THE UNIVERSITY of York

Discussion Papers in Economics

No. 2005/05

What Price Compromise?
Testing a Possibly Surprising Implication of Nash Bargaining Theory

by

John Bone, John Hey and John Suckling

Department of Economics and Related Studies
University of York
Heslington
York, YO10 5DD

WHAT PRICE COMPROMISE?
TESTING A POSSIBLY SURPRISING IMPLICATION OF NASH BARGAINING THEORY

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This paper provides a very simple experimental test of a prediction of Nash Bargaining Theory that seems counterintuitive. The context is a simple bargaining problem between two players who have to agree a choice from three alternatives. One alternative favors one player and a second favors the other. The third is a fair compromise, but is excluded as an agreed choice by Nash Bargaining Theory. Our experimental results show that agreement on this third outcome occurs rather often. So the Nash theory is not well-supported by our evidence, although neither is a Strategic explanation of the data. The Nash-precluded outcome appeals because of its compromise nature; indeed, players are prepared to pay a price which is (according to the Nash theory) irrationally high, in order to reach a fair compromise.

1. INTRODUCTION

THIS PAPER REPORTS on an experimental investigation based on the following decision problem. There is a single (desirable) prize that may be allocated to either of two individuals, J and K. The allocation is to be decided randomly, by drawing a colored ball from an opaque bag. The prize goes to J if the drawn ball is yellow, and to K if blue. If the drawn ball is red, however, then they each receive nothing. The problem for J and K is that they have to agree which one of three bags is to be used for the draw, with contents as shown in Table 1.

If they fail to agree then by default no draw occurs and they each receive nothing, an outcome we denote as *z*.

Assuming that they are both self-interested, J and K have opposing preferences, *ex ante*, over the three bags. Bag C, being the middle-ranked alternative for both partners, represents the compromise agreement. It is also uniquely fair, in the obvious sense that it gives J and K an equal chance of winning the prize. However this fair compromise comes at a price, in the form of the red ball. Five or more red balls in Bag C, yellows and blues being unchanged throughout, would be too high a price, in that both partners would be better off, *ex ante*, with either of Bags A and B. We can say that, in that case, agreement on Bag C would be *collectively irrational* for the two partners.[1] But what if, as here, Bag C contains only one red ball? Is this too high a price to pay for the fair compromise?

It would be so if J and K could instead privately, and bindingly, agree to toss a fair coin to decide between Bags A and B, since this would give them each, *ex ante*, a 50% chance of winning the prize. It would similarly be so if they could bindingly agree to share the prize afterwards, either by direct division or through side-payments and/or further randomization, since each of Bags A and B delivers with certainty the prize thereby to be shared. But suppose that neither type of agreement is possible, so that the only options for J and K are just as initially described. Might they then reasonably agree to choose the fair, but costly, compromise in the form of Bag C? Our conjecture was that reasonable people, including ourselves, probably would do so. However, the agreed choice of Bag C is precluded by Nash Bargaining Theory.

In the following section we demonstrate this proposition. In section 3 we describe an experiment based on this decision problem. The results are discussed in section 4.

2. COLLECTIVE RATIONALITY IN THE COSTLY COMPROMISE PROBLEM

DEFINE a *Costly Compromise Problem* (CCP) where, for given parameters $\pi \in (\frac{1}{2}, 1)$ and $\gamma \in (1\text{-}\pi, \frac{1}{2})$, and a given prospective prize P, individuals J and K have to agree a choice from three alternative "bags" (or any equivalent devices) as defined in Table 2. Thus, Table 1 represents a CCP with $\pi = 0.75$ and $\gamma = 0.4$. Note that in general no assumption is made about the correlation between the two events [J wins] and [K wins]. Section 1 describes a CCP in which these events are mutually exclusive. But there could be a variation in which for each partner an independent draw (with replacement) is to be made from the agreed bag, with the attendant possibility of both partners winning P.

Define $\hat{\pi} = \sqrt{\pi(1\text{-}\pi)}$, where necessarily $\hat{\pi} \in (1\text{-}\pi, \frac{1}{2})$ (in Table 1, for example, we have $\hat{\pi} \approx 0.43$). Our counterintuitive result is the following: if $\gamma < \hat{\pi}$, as in Table 1, **then Nash Bargaining Theory rules out Bag C as an agreed choice in the CCP**.

We demonstrate this in two ways. The first, and simpler, is in terms of the *Nash Product*. In abstract, a two-person bargaining problem comprises a set of available alternatives X, each of which is weakly preferred by both bargaining partners to some given default outcome *d*. Nash's axioms together require the existence of some $\rho \in (0,1)$ such that the agreed choice $x \in \mathrm{X}$ maximizes the Nash Product:

(1) $$\mathrm{N}(x) = [u_j(x)]^{\rho}[u_k(x)]^{1-\rho}$$

where $u_j(x)$ and $u_k(x)$ are the two partners' individual vNM utilities,[2] each normalized to zero at *d*. (The further inclusion of a "symmetry" axiom requires the agreed choice to maximize (1) specifically for $\rho = \frac{1}{2}$.)

The CCP is a two-person bargaining problem with $d = z$ and X={A,B,C}, taking as given the prospective prize P and the probability parameters {B,(}. Here vNM utilities may be normalized to:

$$u_j(z) = 0 \qquad u_j(\mathrm{A}) = \pi \qquad u_j(\mathrm{B}) = 1\text{-}\pi \qquad u_j(\mathrm{C}) = \gamma$$

$$u_k(z) = 0 \qquad u_k(\mathrm{A}) = 1\text{-}\pi \qquad u_k(\mathrm{B}) = \pi \qquad u_k(\mathrm{C}) = \gamma$$

so that, for any given D:

(2) $$\mathrm{N(A)} = \pi^{\rho}(1\text{-}\pi)^{1-\rho} \qquad \mathrm{N(B)} = (1\text{-}\pi)^{\rho}\pi^{1-\rho} \qquad \mathrm{N(C)} = \gamma$$

Evidently $\mathrm{N(C)} \geq \mathrm{N(A)}$ and $\mathrm{N(C)} \geq \mathrm{N(B)}$ together imply $\gamma^2 \geq \pi(1\text{-}\pi)$. Given $\gamma < \hat{\pi}$, therefore, there is no value of D for which Bag C maximizes the Nash Product. This completes the first demonstration.

Collective rationality, as characterized by the Nash axioms, is implicit in the maximization of (1).[3] The second demonstration makes this more explicit by appealing directly to Nash-type axioms. For any bargaining problem, given the partners and their individual preferences, define the *eligible subset* $\Gamma(\mathrm{X}, d) \subseteq \mathrm{X}$. This is analogous to the set of most-preferred alternatives in the case of individual choice,[4] with the following three axioms thus being interpretable as requirements of rationality:

Non-emptiness $\Gamma(\mathrm{X}, d)$ is non-empty.

Efficiency $x \notin \Gamma(\mathrm{X}, d)$ if there exists some $y \in \mathrm{X}$ strictly preferred to *x* by each partner.

Consistency $x \notin \Gamma(\mathrm{X}, d)$ if there exists some $y \in \mathrm{X}$ and $\mathrm{Y} \supset \mathrm{X}$ such that $x \notin \Gamma(\mathrm{Y}, d)$ and $y \in \Gamma(\mathrm{Y}, d)$.

Now consider a hypothetical variant on the CCP in which J and K have to agree not only a choice of bag but also, at the same time, a choice of prize from Q and R, over which they have opposing preferences. Specifically, given B we can hypothesize prizes Q and R such that:

(3) $$[\mathrm{Q}, \hat{\pi}] \sim_j [\mathrm{R}, \pi] \qquad \textit{and} \qquad [\mathrm{R}, \hat{\pi}] \sim_k [\mathrm{Q}, \pi]$$

where $[\mathrm{P}, \varphi]$ denotes the prospect of winning P with probability φ. If J and K each have preferences conforming to Expected Utility (EU) theory, then (3) implies additionally that:

(4) $$[\mathrm{Q},1\text{-}\pi] \sim_j [\mathrm{R},\hat{\pi}] \qquad \textit{and} \qquad [\mathrm{R},1\text{-}\pi] \sim_k [\mathrm{Q},\hat{\pi}]$$

since the two probabilities in each prospect-pair have a common ratio throughout.

