have been at work. In these games, standardised efficiency is somewhat greater than blind efficiency, suggesting that players made some use of the spatial layout of discs to facilitate coordination.

In all four C games, efficiency is more than twice as high as in the corresponding N games; in each case, the difference is significant at the 1 per cent level. Clearly, the rule of closeness is a powerful focal point in all these games. If the power of a spatial cue is measured by the relative change in efficiency attributable to its presence, closeness cues seem to be no less powerful in the equality-incompatible games than the equality-compatible ones. Although levels of efficiency fall off as complexity increases, closeness cues seem to become *more* powerful.

As in the N games, agreement rates in the C games are markedly higher than the corresponding efficiency measures. This reflects the fact that many players did not claim all the discs that, according to the spatial cues, were 'theirs'. For example, consider G18. In this equality-compatible eight-disc C game, standardised efficiency is 51.8 per cent, while the standardised agreement rate is 62.2 per cent. Table 2 shows that 43 of the 100 players of this game claimed discs worth less than £5, while only four claimed discs worth more than £5. It is natural to ask whether players made use of closeness cues in deciding which of 'their' discs to claim. The data in Table 3 suggest that they did. In G18, for example, 41 of the 50 Left players claimed the £1 disc in column –4 (disc d_3), while only 34 chose the £1 disc in column –1 (disc d_2); similarly, 39 Right players claimed the £1 disc in column 4 (disc d_6), while only 24 chose the £1 disc in column 1 (disc d_7).

The A games show qualitatively similar effects to those found in the C games. In all four A games, efficiency is greater than in the corresponding N games, and in each case the difference is significant at the 1 per cent level. However, the accession cues are more powerful in the eight-disc games (where their effect on efficiency is similar to that of the closeness cues) than in the four-disc games. This difference can also be observed in the spatial distributions of the claims of Left and Right players in A games (see Table 3): Left/Right asymmetries in central-column claims are more pronounced in eight-disc games. Intuitively, this difference seems to reflect the relative salience of the accession cues in the two cases: if one looks at the displays of the A games (see Appendix A), it is immediately obvious that the two blocks appear much closer to the bases in G21and G22 than in G7 and G8).

The distributional effects of relational cues are less pronounced in four- and eight-disc games than in two-disc games. In all the four- and eight-disc games, favoured players claim more and have higher expected payoffs than unfavoured players, but the effects on claims are never significant at more than the 10 per cent level, and the effects on payoffs never achieve even this level of significance (see Table 6). There is a suggestive parallel here with the observation that, in the context of efficiency comparisons, the differences between equality-compatible and equality-incompatible games become less sharp as the number of discs increases. It seems that, as the number of discs increases, the issue of whether the total value of the discs can be divided equally between the two players becomes less salient. This is perhaps connected with the tendency for players of four- and eight-disc games to claim less than half the total value of the discs on the table. For a player who expects some discs to remain unclaimed, it may seem immaterial to ask whether or not the total value of the discs can be divided equally.

E. The Effect of Experience

Since no feedback was provided between scenarios, and since subjects were paid only for one of them, each of our scenarios can be regarded as a one-shot game. However, subjects may have become more conscious of labelling cues as the experiment progressed. To test for this possibility, we investigated whether there were systematic changes in subjects' behaviour over the course of the experiment. For each game, we investigated whether behaviour in that game differed according to its location in the sequence of scenarios. We found no systematic effects for two-disc games, but for four- and eight-disc games with relational cues there was some tendency for expected payoffs to increase over the course of the experiment.[21] It seems that experience of playing two-disc games may have helped subjects to recognise relational cues in more complex games.

V. Discussion

The results reported in Section IV show that label invariance fails in both equality-compatible and equality-incompatible bargaining table games. The nature of this failure is as predicted by Schelling's theory of the role of focal points in tacit bargaining. That is, labelling cues that suggest relations between specific objects and specific players increase efficiency and, where those cues suggest unequal distributions, induce corresponding inequalities in both claims and payoffs. The relative strength of the efficiency and distributional effects of labelling cues varies between the games we have studied, but in *all* the games in which there are cues of accession or closeness, at least one of those effects is strongly significant.

It is perhaps not particularly surprising that relational cues that point to equal and efficient solutions are powerful focal points. It is well established that, in bargaining games in which there is exactly one outcome that gives an equal and efficient division of monetary payoffs, players who are able to communicate with one another tend to agree on that outcome (e.g. Roth and Murnighan 1982). It is also known that spatial cues of accession and closeness are salient in matching games in which players' interests are fully aligned (Mehta et al. 1994a, 1994b). One might therefore have expected that, in tacit bargaining games, the same kinds of spatial cues would be used to select among equal and efficient equilibria – which is exactly what we found in our *equality-compatible* games. But for our purposes, the main relevance of this result is as a benchmark from which to assess the power of relational cues in *equality-incompatible* games.

[21] For each game we compared the average expected payoff when the game was played in the first half of the experiment (scenarios 1–12) and when it was played in the second half (scenarios 13–24). Expected payoffs were calculated using the legitimate matching procedure separately for participants who played the game in each half of the experiment. We found no significant increases in efficiency for any 2-disc game. There were significant increases in five out of the eight C and A 4- and 8-disc games. In principle, similar comparisons can be made between average expected payoffs for games played in scenario 1 (i.e. by subjects who had had no opportunities for learning) and in the experiment as a whole. These data do not show any obvious learning effects, but there are too few scenario 1 observations for meaningful statistical tests. Our tests for the effects of repetition are detailed in Appendix B, Section B.2.

Intuitively, there seems to be some psychological tension between the idea of using payoff-irrelevant cues as a coordinating device and the recognition that this can imply arbitrary payoff inequalities. Schelling himself acknowledges this when, in the passage we quoted in the Introduction, he says that a rational player must exercise 'discipline' in accepting the lesser payoff in a focal equilibrium. In interpreting evidence about the power of payoff-irrelevant cues, one must therefore be cautious in extrapolating from games in which acting on such cues does not require players to accept inequality to games in which it does. An experiment recently reported by Crawford et al. (2008) suggests that this kind of extrapolation may not be valid for matching games. Using cues that are powerful focal points in *symmetric* matching games – that is, matching games in which both players receive the same payoff in all equilibria – Crawford et al. find that the introduction of small payoff asymmetries can induce coordination failure. If it were *generally* true that payoff-irrelevant cues had power only in the complete absence of conflicts of interest, a theory of focal points would have little to contribute to the understanding of tacit bargaining. It is therefore important to know whether focal points are effective in equality-incompatible tacit bargaining games. Our results suggest that they are.

In the light of our results, it is natural to ask whether particular features of tacit bargaining games facilitate focal-point reasoning in relation to equilibria with unequal payoffs. We offer the following conjectures about how players' perceptions of payoff inequalities might differ between tacit bargaining and matching games.