We are here considering, in effect, a two-person bargaining problem with $d = z$ and $X=\{A_Q,B_Q,C_Q,A_R,B_R,C_R\}$, the subscripts indicating the variable prize. Now assume that $\gamma < \hat{\pi}$, so that for both partners:

(5) $$[\mathrm{Q},\hat{\pi}] \succ_{j,k} [\mathrm{Q},\gamma] \qquad \textit{and} \qquad [\mathrm{R},\hat{\pi}] \succ_{j,k} [\mathrm{R},\gamma]$$

It follows from (3), (4) and (5) that C_Q and C_R are both Pareto-dominated, the former by A_R and the latter by B_Q. Efficiency therefore requires that Bag C is ineligible here, whatever the agreed choice of prize, if $\gamma < \hat{\pi}$.

Next decompose this hypothetical problem into its two constituent CCPs. In each of these J and K have to agree a choice from {A,B,C} with the same {B,(} values as in the composite problem, but with the prize in each case being fixed, respectively, as Q and R. In the composite problem, given that C_Q and C_R are both ineligible, Non-emptiness requires that at least one of $\{A_Q,B_Q,A_R,B_R\}$ is eligible. Consistency then implies that in the constituent problems either $C_Q \notin \{A_Q,B_Q,C_Q\}$ or $C_R \notin \{A_R,B_R,C_R\}$. In other words, if $\gamma < \hat{\pi}$, then C is ineligible in at least one of these constituent CCPs.

So for any {B,(} values such that $\gamma < \hat{\pi}$, there exists at least one, albeit hypothetical, CCP in which the agreed choice of Bag C is precluded by the above three axioms of collective rationality. Now add a fourth, more context-specific, axiom:

Prize-Independence In any CCP, the eligibility of each bag depends only on the values of {B,(}

Then it follows that Bag C is ineligible in any (hypothetical or actual) CCP with $\gamma < \hat{\pi}$, irrespective of the prize at stake. This completes the second demonstration.

In the next section we describe an experiment designed to test this specific implication of the Nash theory, i.e., that Bag C cannot be the agreed choice in a CCP if $\gamma < \hat{\pi}$. As is evident from the axiomatic argument, in effect this is a joint test of a number of assumptions. It may be thought that such an exercise is superfluous, given the prior existence of adverse experimental evidence on some of these assumptions individually. Most obviously, the assumption of EU preferences, by which we derived (4) from (3), is contradicted by a long record of experimental findings.[5] However, for our purposes this assumption is unnecessarily strong. The axiomatic argument would still go through if (4) was weakened to:

$$[Q, 1\text{-}\pi] \succsim_j [R, \hat{\pi}] \qquad \text{and} \qquad [R, 1\text{-}\pi] \succsim_k [Q, \hat{\pi}]$$

which, in conjunction with (3), would be consistent not only with EU but also with the *common-ratio* violation of EU, regularly observed under experimental conditions, whereby an individual's preference for the riskier prospect (i.e., that with the preferred prize but lower probability of winning) over the safer is inversely related to the overall probability levels.

Similarly, consider the axiom of Prize-Independence. This is implied by the Nash theory, as is evident in the Nash Products given in (2) which, like the vNM utility values on which they are based, are independent of the prize at stake. Indeed, these utility values would be the same even if there were different prizes in prospect for each partner. Thus in our definition of a CCP we can allow the more general possibility that $P=[P_J, P_K]$ is a vector of prizes, with P_J awarded to J in the event that J wins, and likewise P_K to K. Both demonstrations of the ineligibility of Bag C, given $\gamma < \hat{\pi}$, go through without amendment. However, there is prior evidence to suggest that Prize-Independence would be violated, empirically, for some CCPs of this type. In a series of experiments by Roth and various associates,[6] a monetary prize was allocated by lottery to one of two partners, who had to agree in advance how to divide a given total of lottery tickets between themselves. In treatments where it was common knowledge that the partners faced different prizes, compensating unequal divisions of tickets were regularly agreed, with the effect of equalizing expected monetary values. Equivalent behavior in a CCP would be for J and K to agree a choice of Bag A given common knowledge of $\mathrm{P} = [£\,x/\pi, £\,x/(1-\pi)]$, but Bag B given $\mathrm{P} = [£\,x/(1-\pi), £\,x/\pi]$, each partner having an expected return of £x throughout. The behavior of Roth's subjects could be interpreted in terms of fairness or of focal points. Either way, it casts doubt on the predictive power of the Nash theory, and in particular Prize-Independence.

To avoid our axiomatic argument, and thus our experiment, being vitiated by Roth's findings, we can simply restrict our definition of a CCP. One possibility is to require, for a CCP, that if $\mathrm{P_J} \neq \mathrm{P_K}$ then the prizes are not common knowledge. Another is to require (common knowledge) that $\mathrm{P}=[\mathrm{P_J},\mathrm{P_K}]$ is envy-free, i.e., that neither partner strictly prefers the other's prize to their own. The form of CCP used in our experiment could be interpreted as satisfying either of these conditions.

In summary, the proposition that $\gamma < \hat{\pi}$ makes Bag C ineligible in the CCP follows from a relatively weak version of Nash Bargaining Theory, the testing of which does not appear to have been pre-empted by already existing empirical evidence.

3. THE EXPERIMENT

IN DESIGNING THE EXPERIMENT a central concern was to prevent collusive agreements of the type described in Section 1. Thus our subjects had to negotiate anonymously and via computer, and with minimal exploitable information about the value of the prize in prospect, which could differ between partners.

The experiment was conducted in the **EXEC** laboratory at the University of York, the subjects being undergraduate and postgraduate students. There were four experimental treatments, as described below. For each treatment there were two separate sessions, each lasting around 45 minutes and employing a group of sixteen new subjects seated at individual computer terminals. Apart from oral instructions, pre-recorded and played back to the whole group, the session was carried out in silence with subjects communicating only with or via the computer. The principal off-screen instructions are presented in Appendix A, and can usefully be read now.

In the main part ("Part 2") of the experiment the sixteen subjects were randomly and anonymously paired. Each partnership had to agree a choice of bag. This process was repeated in each of three further rounds, with re-matching of partners in such a way as to avoid cross-contamination by previous matches. In each round, the two partners negotiated within a structured protocol of alternating offers. The partner randomly designated as J (i.e., Yellow) opened by proposing one of the three bags, optionally accompanying the proposal with a brief message. K could either accept this proposal, thus ending the negotiations with agreement, or reject it. Rejection would trigger a computerized randomizer to determine whether the process would end at that stage in disagreement or could continue, with K making a counterproposal. Negotiations continued in this way until either a proposal was accepted, or the randomizer ended the process in disagreement. Appendix B shows a representative screenshot, in this case for a proposer about to compose a message to accompany the proposal of Bag A. The randomizer took the form of an onscreen spinning wheel, visible simultaneously to both partners, containing two sectors: green for continuation and red for termination. At the outset of Part 2, prior to being paired-up for the first round, individual subjects were given dummy screens so that they could practice making proposals and responses. In particular they were invited to spin the wheel as many times as they wanted, the aim being to give them confidence that it was genuine (which it was).

The probability of continuation, after any rejection, had to be low enough to keep negotiations to a manageable length, while high enough to permit agreement on any of the three bags as a strategic equilibrium, and therefore to provide a test of the Axiomatic theory. A sufficiently low continuation probability 2 produces, in effect, an Ultimatum Game. Assuming common-knowledge of (self-interested) rationality, the unique equilibrium here has J proposing, and K accepting, Bag A at the outset.[7] Specifically, if $1-\pi > \theta\pi$ then K accepts this proposal, since the best that K could achieve otherwise is J's acceptance of Bag B at the next stage, which occurs only with probability 2.

By contrast, a sufficiently high value of 2 produces a negotiation game with multiple equilibria. Suppose that K's strategy is always to propose, and to accept only, Bag B. Then clearly J can do no better than likewise to propose or accept B at any stage. In turn, K's strategy of accepting only B, and thus in particular of rejecting C, is rational if $\gamma < \theta\pi$. So given this condition there is an equilibrium in which Bag B is the agreed choice irrespective of who makes the first proposal. But, by symmetric reasoning, this same condition implies a second equilibrium in which both partners always propose/accept Bag A. Strategically this resembles a one-off Chicken Game, having one equilibrium in which J defers to K, and another in which K defers to J. With a sufficiently high 2 there is also an equilibrium in which Bag C is the agreed choice irrespective of who makes the first proposal. Suppose that K's strategy is always to propose or accept C and to reject A. Given this, it is rational for J likewise always to propose or accept C. It is additionally rational for J always to reject B if $1\text{-}\pi < \theta\gamma$. The two strategies here are symmetric, so this same condition rationalizes K's strategy, given J's. Overall, therefore, if $\theta > \max[\gamma/\pi, (1-\pi)/\gamma]$ then there exist equilibria supporting agreement on each of the three bags, and in each case irrespective of who makes the first proposal.[8]

These considerations suggested to us a 2×2 structure of experimental treatments, providing a comparison of the Axiomatic and Strategic theories in a unified setting. Table 3 defines these four treatments parametrically, and in each case indicates the permitted/predicted agreements according to the two theories.

In implementing these treatments we used bags in which the number of yellow and blue balls was double that shown in Table 1. Thus, as in Table 1, each treatment had $\pi = 0.75$ and $\hat{\pi} \approx 0.43$. This doubling made possible Treatments 1 and 3, for which there was just one red ball in Bag C, corresponding to $\gamma \approx 0.44$. For Treatments 2 and 4 there were two red balls, thus corresponding to $\gamma = 0.4$ just as in Table 1. The continuation probabilities were $\theta = 0.85$ for Treatments 1 and 2, and $\theta = 0.15$ for Treatments 3 and 4, these values being comfortably within the required constraints indicated in Table 3.

To inhibit *ex post* sharing agreements, negotiation over the agreed choice of bag was carried out with both partners unaware not only of each others' prospective prize but also of their own. We also wanted to make it difficult for partners to estimate expected values for these prizes, including from any prior communication with subjects from previous sessions. To this end we preceded the main part of the experiment with an individual decision problem ("Part 1") in which each of the sixteen subjects privately nominated one of seven virtual boxes, labeled A-G. Each box contained £30 to be divided equally between all those subjects nominating it. The subject's individual dividend from this process then became his (or her) prospective monetary prize in Part 2. There were two practice rounds, after each of which the distribution of nominations across the seven boxes was displayed on all screens, with the corresponding hypothetical dividend being shown individually and privately for each subject. The third round of nominations was for real. Each subject could of course infer his own dividend from the distribution of nominations in this round, and that information was indeed disclosed, simultaneously to all subjects, but not until the end of Part 2 when the negotiations had all been completed. After this, each subject was called separately, in turn, into the adjacent office, where he first drew a numbered ball from a bag to determine which of the four rounds in Part 2 was actually to count and be played out for real. If the indicated round was one in which he had failed to reach agreement with his partner, then he left with nothing. Otherwise he next drew a ball from the bag he had agreed in that round. If this ball matched his designated color in that round, then he was paid his dividend, the value of which was known only to himself and the experimenter; otherwise he left with nothing.

4. THE RESULTS

FOR EACH of the four treatments there were 64 CCPs (two sessions, each comprising four rounds re-matching eight pairs of subjects). The outcome of each CCP was either agreement on one of the bags {A,B,C} or else disagreement (*z*). Figure 1 charts, for each treatment, the frequency of each outcome, aggregating over rounds and sessions.[9] Figure 1 should be read in conjunction with Table 3, from which we see that the principal test of the Axiomatic theory is its implication of no C-agreements in Treatment 2. The theory clearly fails this test. Similarly, the principal test of the Strategic theory is its implication of no C-agreements (indeed only A-agreements) in Treatment 3, on which it similarly fails. Each of these theories implies no C-agreements also in Treatment 4, on which basis again each fails. These are stringent tests, of course. From the results in Figure 1 we can infer that not all subjects conform to the Axiomatic theory, and likewise that not all subjects conform to the Strategic theory. But perhaps some subjects do, in each case. So a less stringent test would involve comparing the relative frequencies of agreements across relevant treatments.

Thus, while the Strategic theory does not predict any change in behavior in moving from Treatment 1 to 2, or from Treatment 3 to 4, if there are any subjects who conform to the Axiomatic theory then we should expect fewer C-agreements in Treatments 2 and 4 than in Treatments 1 and 3 respectively. Figure 1 shows that the data is ambivalent here - there being indeed fewer C-agreements in Treatment 4 than in 3, but more in Treatment 2 than in 1. Similarly, while the Axiomatic theory does not predict any change in behavior in moving from Treatment 1 to Treatment 3, or from Treatment 2 to Treatment 4, if there are any subjects who conform to the Strategic theory then we should expect more A-agreements in Treatments 3 and 4 than in Treatments 1 and 2 respectively. In this sense the data appears to give some support to the Strategic theory - at least at this level of aggregation. Let us now look at some detail.

According to the Axiomatic theory, there should have been no C-agreements at all in Treatment 2. In fact there were more than in Treatment 1, and proportionately more of these (63% compared with 50%) were reached immediately, on the opening proposal. Table 4 shows, by each of the four rounds and in total, the opening proposals and responses in each CCP. After just one proposal there had been 29 C-agreements in Treatment 2, compared with 21 in Treatment 1. This reflects both a greater incidence of C-proposals (50% compared with 41%), and a higher acceptance rate (91% compared with 81%), although on a chi-squared test neither of these differences is statistically significant ($p = 0.287$ and $p = 0.279$ respectively). Figure 2 charts the number of C-agreements reached on or before the *n*th proposal in each treatment. The longest such negotiation was in Treatment 1, with agreement reached on the eighth proposal.

At the individual level there is similarly little evidence in support of the Axiomatic theory. Every one of the 32 individual subjects in Treatment 2 was party to at least one C-agreement over the four rounds. Furthermore there were very few messages, at any stage, expressing aversion to Bag C. Of the 57 proposals for Bag A or B throughout Treatment 2, 44 were accompanied by messages of some type. Only five of these clearly referred directly or indirectly to the red balls in Bag C. These five messages came from three different subjects, all in Session 2. One was Subject 5, whose brief negotiation with Subject 15 ran as follows.

Treatment 2 Session 2 Round 4					Pair 8
5	**A**	no reds which are a waste for us	15	**C**	we wont agree on the other 2 – reds are a fair price to pay for equality !
5	**accept C**				

In this respect there was little difference between the two treatments. Throughout Treatment 1 there were 79 proposals for Bag A or B; 66 of these were accompanied by messages of some type and, of these, six expressed aversion to Bag C.

So the results from Treatment 2 offer little support for the Axiomatic theory. Similarly, those from Treatments 3 and 4 appear to disconfirm the Strategic theory, according to which there should have been no C-agreements in either treatment. However, as noted above in Section 3, this assumes common knowledge of rationality. A strategically rational (SR) player will: (SR1) accept whatever is proposed, and (SR2) propose the best for him that his partner will accept. If he knows his partner to be rational, and therefore following SR1, then SR2 prescribes proposing his most-preferred bag. But if instead he believes that his partner would irrationally reject this, then proposing it would not be rational. So any number of C-agreements, or even B-agreements, in Treatment 3 would be consistent with all individual subjects being SR, but with some of them being sufficiently doubtful of this fact.

Nevertheless, a sure indicator that not all subjects were SR is the occurrence of disagreement, i.e., termination after rejection, comprising 25% of all outcomes in Treatment 3, and 20% in Treatment 4. Indeed, an upper bound to the number of SR subjects in each treatment is given by the number who (in conformity with SR1) did not reject any proposal throughout the four rounds. On this basis there were at most 16 SR subjects (out of 32) in Treatment 3, and 20 in Treatment 4.

So the Strategic theory fails the strong test, the data revealing that not all subjects were strategically rational. There is some support for the theory on the weaker test, however, in that there were rather more A-agreements in Treatments 3 and 4 than in Treatments 1 and 2 respectively. On a chi-squared test we can reject the hypothesis that the proportion of A-agreements to all outcomes is the same in Treatments 1 and 3 $(p = 0.013)$, and likewise in Treatments 2 and 4 $(p < 0.001)$. This suggests the presence of at least some SR subjects.