In a matching game, coordination occurs when two players choose the *same* strategy. The logic of an asymmetric matching game prompts players to think of their problem as that of coordinating on a particular distribution of payoffs, thereby foregrounding conflicts of interest. Payoff-irrelevant cues take the form of labels that are arbitrarily attached to particular equilibria. When those equilibria are distinguishable by their payoffs, subjects may perceive the labels as serving no purpose and so overlook their potential value as coordinating devices. Our tacit bargaining games have a different emphasis. In these games, players do not have to specify what their co-players are to get, but only what they want to get for themselves. Thus, each player's attention is directed towards his or her own claims and potential payoffs, rather than towards the distribution of payoffs between the two players. This feature of tacit bargaining games is reinforced by the relational nature of the cues, which suggest associations between players and claimable objects.

As we explained in the Introduction, the features that differentiate our tacit bargaining games from matching games have analogues in many real-world problems of tacit bargaining. If, as we have conjectured, the tacit bargaining frame makes distributional considerations less salient, there may be an additional reason for expecting our experimental design to have external validity. We suggest that distributional properties are often less relevant in real bargaining than in laboratory implementations of fully-specified games. In many real situations, there is no single, homogenous unit of payoff that is common knowledge between the players and that could therefore be used to specify distributional concepts. In classical game theory, utility is the relevant unit, but real players typically lack information about one another's utility functions. In some real cases there is a salient unit of *material* payoff, but common knowledge is lacking. (Think of profit in the case of tacit bargaining between duopolists.) In other cases, there is not even an obvious unit. (Consider a buyer and a seller bargaining over the price at which a car is to be sold. To specify equality in material payoffs, they first need a rate of equivalence between two material units, cars and money – and that is exactly what is in dispute between them.) Typically, each bargainer can think more easily about her own payoffs, and is better informed about them, than about those of the other person. This may help to explain why object/claimant rules, which do not require players to take account of one another's payoffs, are commonly used to resolve real bargaining problems.

We have developed an experimental design that captures significant features of real problems of tacit bargaining, while allowing sharp tests of Schelling's hypotheses about the role of payoff-irrelevant relational cues in these problems. Our results provide strong support for those hypotheses. They suggest that analyses of tacit bargaining need to take account of subjectively perceived relations between claimants and disputed objects, whether or not those relations are represented in conventional game-theoretic models.

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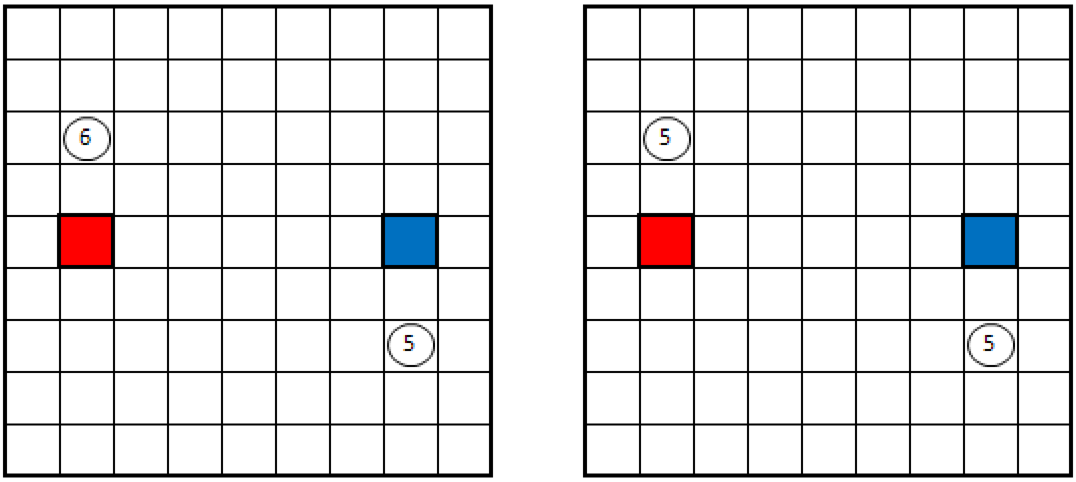
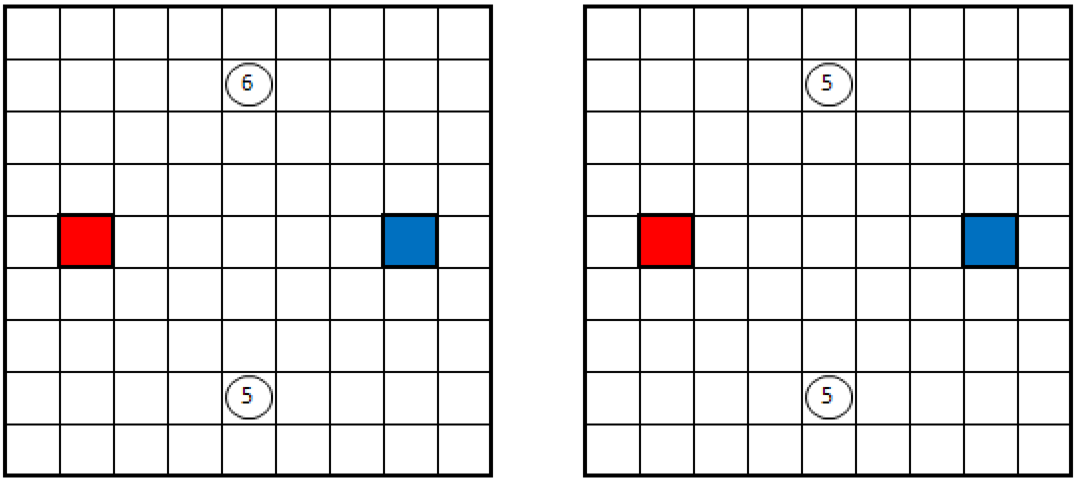


G1 = 6| |5 G2 = 5| |5

Figure 1 – Bargaining Tables for G1 and G2



G3 = |6,5| G4 = |5,5|

Figure 2 – Bargaining Tables for G3 and G4

Table 1 – Summary of Experimental Design

LUE[a]	Spatial Cue[b]	2 discs	4 discs	8 discs
5:5	N	G4 = |5,5|	G12 = |3,2,2,3|	G20 = |2,1,1,1,1,1,1,2|
5:5	B		G10 = |(3,2) (2,3)|	G24 = |(2,1,1,1)(1,1,1,2)|
5:5	C	G2 = 5| |5	G6 = 3,2| |2,3	G18 = 2,1,1,1| |1,1,1,2
5:5	A		G8 = (3|2)(2|3)	G22 = (2,1,1|1)(1|1,1,2)
6:5	N	G3 = |6,5|	G11 = |3,3,2,3|	G19 = |2,2,1,1,1,1,1,2|
6:5	B		G9 = |(3,3) (2,3)|	G23 = |(2,2,1,1)(1,1,1,2)|
6:5	C	G1 = 6| |5	G5 = 3,3| |2,3	G17 = 2,2,1,1| |1,1,1,2
6:5	A		G7 = (3|3)(2|3)	G21 = (2,2,1|1)(1|1,1,2)
8:3	N	G15 = |8,3|		
8:3	C	G13 = 8| |3		
10:1	N	G16 = |10,1|		
10:1	C	G14 = 10| |1		

a – Least unequal efficient distribution.

b – N = Neutral; B = Blocks; C = Closeness; A = Accession.

Table 2 – Distribution of Claim Values by Game

<table>
<tr><th rowspan="2">Game Description</th><th rowspan="2">Fav/ Unfav</th><th rowspan="2">Mean</th><th rowspan="2">Med.</th><th rowspan="2">Std. Dev.</th><th colspan="12">Claim Value</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th></tr>
<tr><td rowspan="2">G1 = 6| |5</td><td>Fav</td><td>5.62</td><td>6</td><td>0.92</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>13</td><td>36</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td></tr>
<tr><td>Unfav</td><td>5.18</td><td>5</td><td>0.39</td><td>0</td><td>-</td><td>-</td><td>-</td><td>-</td><td>41</td><td>9</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td></tr>
<tr><td>G2 = 5| |5</td><td></td><td>4.95</td><td>5</td><td>0.50</td><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td><td>99</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td><td>-</td></tr>
<tr><td>G3 = |6,5|</td><td></td><td>5.47</td><td>5</td><td>0.50</td><td>0</td><td>-</td><td>-</td><td>-</td><td>-</td><td>53</td><td>47</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td></tr>
<tr><td>G4 = |5,5|</td><td></td><td>5.00</td><td>5</td><td>0.00</td><td>0</td><td>-</td><td>-</td><td>-</td><td>-</td><td>100</td><td>-</td><td>-</td><td>-</td><td>-</td><td>0</td><td>-</td></tr>
<tr><td rowspan="2">G5 = 3,3| |2,3</td><td>Fav</td><td>4.78</td><td>6</td><td>1.63</td><td>0</td><td>-</td><td>5</td><td>13</td><td>-</td><td>4</td><td>27</td><td>-</td><td>1</td><td>0</td><td>-</td><td>0</td></tr>
<tr><td>Unfav</td><td>4.78</td><td>5</td><td>1.30</td><td>0</td><td>-</td><td>1</td><td>11</td><td>-</td><td>29</td><td>7</td><td>-</td><td>1</td><td>1</td><td>-</td><td>0</td></tr>
<tr><td>G6 = 3,2| |2,3</td><td></td><td>4.51</td><td>5</td><td>1.31</td><td>0</td><td>-</td><td>7</td><td>19</td><td>2</td><td>68</td><td>2</td><td>0</td><td>0</td><td>-</td><td>2</td><td>-</td></tr>
<tr><td rowspan="2">G7 = (3|3)(2|3)</td><td>Fav</td><td>4.88</td><td>5</td><td>1.60</td><td>0</td><td>-</td><td>3</td><td>10</td><td>-</td><td>21</td><td>14</td><td>-</td><td>1</td><td>0</td><td>-</td><td>1</td></tr>
<tr><td>Unfav</td><td>4.70</td><td>5</td><td>1.63</td><td>0</td><td>-</td><td>4</td><td>10</td><td>-</td><td>27</td><td>7</td><td>-</td><td>0</td><td>1</td><td>-</td><td>1</td></tr>
<tr><td>G8 = (3|2)(2|3)</td><td></td><td>4.37</td><td>5</td><td>1.24</td><td>0</td><td>-</td><td>12</td><td>17</td><td>1</td><td>65</td><td>3</td><td>1</td><td>1</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>G9 = |(3,3) (2,3)|</td><td></td><td>4.64</td><td>5</td><td>1.45</td><td>0</td><td>-</td><td>5</td><td>28</td><td>-</td><td>37</td><td>29</td><td>-</td><td>0</td><td>0</td><td>-</td><td>1</td></tr>
<tr><td>G10 = |(3,2) (2,3)|</td><td></td><td>4.49</td><td>5</td><td>1.21</td><td>0</td><td>-</td><td>7</td><td>18</td><td>4</td><td>66</td><td>3</td><td>1</td><td>0</td><td>-</td><td>1</td><td>-</td></tr>
<tr><td>G11 = |3,3,2,3|</td><td></td><td>4.78</td><td>5</td><td>1.40</td><td>0</td><td>-</td><td>5</td><td>22</td><td>-</td><td>44</td><td>26</td><td>-</td><td>1</td><td>2</td><td>-</td><td>0</td></tr>
<tr><td>G12 = |3,2,2,3|</td><td></td><td>4.21</td><td>5</td><td>1.27</td><td>1</td><td>-</td><td>13</td><td>18</td><td>3</td><td>61</td><td>4</td><td>0</td><td>0</td><td>-</td><td>0</td><td>-</td></tr>
<tr><td rowspan="2">G13 = 8| |3</td><td>Fav</td><td>6.46</td><td>8</td><td>2.43</td><td>0</td><td>-</td><td>-</td><td>16</td><td>-</td><td>-</td><td>-</td><td>-</td><td>33</td><td>-</td><td>-</td><td>1</td></tr>
<tr><td>Unfav</td><td>5.16</td><td>3</td><td>2.60</td><td>0</td><td>-</td><td>-</td><td>29</td><td>-</td><td>-</td><td>-</td><td>-</td><td>20</td><td>-</td><td>-</td><td>1</td></tr>
<tr><td rowspan="2">G14 = 10| |1</td><td>Fav</td><td>8.42</td><td>10</td><td>3.52</td><td>0</td><td>9</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>39</td><td>2</td></tr>
<tr><td>Unfav</td><td>6.56</td><td>10</td><td>4.44</td><td>1</td><td>18</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>31</td><td>0</td></tr>
<tr><td>G15 = |8,3|</td><td></td><td>5.90</td><td>8</td><td>2.58</td><td>1</td><td>-</td><td>-</td><td>41</td><td>-</td><td>-</td><td>-</td><td>-</td><td>57</td><td>-</td><td>-</td><td>1</td></tr>
<tr><td>G16 = |10,1|</td><td></td><td>7.84</td><td>10</td><td>3.92</td><td>2</td><td>22</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>74</td><td>2</td></tr>
<tr><td rowspan="2">G17 = 2,2,1,1| |1,1,1,2</td><td>Fav</td><td>4.72</td><td>5</td><td>1.44</td><td>0</td><td>2</td><td>3</td><td>3</td><td>12</td><td>10</td><td>19</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Unfav</td><td>4.46</td><td>5</td><td>1.31</td><td>0</td><td>3</td><td>2</td><td>4</td><td>6</td><td>32</td><td>2</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>G18 = 2,1,1,1| |1,1,1,2</td><td></td><td>4.31</td><td>5</td><td>1.29</td><td>0</td><td>5</td><td>5</td><td>9</td><td>24</td><td>53</td><td>3</td><td>0</td><td>0</td><td>0</td><td>1</td><td>-</td></tr>
<tr><td>G19 = |2,2,1,1,1,1,1,2|</td><td></td><td>4.30</td><td>4</td><td>1.41</td><td>0</td><td>4</td><td>8</td><td>13</td><td>26</td><td>31</td><td>15</td><td>2</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>G20 = |2,1,1,1,1,1,1,2|</td><td></td><td>3.95</td><td>4</td><td>1.33</td><td>0</td><td>5</td><td>12</td><td>17</td><td>21</td><td>40</td><td>4</td><td>1</td><td>0</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td rowspan="2">G21 = (2,2,1|1)(1|1,1,2)</td><td>Fav</td><td>4.58</td><td>5</td><td>1.62</td><td>0</td><td>2</td><td>5</td><td>6</td><td>8</td><td>9</td><td>19</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Unfav</td><td>4.36</td><td>5</td><td>1.26</td><td>0</td><td>2</td><td>4</td><td>6</td><td>3</td><td>32</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>G22 = (2,1,1|1)(1|1,1,2)</td><td></td><td>4.21</td><td>5</td><td>1.34</td><td>0</td><td>6</td><td>11</td><td>8</td><td>9</td><td>63</td><td>3</td><td>0</td><td>0</td><td>0</td><td>0</td><td>-</td></tr>
<tr><td>G23 = |(2,2,1,1)(1,1,1,2)|</td><td></td><td>4.10</td><td>5</td><td>1.35</td><td>0</td><td>7</td><td>8</td><td>15</td><td>13</td><td>52</td><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>G24 = |(2,1,1,1)(1,1,1,2)|</td><td></td><td>4.23</td><td>5</td><td>1.28</td><td>0</td><td>5</td><td>6</td><td>14</td><td>19</td><td>50</td><td>4</td><td>2</td><td>0</td><td>0</td><td>0</td><td>-</td></tr>
</table>