The question then arises as to what coherent strategies, if any, were being followed by the other subjects and, relatedly, how to account for the different pattern of outcomes between Treatments 3 and 4, as indicated by Figure 1. A chi-squared test rejects $(p = 0.040)$ the hypothesis that the overall (four-outcome) frequencies are drawn from the same population, and likewise $(p = 0.005)$ the proportion of C-agreements to all agreements. Table 4 suggests that the explanation for this difference lies mainly in the proposals rather than the responses. There is no significant difference $(p = 0.387)$ in the proportion of opening C-proposals accepted (89% in Treatment 3 and 95% in Treatment 4). The proportion of opening A-proposals accepted is higher in Treatment 4 (66% compared with 46%), but this difference is not clearly significant $(p = 0.127)$. The ratio of A-proposals to C-proposals is, however, substantially and significantly $(p = 0.034)$ higher in Treatment 4. Given that proportionately more A-proposals were accepted overall in Treatment 4 than in Treatment 3, it could be that experience of this over the course of the four rounds led SR subjects to propose Bag A more frequently. However, as Table 4 also reveals, if anything the trend was in the opposite direction; the greater propensity towards A-proposals in Treatment 4 is especially evident at the outset, in Round 1.

It may have simply been that SR subjects in Treatment 4 were more optimistic that their A-proposals would be accepted than were their counterparts in Treatment 3. However, as noted above, many subjects revealed themselves to be irrational by rejecting one or more proposals over the four rounds. So an alternative explanation might be there were other irrational, but coherent, strategies being followed, and by different numbers of subjects in each of the two treatments. One possibility is a *Fair* strategy (F), which prescribes never rejecting Bag C or proposing Bag A or B. This is an incomplete characterization, and compatible with the minimum criterion (no rejections) for rationality; a stronger version (F+) additionally prescribes never accepting the least-preferred bag. Another possibility, especially in Treatment 4, is a *Non-C* strategy (NC), which prescribes never proposing Bag C, and its correspondingly stronger version (NC+) which additionally prescribes never accepting Bag C. Table 5 records, for each of these strategies, the number of subjects whose proposals and responses, through all four rounds, were consistent with the respective criteria. This gives an upper bound to the number of subjects following that strategy. Some subjects satisfied the criteria for several of these strategies; others did so for none. The table also records the number of subjects who satisfied the weaker criteria for only one of these three strategies.

The number of subjects possibly NC in Treatment 4 is almost twice that in Treatment 3. But only three of these could only have been NC, and at most five of them could have been following the stronger NC+ strategy. So it is not clear that the extra red ball in Bag C is a coherent influence in Treatment 4. This conclusion is supported by the transcripts. Of the 37 messages accompanying proposals of Bag A or B, none referred to the red balls in Bag C or to the absence of them in Bags A or B.

Table 5 also shows the results of applying the same criteria to Treatments 1 and 2. Given the high continuation probability, strategic rationality has no clear unconditional prescriptions here, so no subject can be ruled out as being SR. Thus our interest is in the number of subjects possibly F or NC, defined as those whose behavior is consistent throughout the whole session with the respective criteria for these strategies. The number of subjects possibly F is similar across all four treatments. In Treatments 1 and 2 each these subjects is also possibly F+, presumably reflecting the lower cost here of rejecting a proposal. Interestingly, the number of subjects possibly NC is at its lowest in Treatment 2. Furthermore, none of these could also have been NC+. Indeed, as already noted above, every subject in Treatment 2 was party to at least one C-agreement.

In summary, therefore, both the Axiomatic and the Strategic theories are rejected on a strong test, respectively by virtue of the C-agreements in Treatment 2 and the disagreements in Treatments 3 and 4. The Strategic theory finds some weak support in the greater number of A-agreements in Treatments 2 and 4 compared with Treatments 1 and 3 respectively. Even on a weaker test of this type, however, the Axiomatic theory finds no support. The number of C-agreements is actually higher in Treatment 2 than in Treatment 1. It is lower in Treatment 4 than in Treatment 3, but closer inspection reveals no clear indication that this is due to the extra red ball in Bag C.

5. CONCLUSIONS

NASH BARGAINING THEORY rests on axioms of collective rationality. We investigated an implication of the theory that seems to be strongly counterintuitive, that is, that bargaining partners should agree to reject what appears to be a reasonable and fair compromise. We put this implication to the test in an experiment which also exposed the Strategic theory of bargaining to a parallel test. We find that neither theory gets much support from the evidence. It seems that individuals are more attracted by the appeal of a fair compromise than is allowed either by the Nash theory or, for that matter, the Strategic theory.

Department of Economics and Related Studies, University of York, Heslington, York YO10 5DD, U.K. jdb1@york.ac.uk http://www-users.york.ac.uk/~jdb1/index.html

and

Department of Economics and Related Studies, University of York, Heslington, York YO10 5DD, U.K. jdh1@york.ac.uk http://www-users.york.ac.uk/~jdh1/index.html and Dipartimento di Scienze Economiche, Università di Bari, via Camillo Rosalba 53, Bari, *70124, Italy*

and

Department of Economics and Related Studies, University of York, Heslington, York YO10 5DD, U.K. *jrs1@york.ac.uk* *http://www.york.ac.uk/depts/econ/res/indiv/suckling.htm*

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TABLE 1

THE THREE BAGS

	Bag A	Bag B	Bag C
yellow balls	3	1	2
blue balls	1	3	2
red balls	0	0	1

TABLE 2

THE GENERAL COSTLY COMPROMISE PROBLEM

	Bag A	Bag B	Bag C
Prob[J wins]	B	1-B	(
Prob[K wins]	1-B	B	(

TABLE 3

THE VARIOUS TREATMENTS IN THE EXPERIMENT

	$\gamma > \hat{\pi}$	$\gamma < \hat{\pi}$
$\theta > \max\left[\frac{\gamma}{\pi}, \frac{1-\pi}{\gamma}\right]$	<u>Treatment 1</u> Axiomatic: any bag Strategic: any bag	<u>Treatment 2</u> Axiomatic: not Bag C Strategic: any bag
$\theta < \frac{1-\pi}{\pi}$	<u>Treatment 3</u> Axiomatic: any bag Strategic: Bag A	<u>Treatment 4</u> Axiomatic: not Bag C Strategic: Bag A

TABLE 4

OPENING PROPOSALS AND RESPONSES BY TREATMENT AND ROUND

		Treatment 1			Treatment 2		
		A	B	C	A	B	C
R1	proposed	10	0	6	5	2	9
	accepted	1	0	6	1	2	8
R2	proposed	8	0	8	11	0	5
	accepted	1	0	5	0	0	5
R3	proposed	9	1	6	6	1	9
	accepted	0	1	6	0	1	8
R4	proposed	10	0	6	6	1	9
	accepted	1	0	4	1	1	8
all	**proposed**	**37**	**1**	**26**	**28**	**4**	**32**
	accepted	**3**	**1**	**21**	**2**	**4**	**29**

		Treatment 3			Treatment 4		
		A	B	C	A	B	C
R1	proposed	5	1	10	11	2	3
	accepted	3	1	9	6	2	3
R2	proposed	6	1	9	10	1	5
	accepted	3	1	8	7	0	5
R3	proposed	6	0	10	8	2	6
	accepted	2	-	9	4	2	5
R4	proposed	9	0	7	6	2	8
	accepted	4	-	6	6	2	8
all	**proposed**	**26**	**2**	**36**	**35**	**7**	**22**
	accepted	**12**	**2**	**32**	**23**	**6**	**21**

TABLE 5

POSSIBLE STRATEGY TYPES (OUT OF 32 SUBJECTS IN EACH TREATMENT)

	consistent with						consistent only with		
	RS	F	F+	NC	NC+	none	RS	F	NC
Treatment 1	32	8	8	8	1	0	16	0	0
Treatment 2	32	9	9	4	0	0	18	0	0
Treatment 3	16	11	9	10	3	5	7	7	3
Treatment 4	20	9	4	18	5	4	4	3	3

FIGURE 1

OUTCOME FREQUENCIES BY TREATMENT (n=64 IN EACH TREATMENT)