Table 3 – Spatial Distribution of Claims in C and A games

Game		Column Coordinate								
		–4	–3	–2	–1	0	1	2	3	4
G1 = 6| |5			76:20						24:78	
G2 = 5| |5			94:10						6:88	
G5 = 3,3| |2,3			80:10	62:26				16:66	16:70	
G6 = 3,2| |2,3			84:12	80:10				6:70	8:86	
G7 = (3|3)(2|3)	[row –2]				68:20	44:34				
	[row 2]					48:60	20:64			
G8 = (3|2)(2|3)	[row –2]				74:18	48:18				
	[row 2]					38:60	16:74			
G13 = 8| |3			66:40						36:62	
G14 = 10| |1			66:50						34:52	
G17 = 2,2,1,1| |1,1,1,2		82:16	78:20	82:8	64:14		8:54	8:66	4:66	6:84
G18 = 2,1,1,1| |1,1,1,2		82:14	86:20	84:14	68:10		4:48	6:66	12:72	8:78
G21 = (2,2,1|1)(1|1,1,2)	[row –2]		76:14	66:12	72:10	64:10				
	[row 2]					20:56	12:66	14:68	12:74	
G22 = (2,1,1|1)(1|1,1,2)	[row –2]		78:12	82:10	70:4	78:6				
	[row 2]					12:62	8:78	6:74	8:78	
Average claims by Left (%)		82	78	76	69	44	11	9	16	7
Average claims by Right (%)		15	21	13	13	38	64	68	73	81

Table 4 – Spatial Distribution of Claims in N and B games

Game	Row Coordinate								
	-4	-3	-2	-1	0	1	2	3	4
G3 = |6,5|		46:40						54:60	
G4 = |5,5|		42:30						58:70	
G9 = |(3,3) (2,3)|		44:22	46:26				40:54	40:66	
G10 = |(3,2) (2,3)|		42:38	46:26				44:54	50:56	
G11 = |3,3,2,3|		52:30		36:26		46:56		52:54	
G12 = |3,2,2,3|		38:22		42:24		42:52		46:68	
G15 = |8,3|		42:44						60:54	
G16 = |10,1|		44:44						60:52	
G19 = |2,2,1,1,1,1,1,2|	35:19	36:28	34:32	38:24	28:30	32:48	48:50	50:58	38:63
G20 = |2,1,1,1,1,1,1,2|	50:27	46:20	42:32	36:14	20:34	42:46	50:60	46:54	50:58
G23 = |(2,2,1,1)(1,1,1,2)|	36:20	42:24	38:18	34:18		34:62	42:54	44:62	54:64
G24 = |(2,1,1,1)(1,1,1,2)|	50:32	52:28	34:20	30:16		34:50	38:52	40:60	52:62
Average claims by Left (%)	43	44	40	36	24	38	44	50	48
Average claims by Right (%)	25	31	26	20	32	52	54	60	62

Table 5 – Efficiency in 2-Disc Games

	5:5	6:5	8:3	10:1
Game description:				
N	G4 = |5,5|	G3 = |6,5|	G15 = |8,3|	G16 = |10,1|
C	G2 = 5| |5	G1 = 6| |5	G13 = 8| |3	G14 = 10| |1
Benchmarks (%):				
Nash efficiency	50.0	49.6	39.7	16.5
Blind efficiency	50.0	50.3	48.3	35.8
Standardised Efficiency (%)				
N	46.7	48.6	45.7	35.0
C	84.4	64.8	51.4	36.9
Power of Relational Cues:[a]				
C	1.80***	1.33***	1.12*	1.06

N = Neutral; C = Closeness.

a – Standardised efficiency in C as proportion of standardised efficiency in N. Asterisks show significance in one-tail Wilcoxon signed-rank tests on expected payoffs: * = 10%; ** = 5%; *** = 1%.

Table 6 - Distributional Effects of Relational Cues in Equality-incompatible Games

Game Description	Claims[a]			Expected Payoff[a]		
	Fav.	Unfav.	Sig.[b]	Fav.	Unfav.	Sig.[b]
G1 = 6| |5	5.62 (6)	5.18 (5)	***	3.79 (4.5)	3.35 (3.8)	***
G5 = 3,3| |3,2	4.78 (6)	4.78 (5)	*	3.00 (2.8)	2.88 (3.0)	
G7 = (3|3) (2|3)	4.88 (5)	4.70 (5)		1.86 (1.3)	1.72 (1.7)	
G13 = 8| |3	6.46 (8)	5.16 (3)	***	3.45 (4.0)	2.20 (1.9)	***
G14 = 10| |1	8.42 (10)	6.56 (10)	***	2.87 (2.4)	1.18 (0.7)	***
G17 = 2,2,1,1| |2,1,1,1	4.72 (5)	4.46 (5)	*	2.96 (3.1)	2.74 (3.4)	
G21 = (2,2,1|1) (1|2,1,1)	4.58 (5)	4.36 (5)	*	2.71 (3.3)	2.43 (3.2)	

a – The numbers are means; medians in brackets.

b – Significance in one-tail Mann-Whitney tests: * = 10%; ** = 5%; *** = 1%.

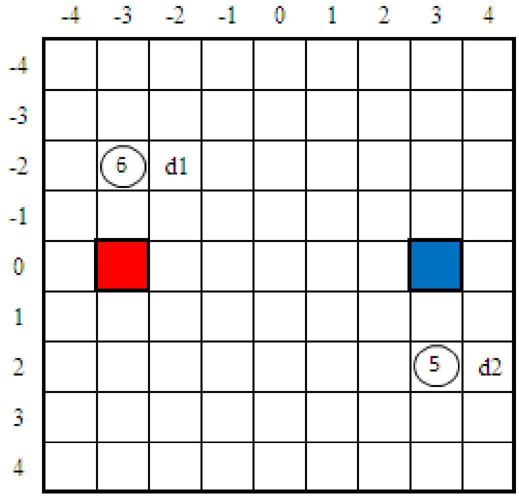
Table 7 – Efficiency in 4-Disc and 8-Disc Games

	4 discs		8 discs	
	5:5	**6:5**	**5:5**	**6:5**
Game description:				
N	G12 = |3,2,2,3|	G11 = |3,3,2,3|	G20 = |2,1,1,1,1,1,1,2|	G19 = |2,2,1,1,1,1,1,2|
B	G10 = |(3,2) (2,3)|	G9 = |(3,3) (2,3)|	G24 = |(2,1,1,1)(1,1,1,2)|	G23 = |(2,2,1,1)(1,1,1,2)|
C	G6 = 3,2| |2,3	G5 = 3,3| |2,3	G18 = 2,1,1,1| |1,1,1,2	G17 = 2,2,1,1| |1,1,1,2
A	G8 = (3|2)(2|3)	G7 = (3|3)(2|3)	G22 = (2,1,1|1)(1|1,1,2)	G21 = (2,2,1|1)(1|1,1,2)
Benchmark (%):				
Blind efficiency	30.0	25.3	12.4	12.1
Standardised Efficiency (%):				
N	32.0	23.8	22.0	18.5
B	33.3	35.2	22.0	22.1
C	65.8	53.4	52.9	51.8
A	41.1	32.5	58.7	46.7
Standardised Agreement Rate (%):				
N	41.5	30.7	29.9	27.0
B	39.8	44.8	28.0	32.2
C	74.9	62.8	63.4	62.2
A	49.3	40.2	68.3	57.4
Power of Relational Cues:[a]				
C	2.06***	2.24***	2.40***	2.80***
A	1.28***	1.37***	2.67***	2.53***

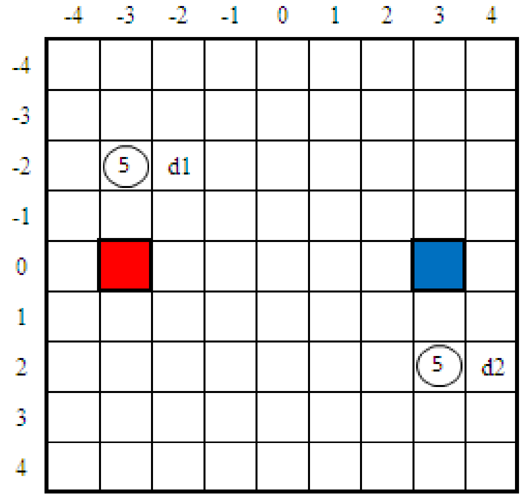
N = Neutral; B = Blocks; C = Closeness; A = Accession.

a – Standardised efficiency in C or A as proportion of standardised efficiency in N. Asterisks show significance in one-tail Wilcoxon signed-rank tests on expected payoffs: * = 10%; ** = 5%; *** = 1%.

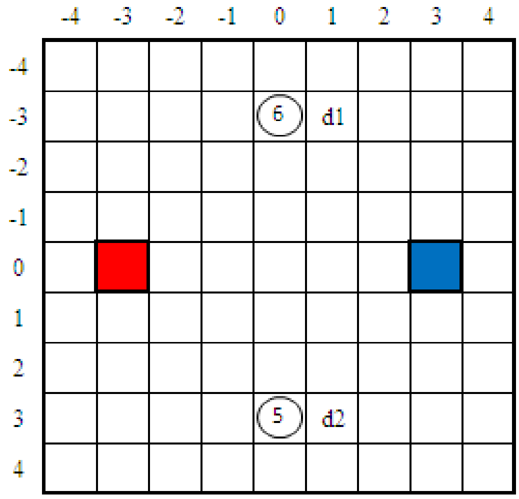
Appendix A – The Scenarios



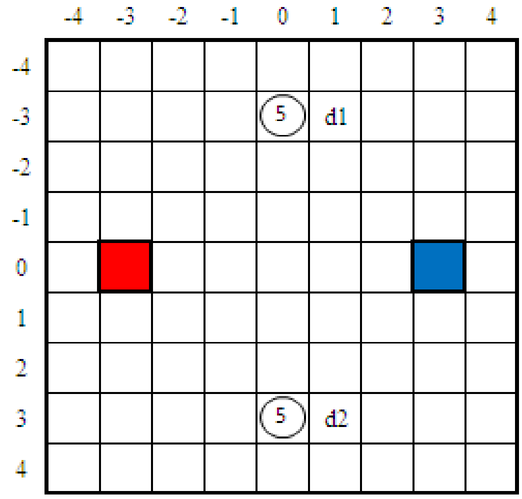
Game: 1 **LUE:** 6:5
Descr.: G1 = 6| |5 **Cue:** C



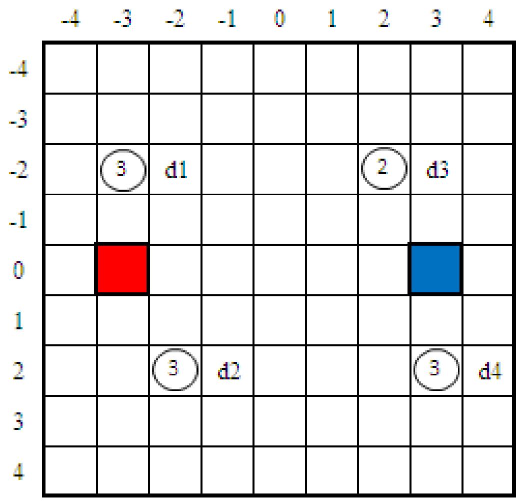
Game: 2 **LUE:** 5:5
Descr.: G2 = 5| |5 **Cue:** C