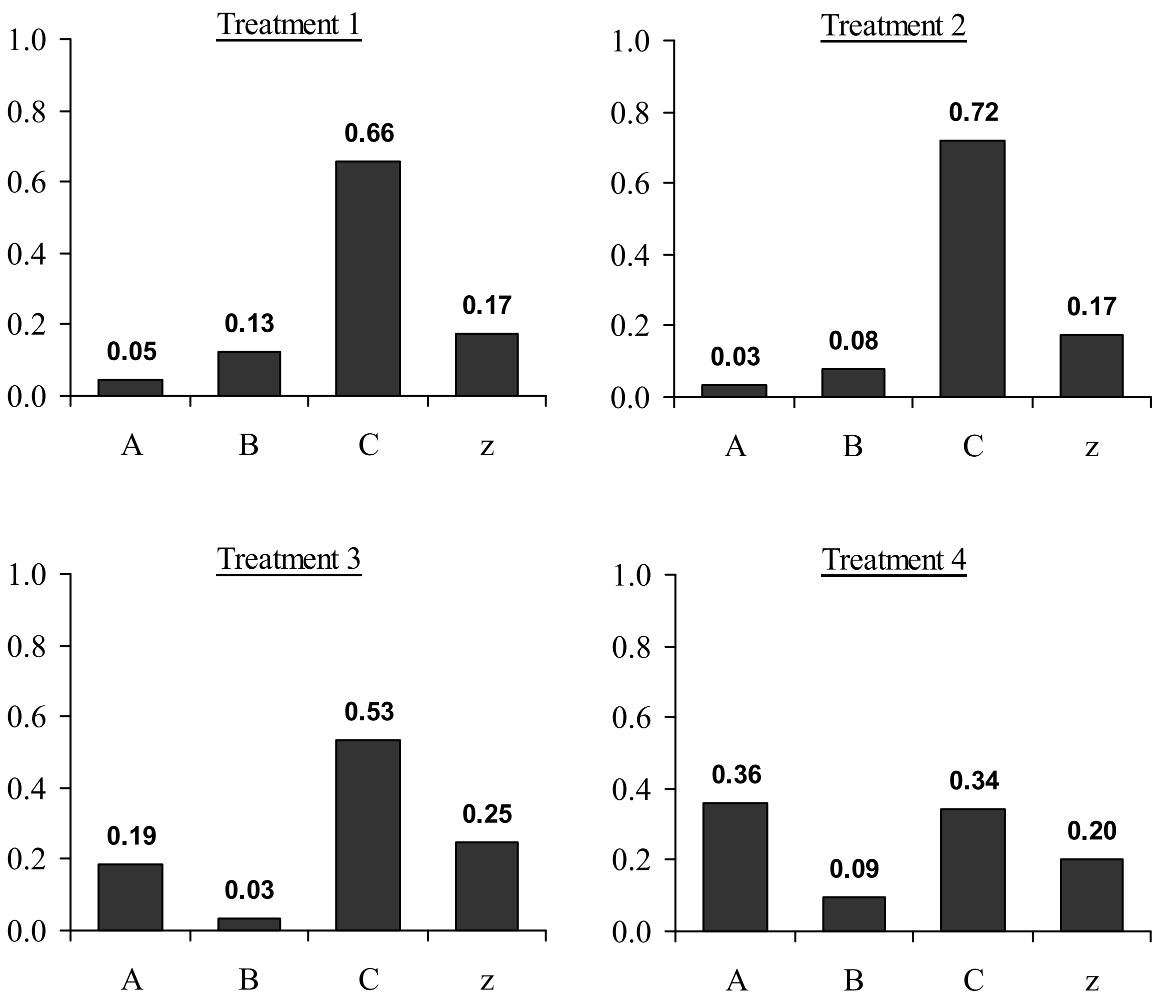
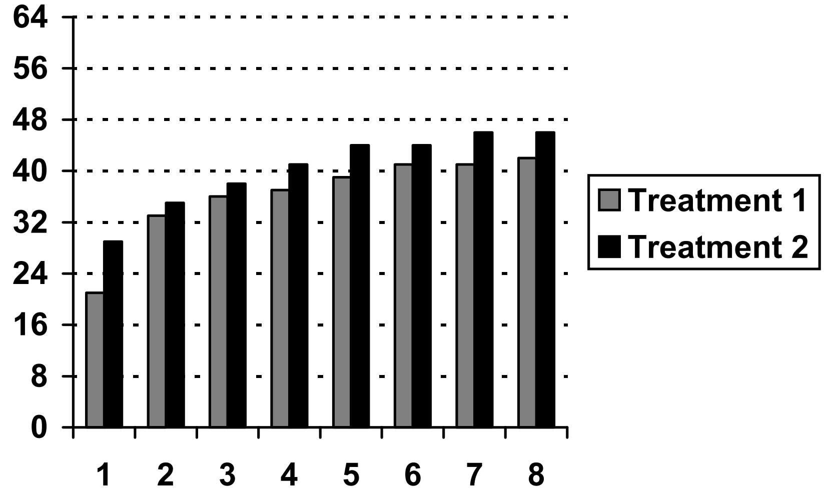


FIGURE 2

NUMBER OF C-AGREEEMENTS REACHED ON OR BEFORE THE n^{th} PROPOSAL



APPENDIX A

INSTRUCTIONS

Initial (pre-recorded) oral instructions prior to Part 1

Thank you for participating in this experiment. We hope that you will enjoy it. If you have a mobile phone with you, please check now that it is switched off. [*pause*]

The experiment requires you to make a few simple decisions which, together with a random factor, will determine the amount you are paid at the end of the session.

There are sixteen participants in this session, all facing the same decisions and receiving the same instructions. Beside your terminal you have an envelope, some blank paper, and a pen. Please do not open the envelope until instructed to do so. The pen and paper are provided should you wish to keep a record of your decisions, although it is not necessary to do this. Please leave the pen here at the end of the session.

The session is in two parts. Decisions in Part 1 will determine an amount of money which we will call your dividend. This amount may vary from one individual to another.

However, whether or not you receive your dividend will depend on Part 2, where you will have to agree some decisions with other participants. We will give you further details on this at the start of Part 2.

You will receive instructions both orally, like this, and also on the computer screen. In addition, at all times there will be an information bar at the bottom of the screen. This will remind you what action needs to be taken at that time.

You will have opportunities to ask questions should the instructions not be clear to you. Otherwise, however, you must remain silent throughout the session. At various times you may have to wait for other participants to complete their decisions. If so, please be patient.

Before we proceed to Part 1, are there any questions? [*pause*]

Please click the Start button now. Read the onscreen information and then wait for further instructions. [*pause*]

Your task in Part 1 is simply to choose one of the seven boxes. Each box contains £30, to be shared equally among the participants choosing that box. There will be three rounds. The first two are for practice only, and will not count. But the third round is for real, and will determine your dividend.

There will be no further oral instructions until Part 1 is completed. Are there any questions? [*pause*]

Please make your first practice selection now and then follow onscreen instructions until Part 1 is complete.

(Pre-recorded) oral instructions prior to Part 2

Part 1 is now complete. Your dividend has been computed, but will not be revealed to you until the end of the session.

We will now proceed to Part 2, which consists of four rounds. In each round the computer will pair you, at random, with another participant. It will designate one of you as Yellow and the other as Blue. The pair of you have to agree a decision, which will be explained shortly. You will then be assigned a new partner for the next round, and so on.

Thus, after four rounds, you will have agreed four decisions, each with a different partner. However, only one of these four agreements will actually count for you.

At the end of the session, each participant will be paid individually in private, in the adjoining office. So no other participant will know what payment you receive, unless you yourself choose to reveal it to them afterwards.

Your payment will be determined as follows. Firstly you will draw a number from 1 to 4, from this bag. This will select which of the four rounds in Part 2 is to count for you. Your color, either Yellow or Blue, will be as designated in your selected round. Then you will draw a ball from this bag, which will contain some yellow and blue balls, and possibly some red balls. If you draw your designated color, then you will be paid your dividend. Otherwise you will be paid nothing.

We have not yet told you how many balls of each color will be in your bag. In fact, this is the decision you have to agree with your partner. The contents of your bag will be as agreed by you and your partner in your selected round.

The envelope contains a summary of the information so far. Please open it now and read the summary. [*pause*]

You may consult the summary again at any time during Part 2.