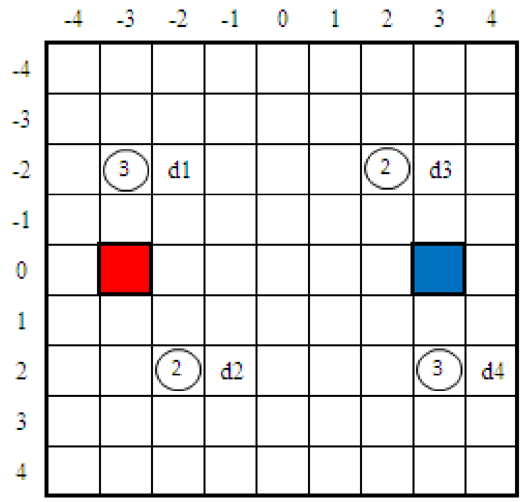
Game: 3 **LUE:** 6:5
Descr.: G3 = |6,5| **Cue:** N



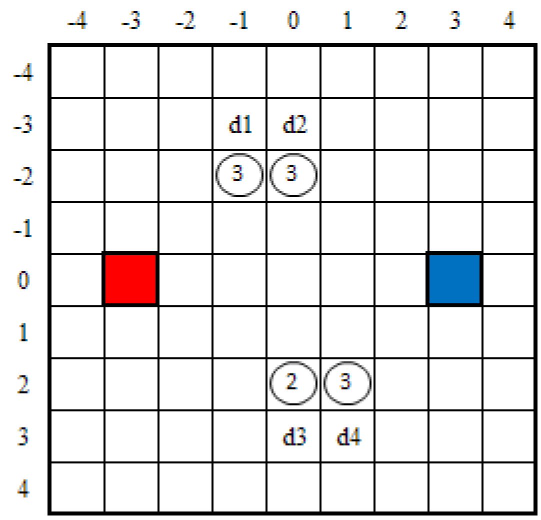
Game: 4 **LUE:** 5:5
Descr.: G4 = |5,5| **Cue:** N



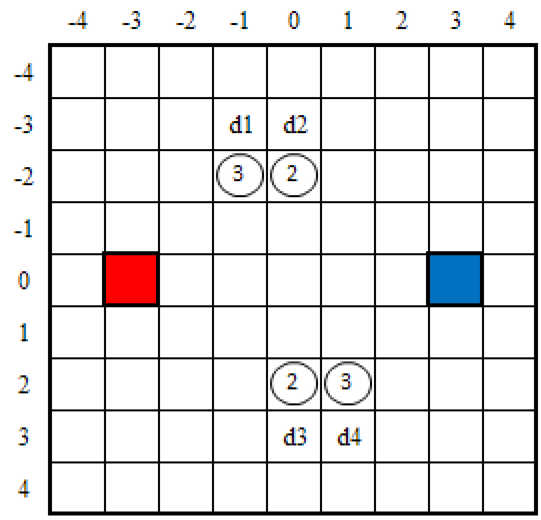
Game: 5 **LUE:** 6:5
Descr.: G5 = 3,3| |2,3 **Cue:** C



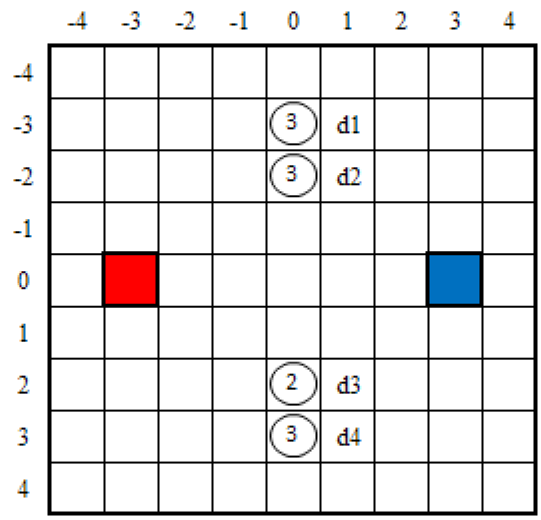
Game: 6 **LUE:** 5:5
Descr.: G6 = 3,2| |2,3 **Cue:** C



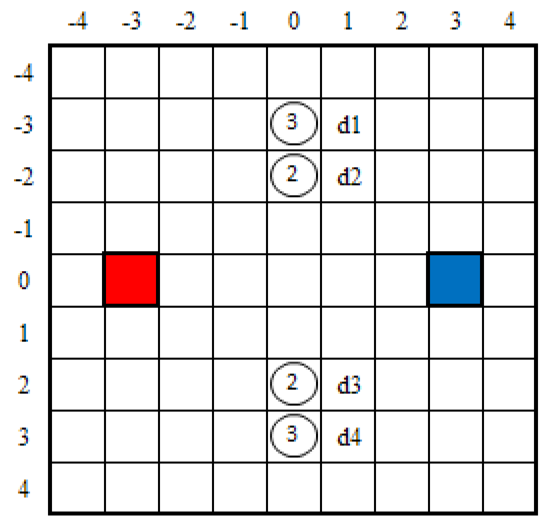
Game: 7 **LUE:** 6:5
Descr.: G7 = (3|3)(2|3) **Cue:** A



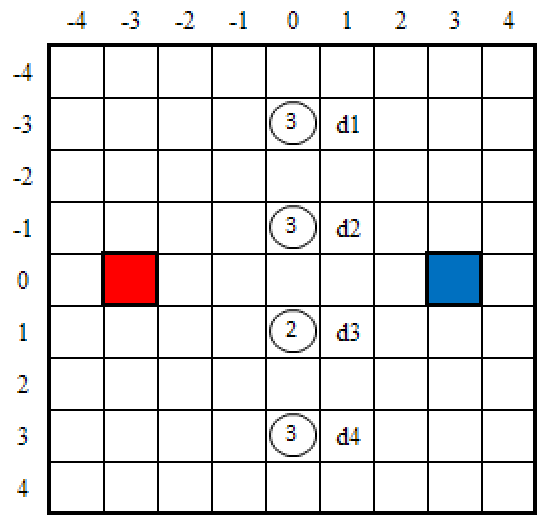
Game: 8 **LUE:** 5:5
Descr.: G8 = (3|2)(2|3) **Cue:** A