In each round you will communicate with your partner only via the computer. Instructions for doing this will appear on your screen. Are there any questions? [*pause*]

Please click the Continue button now. The next few screens give you further details on Part 2, and enable you to practice communicating with your partner. Please note that for the purpose of these practice screens you will be communicating with yourself, as if you were your own partner.

Please read and follow the instructions, continuing through the practice screens in your own time. [*pause*]

Are there any questions? [*pause*]

Then please begin Part 2 now.

Written summary information, provided prior to Part 2

Part 1

Your dividend is determined. It will be revealed to you after Part 2.

Part 2

Round 1	The computer randomly assigns you a partner, and designates one of you as Yellow and the other as Blue. You and your partner agree the contents of the bag.
Round 2	The computer randomly assigns you a new partner, and designates one of you as Yellow and the other as Blue. You and your partner agree the contents of the bag.
Round 3	The computer randomly assigns you a new partner, and designates one of you as Yellow and the other as Blue. You and your partner agree the contents of the bag.
Round 4	The computer randomly assigns you a new partner, and designates one of you as Yellow and the other as Blue. You and your partner

agree the contents of the bag.

Payment

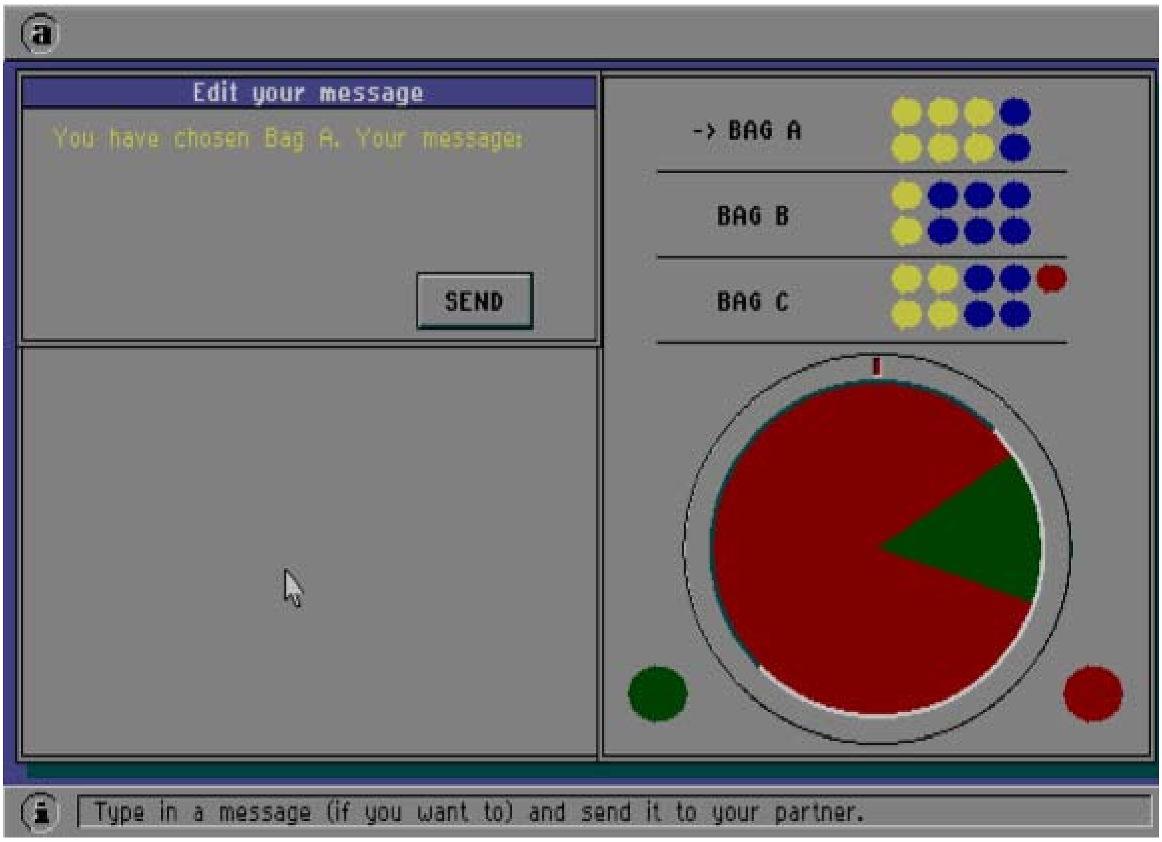
You are paid individually and privately in the office, as follows....

You select one round (1-4) at random. Your color (Yellow or Blue) is as designated in that round, and the contents of your bag are as agreed with your partner in that round.

You draw a ball from your bag. If it is your designated color, then you are paid your dividend. Otherwise you are paid nothing.

APPENDIX B

SCREENSHOT FROM EXPERIMENT



APPENDIX C

TRANSCRIPTS

Treatment 1 $\theta = 0.85 \quad \gamma = 4/9$

<u>Treatment 1 Session 1 Round 1</u> Pair 1

12	**C**	Any other suggestions?	14	**accept C**	

Treatment 1 Session 1 Round 1 Pair 2

2	**A**	is it ok?	9	**C**	Let's coordinate so at least we play.
2	**accept C**				

Treatment 1 Session 1 Round 1 Pair 3

2	**A**		9	**C**	
2	**reject C**				

Treatment 1 Session 1 Round 1 Pair 4

5	**C**	lets play safe	6	**accept C**	

Treatment 1 Session 1 Round 1 Pair 5

11	**C**	it's the only fair option.	16	**accept C**	

Treatment 1 Session 1 Round 1 Pair 6

15	**A**	What do you think?	7	**accept A**	

Treatment 1 Session 1 Round 1 Pair 7

3	**C**	50/50	10	**accept C**	

Treatment 1 Session 1 Round 1 Pair 8

1	**A**	Yes?	8	**C**	it's fairer for both, isn't it?
1	**accept C**				

<u>Treatment 1 Session 1 Round 2</u> Pair 1

9	**A**	Is this ok ?	14	**B**	any other suggestions?
9	**A**	You may risk sometimes... don't you?	14	**B**	As you said, you may risk......
9	**C**	Is this the only bag you like bag b?	14	**accept C**	

Treatment 1 Session 1 Round 2 Pair 2

2	**A**	Bag C is penalized, when you are yellow choose bag A and luck!	12	**reject A**	

Treatment 1 Session 1 Round 2 Pair 3

13	**A**		5	**C**	
13	**A**		5	**B**	B OR NOTHING.
13	**A**		5	**B**	B OR NOTHING.
13	**A**		5	**reject A**	

Treatment 1 Session 1 Round 2 Pair 4

6	**A**	i think that you may have at least once the ideal bag, you should take this choice when you're yellow!	4	**accept A**	

Treatment 1 Session 1 Round 2 Pair 5

11	**C**	the only fair bag.	7	**accept C**	

Treatment 1 Session 1 Round 2 Pair 6

16	**A**	Cbag c= red ball, no payoff for both!!	5	**reject A**	

Treatment 1 Session 1 Round 2 Pair 7

8	**C**	yes?	10	**B**	grrrrrrrrrrrrrr
8	**A**	what now?	10	**B**	ha!
8	**A**	do you agree?	10	**B**	no
8	**A**	neither do i with your choice	10	**C**	ok?
8	**accept C**				

Treatment 1 Session 1 Round 2 Pair 8

3	**C**	50/50	1	**accept C**	

Treatment 1 Session 1 Round 3 Pair 1

13	**A**		14	**B**	hi, agree with me!!!
13	**A**	hi, i think A should be agreed	14	**B**	Hi, do you want to waist our time?
13	**accept B**				

Treatment 1 Session 1 Round 3 Pair 2

4	**A**		12	**B**	
4	**C**	if we agree on bag c than we have the same probability to win. however, we can be unlucky if we choose draw re	12	**accept C**	

Treatment 1 Session 1 Round 3 Pair 3

5	**C**	lets play safe	9	**accept C**	

Treatment 1 Session 1 Round 3 Pair 4

2	**A**	Bag C has a probability lowerthan 50% for both. it is better to agree with bag A at each round. Thus probabilkiti es are maximized	6	**B**	i'm ok with your theorie but i'm blue and i was twice before.You may have at least the best chance once!
2	**A**	I am sorry but I have already accept this theory being blue. I won't accept other solution than A	6	**C**	lets play equal or nothing!!!
2	**accept C**				

Treatment 1 Session 1 Round 3 Pair 5

10	**A**	one of us will win.	11	**C**	don't be selfish. C is fair
10	**accept C**				

Treatment 1 Session 1 Round 3 Pair 6

16	**C**	Just click accept!!	3	**accept C**	

Treatment 1 Session 1 Round 3 Pair 7

7	**B**	B????	8	**accept B**	

Treatment 1 Session 1 Round 3 Pair 8

15	**A**	lets not risk another termination	1	**C**	I believe this works for both of us.
15	**accept C**				

Treatment 1 Session 1 Round 4 Pair 1

11	**C**	clearly the only fair choice	14	**B**	I agree. However....
11	**C**	eat my shorts, you fiend	14	**B**	You really want to disagree? We can share the divident!
11	**C**	i'm stubborn. You'l lose it all for us	14	**reject C**	

Treatment 1 Session 1 Round 4 Pair 2

16	**C**	I am being friendly!!	12	**accept C**	

Treatment 1 Session 1 Round 4 Pair 3

7	**A**	A ??	9	**B**	Never A. Maybe, you are more lucky than me..
7	**C**	C is fair for both!!	9	**B**	WE may draw the red from C!!! are you aware of this?
7	**accept B**				

Treatment 1 Session 1 Round 4 — Pair 4

15	**A**	How about it?	12	**reject A**	

Treatment 1 Session 1 Round 4 — Pair 5

10	**A**	c is boring	13	**accept A**	

Treatment 1 Session 1 Round 4 — Pair 6

4	**A**	i think the aim of the game is the agr when we are paid our payment is based take in your mind an ideal bag by the	3	**B**	Why then should I give you bag a?
4	**accept B**				

Treatment 1 Session 1 Round 4 — Pair 7

8	**A**	i've lost in all the previous section	5	**reject A**	

Treatment 1 Session 1 Round 4 — Pair 8

1		At least one of us will get it?	6		yes sure!! i would like it will be my turn. I was blue twice before, so please!!!!!!! let me have the ideal bag once!!!!!
1		Have never had my ideal choice, it is only fair to be unbias, correct?	6	**accept C**	

Treatment 1 Session 2 Round 1 — Pair 1

16	**C**	fifty fifty chance, at least both of u s can get at least after divedend,do y ou agree	7	**accept C**	

Treatment 1 Session 2 Round 1 — Pair 2

5	**C**	this is the fairest for both of us, giving us an equal chance of success	11	**accept C**	

Treatment 1 Session 2 Round 1 — Pair 3

12	**A**	more yellows	13	**reject A**	

Treatment 1 Session 2 Round 1 — Pair 4

4	**A**	Do you agree to Bag A?	15	**C**	bag c is nash. I'm never going to aggree to a and your never going to agree to b
4	**accept C**				

Treatment 1 Session 2 Round 1 — Pair 5

2	**A**	we can share the benefit,right?	1	**C**	How would benifit be shared? I don't k now who u r, or how much u would b get ting. This gives same chance 4 both.
2	**accept C**				

Treatment 1 Session 2 Round 1 Pair 6

3 **A** What do you think of this?

3 **accept B**

8 **B** This is the one I want

Treatment 1 Session 2 Round 1 Pair 7

10 **A**

10 **accept C**

9 **C**

Treatment 1 Session 2 Round 1 Pair 8

6 **A** Let me know your choice

6 **accept C**

14 **C** bag c - same chance of getting the money

Treatment 1 Session 2 Round 2 Pair 1

11 **C** This is fair for both of us, we have equal chance of winning

16 **accept C**

Treatment 1 Session 2 Round 2 Pair 2

5 **C** This is the fairest for both of us, giving us an equal chance.

7 **accept C**

Treatment 1 Session 2 Round 2 Pair 3

13 **A** more yellow

13 **accept C**

15 **C** yellow's not my colour! C is Nash-I.m never going to agree to A and your never going to agree to B

Treatment 1 Session 2 Round 2 Pair 4

12 **A** if u let me have this bag u can have b ag b on the next round

12 **A** the red ball is a termination ball th ats why i think we should go for bag a now and bag b on the next round otherw wise we dont get anything

12 **A** look we do bag b in the next round bag c is a no go -we both get nothing -bag a now then u have ur equal chance in the next round otherwise we

4 **C** I guess this is the one that both of us will agree on..

4 **C** It's either b or c, there's no way I'll agree to A..

4 **reject A**

Treatment 1 Session 2 Round 2 — Pair 5

1	**C**	This gives an equal chance 2 both part ies.	8	**B**	This is the one I want
1	**C**	We both need 2 agree 2 continue or ris k losing all. Bag C gives both an equa l chance of sucess.	8	**B**	sorry
1	**C**	sorry! Stop trying 2 force me 2 chose an inferior postion. I will not back d own. We have 2 agree or could lose.	8	**accept C**	

Treatment 1 Session 2 Round 2 — Pair 6

2	**C**	It's equal chance.	3	**B**	I'd prefer Bag B. I really like blue, don't you?
2	**accept B**				

Treatment 1 Session 2 Round 2 — Pair 7

6	**A**	Can you do me a favor to let me choose a?	10	**B**	Let me choose B - we can't afford to spin too many times
6	**accept B**				

Treatment 1 Session 2 Round 2 — Pair 8

14	**C**	we've the same chance of getting the money	9	**accept C**	

Treatment 1 Session 2 Round 3 — Pair 1

3	**C**	I am yellow	16	**accept C**	

Treatment 1 Session 2 Round 3 — Pair 2

12	**A**	well done uv cost us 2 rounds so now i suggest we do a and on the next round b which is completely fair,and at lea st we get a chance of winnin	7	**reject A**	

Treatment 1 Session 2 Round 3 — Pair 3

11	**C**	This is fair for both of us	15	**accept C**	

Treatment 1 Session 2 Round 3 — Pair 4

5	**C**	Hi i'm Pete. I suggest Bag C as it gives us an equal chance of winning.	4	**accept C**	

Treatment 1 Session 2 Round 3 — Pair 5

10	**A**	May as well accept it - the spinning wheel is dangerous	1	**C**	stop been silly. We both need 2 agree. That is only possilbe if C is chosen. Dont put extra risk in by rejection.
10	**accept C**				

Treatment 1 Session 2 Round 3 — Pair 6

9	**C**	fair deal for both so we can gat an agreement without risk of losing the deal?	2	**accept C**	

Treatment 1 Session 2 Round 3 — Pair 7

6	**A**	I have got the other 2 choice in last two times. I just want one high rate round. Do me a favour! Thanks!	8	**B**	sorry, same here. Not backing down.
6	**accept B**				

Treatment 1 Session 2 Round 3 — Pair 8

3	**A**	I love yellow. What do you think?	14	**C**	well i like blue & red!
3	**accept C**				

Treatment 1 Session 2 Round 4 — Pair 1

1	**C**	this gives the best chance 4 success 2 both parties and the only one we will both agree on. Dont risk refusal!	16	**accept C**	

Treatment 1 Session 2 Round 4 — Pair 2

2	**A**	I'm sorry to choose what I like.	7	**C**	I would like 2 choose Bag B, but we wo uld never agree, so I think we should just both have equal chance.
2	**accept C**				

Treatment 1 Session 2 Round 4 — Pair 3

8	**A**	This is the one I want	11	**C**	This is the fairest. If you decline this we spin the wheel and could both lose.
8	**A**	Sorry, but I'm not backing down	11	**C**	well if you don't back down you will certainly win nothing if you pick 4 out the bag. At least this way you have a 4/9 chance.
8	**A**		11	**C**	I think it is better for both of us to have a chance of winning if we pick 4 than neither of us
8	**accept C**				

Treatment 1 Session 2 Round 4 Pair 4

5	**C**	Why am i always yellow? Right i'm going to be boring again and suggest bag C as it's fairest for both of us, blah, blah	3	**B**	Normally I'd agree with you, but I'm allergic to red balls. Sorry!
5	**C**	I'm not going to let you choose bag B as it is patently unfair. We can carry on rejecting each other and lose if you want.	3	**accept C**	

Treatment 1 Session 2 Round 4 Pair 5

10	**A**	Lets not risk the bag on the last go	13	**B**	I am blue
10	**reject B**				

Treatment 1 Session 2 Round 4 Pair 6

12	**C**	r u completely crAZY OK WE DO C _NOTHI NG TO LOOSE NOW THANKS A BUNCH	9	**accept C**	