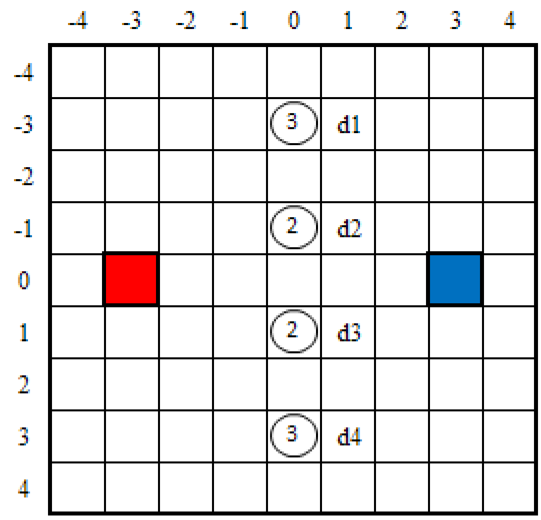
Game: 9 **LUE:** 6:5
Descr.: G9 = |(3,3) (2,3)| **Cue:** B



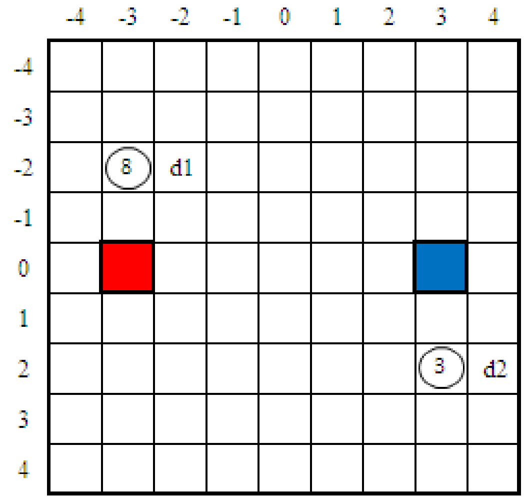
Game: 10 **LUE:** 5:5
Descr.: G10 = |(3,2) (2,3)| **Cue:** B



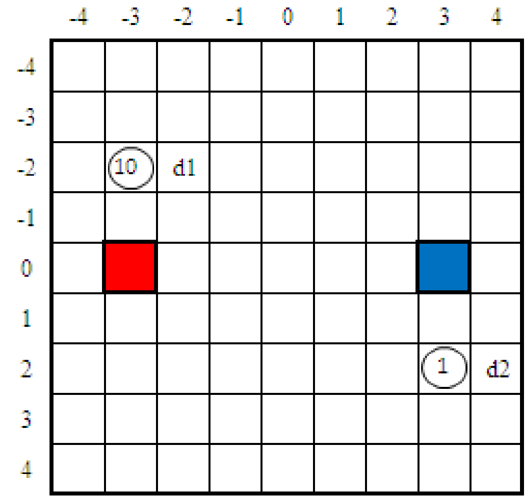
Game: 11 **LUE:** 6:5
Descr.: G11 = |3,3,2,3| **Cue:** N



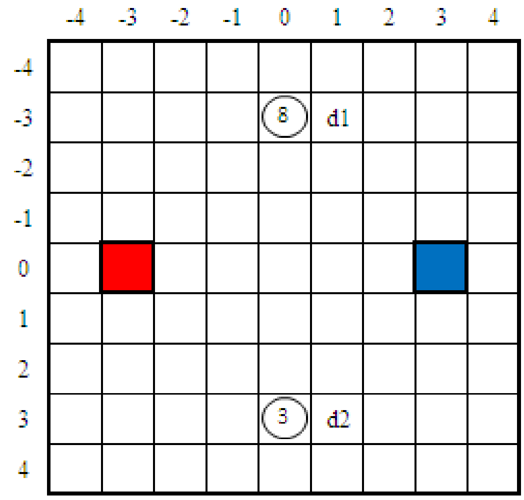
Game: 12 **LUE:** 5:5
Descr.: G12 = |3,2,2,3| **Cue:** N



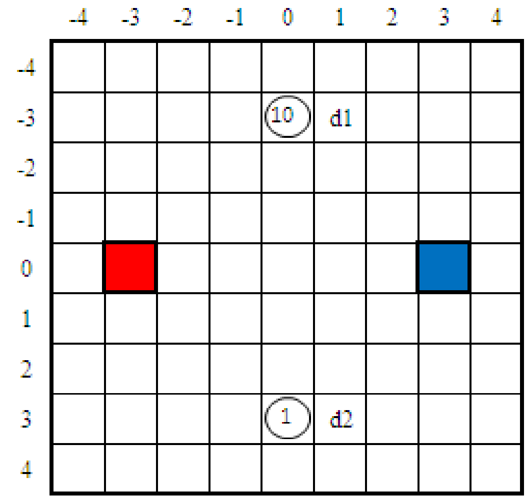
Game: 13 **LUE:** 8:3
Descr.: G13 = 8| |3 **Cue:** C



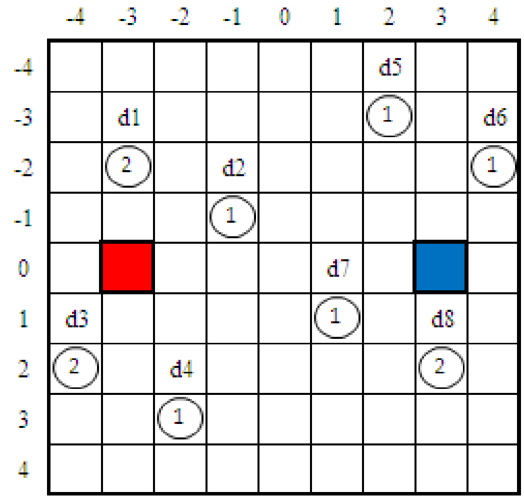
Game: 14 **LUE:** 10:1
Descr.: G14 = 10| |1 **Cue:** C



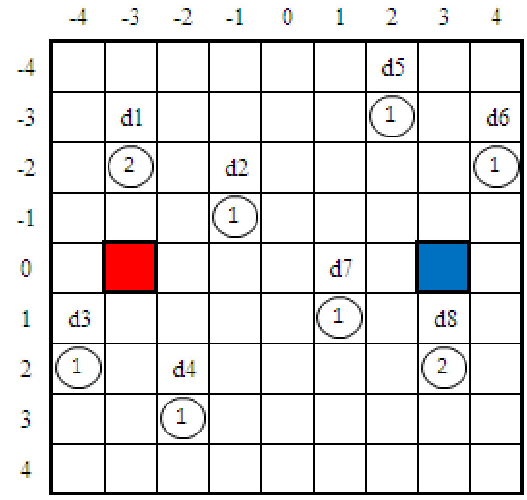
Game: 15 **LUE:** 8:3
Descr.: G15 = |8,3| **Cue:** N



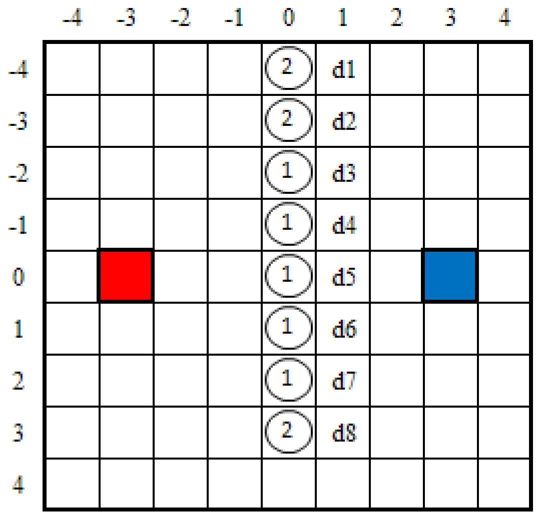
Game: 16 **LUE:** 10:1
Descr.: G16 = |10,1| **Cue:** N



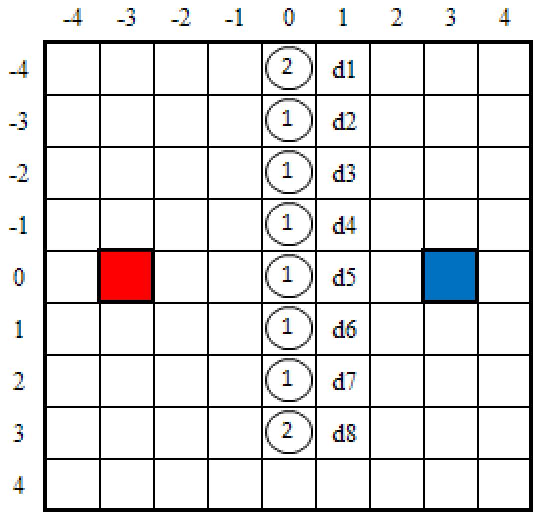
Game: 17 **LUE:** 6:5
Descr.: G17 = 2,2,1,1| |1,1,1,2 **Cue:** C



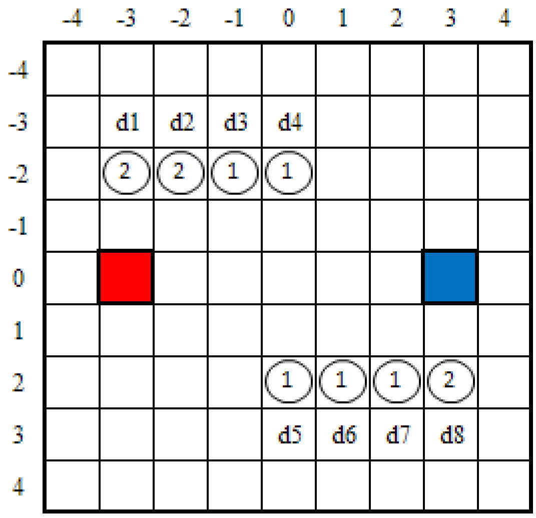
Game: 18 **LUE:** 5:5
Descr.: G18 = 2,1,1,1| |1,1,1,2 **Cue:** C



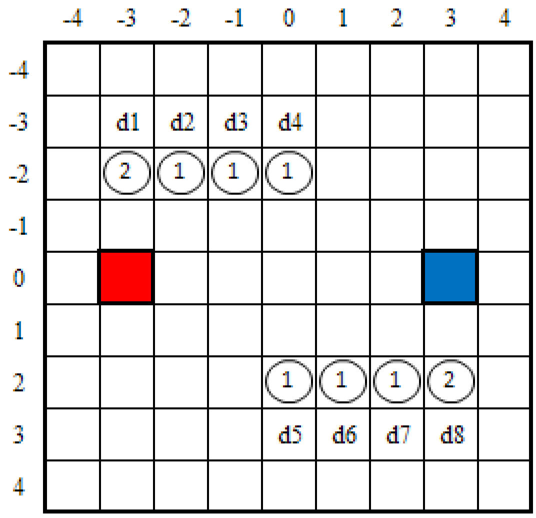
Game: 19 **LUE:** 6:5
Descr.: G19 = |2,2,1,1,1,1,1,2| **Cue:** N



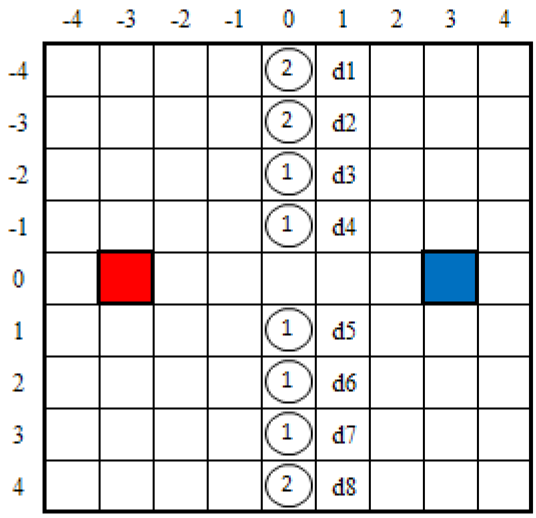
Game: 20 **LUE:** 5:5
Descr.: G20 = |2,1,1,1,1,1,1,2| **Cue:** N



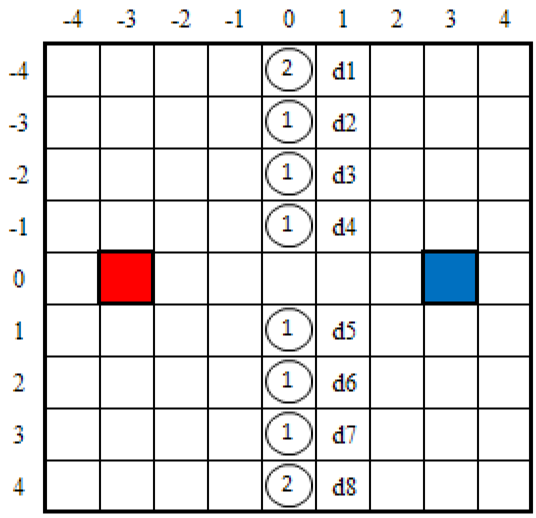
Game: 21 **LUE:** 6:5
Descr.: G21 = (2,2,1|1)(1|1,1,2) **Cue:** A



Game: 22 **LUE:** 5:5
Descr.: G22 = (2,1,1|1)(1|1,1,2) **Cue:** A



Game: 23 **LUE:** 6:5
Descr.: G23 = |(2,2,1,1)(1,1,1,2)| **Cue:** B



Game: 24 **LUE:** 5:5
Descr.: G24 = |(2,1,1,1)(1,1,1,2)| **Cue:** B