Treatment 1 Session 2 Round 4 Pair 7

6	**A**	Last time. I have to choose this. I just want one high rate. Thank you!!	15	**C**	I'm never choosing A, your never choosing B. Your chances of winning reduce drastically if we cannot agree.
6	**A**	I am sorry, I have got a choice of c. That is meanless to me. If you have got a high rate in last rounds. I think choose a will no harm	15	**B**	
6	**A**	It seems you don't get a high rate in last round. Then perhaps we finish in c??	15	**C**	cheap trick.
6	**accept C**				

Treatment 1 Session 2 Round 4 Pair 8

14	**C**	all the colours together!	4	**accept C**	

Treatment 2 $\theta = 0.85 \quad \gamma = 4/10$

Treatment 2 Session 1 Round 1			Pair 1
11	**C** OK?	10	**accept C**

Treatment 2 Session 1 Round 1			Pair 2
13	**A** 4 yellow, 4 blue?	9	**reject A**

Treatment 2 Session 1 Round 1			Pair 3
12	**C** seems the fairest.	1	**accept C**

Treatment 2 Session 1 Round 1			Pair 4
15	**A** is that alright?	7	**B**
15	**A**	7	**B**
15	**C**	7	**accept C**

Treatment 2 Session 1 Round 1			Pair 5
3	**C**	14	**accept C**

Treatment 2 Session 1 Round 1			Pair 6
2	**C** Bag C will give us the same payoff...	5	**accept C**

Treatment 2 Session 1 Round 1			Pair 7
16	**C** bag c, go on	4	**accept C**

Treatment 2 Session 1 Round 1			Pair 8
8	**B**	6	**accept B**

Treatment 2 Session 1 Round 2			Pair 1
10	**A** is this ok?	13	**C** A/B wont be ok for either of us
10	**accept C**		

Treatment 2 Session 1 Round 2			Pair 2
9	**A**	11	**reject A**

Treatment 2 Session 1 Round 2 — Pair 3

15	**A**		12	**B**	
15	**A**	let's see man)	12	**C**	compromise??
15	**accept C**				

Treatment 2 Session 1 Round 2 — Pair 4

7	**A**		1	**C**	ive got more chance of winning but to
7	**A**		1	**C**	
7	**accept C**				

Treatment 2 Session 1 Round 2 — Pair 5

5	**C**	Equal chance of payoff... down with capitalism!	14	**accept C**	

Treatment 2 Session 1 Round 2 — Pair 6

2	**C**	Bag C will give us the same payoff	3	**accept C**	

Treatment 2 Session 1 Round 2 — Pair 7

8	**C**		16	**accept C**	

Treatment 2 Session 1 Round 2 — Pair 8

4	**C**	At least its fair	6	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 1

10	**A**	how's this?	12	**B**	no way am I going for bag A!
10	**C**	this will be the best for both of us, agreed?	12	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 2

1	**A**	sorry, but its a big advantage for me	11	**reject A**	

Treatment 2 Session 1 Round 3 — Pair 3

13	**A**	Its only a game!!	15	**B**	No it's war!!!
13	**C**	We could all use the money	15	**B**	see i'm really broke
13	**C**	Not accepting B. Its C or we terminate	15	**B**	money isn't everything!
13	**C**	Give yourself a chance to win	15	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 4

9	**C**	even chance for both of us...?	7	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 5

14	**B**	Down with stinky self-interest Down with Psychology EXEC treasurers! Have yourself some cash, friend I choose Bag B!!!	16	**accept B**	

Treatment 2 Session 1 Round 3 — Pair 6

3	**C**		4	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 7

5	**C**	I'm not a greedy person. I have lots o f money, so I think it's OK to share.	8	**accept C**	

Treatment 2 Session 1 Round 3 — Pair 8

2	**C**	Let's choose C - gives us equal payoff	6	**accept C**	

Treatment 2 Session 1 Round 4 — Pair 1

14	**B**	Down with stinky self-interest! Down with Psychology EXEC treasurers! Have yourself some money friend! I choose Bag B!!!	10	**accept B**	

Treatment 2 Session 1 Round 4 — Pair 2

3	**A**		11	**reject A**	

Treatment 2 Session 1 Round 4 — Pair 3

5	**C**	I don't like red balls, but we have no choice to be fair!	13	**accept C**	

Treatment 2 Session 1 Round 4 — Pair 4

9	**C**	same chance for both of us?	2	**accept C**	

Treatment 2 Session 1 Round 4 — Pair 5

16	**C**		12	**B**	your generocity could work in your fav or...
16	**C**	you cannot spell generosity!!! next time I'll choose bag a so ha ther e	12	**B**	HAHHAHAAAA
16	**A**	ho ho ho ho	12	**B**	we could be here a while...
16	**C**	or not......	12	**accept C**	

Treatment 2 Session 1 Round 4 — Pair 6

1	**C**	seems the fairest	4	**accept C**	

Treatment 2 Session 1 Round 4 — Pair 7

15	**A**	let the war begin then ;-)	8	**B**	50e this way, that's only fai
15	**reject B**		8		

Treatment 2 Session 1 Round 4 — Pair 8

7	**A**		6	**reject A**	

Treatment 2 Session 2 Round 1 — Pair 1

16	**C**	be fair?	6	**accept C**	

Treatment 2 Session 2 Round 1 — Pair 2

10	**C**	Equal chance for both of us - are we really going to agree on anything else?	2	**accept C**	

Treatment 2 Session 2 Round 1 — Pair 3

8	**C**	If we choose this bag we both have an equal chance of picking a ball of our colour	1	**B**	I"TS STUPID TO HAVE ANY RED BALLS IN THERE. WE MIGHT NEITHER GET PAID
8	**A**	Fair enough, I choose bag A then...	1	**B**	Do B first. We can agree A in the later rounds, and go on the pingpong ball
8	**C**	Neither of us wants a bag with 3 times as many different coloured balls than our own colour in. We must compromise.	1	**accept C**	

Treatment 2 Session 2 Round 1 — Pair 4

7	**A**	there are no red balls- one of us is bound to win	5	**C**	at least here we have equal chance with equal blue and yellow
7	**A**	Sorry I prefer A	5	**B**	well i prefer b
7	**C**	Changed my mind!	5	**accept C**	

Treatment 2 Session 2 Round 1 — Pair 5

14	**B**	Do you agree?	4	**accept B**	

Treatment 2 Session 2 Round 1 — Pair 6

13	**A**	i need one round with a high chance of winning some money	9	**B**	Ok but now it`s my turn
13	**A**	if you let me have one round where i have a good chance, in all other rounds i will do the same for other people	9	**C**	We`ll never meet again. Let`s take an agreement, ok?
13	**accept C**				

Treatment 2 Session 2 Round 1 — Pair 7

3	**A**	I want this bag. you cannot refuse me!	11	**accept A**	

Treatment 2 Session 2 Round 1 — Pair 8

12	**C**	We should share because i am not very	15	**accept C**	

Treatment 2 Session 2 Round 2 — Pair 1

10	**C**	Equal chance for both of us - and are we really going to agree on anything else?	16	**accept C**	

Treatment 2 Session 2 Round 2 — Pair 2

2	**A**	what do you think about this	6	**C**	Look, I'm a fair guy. I'm also very stubborn. Be principled or I'll keep rejecting. Fair? {{-]
2	**accept C**				

Treatment 2 Session 2 Round 2 — Pair 3

7	**A**	If you reject this we could lose it all	8	**B**	Ditto...
7	**C**	Compromise??	8	**accept C**	

Treatment 2 Session 2 Round 2 — Pair 4

1	**A**	I'ts stupid to have a bag with any red balls in. We should pick this one, and then trade off in the later rounds	5	**reject A**	

Treatment 2 Session 2 Round 2 — Pair 5

13	**A**	if i can have one round with a good chance of winning, you should be able to agree the same thing with somebody else in a later round	14	**C**	Let's have an even chance of winning
13	**accept C**				

Treatment 2 Session 2 Round 2 — Pair 6

9	**A**	I need a round with high chance, please! And your probability is 1/4	4	**C**	I could do with one as well - but have chosen this as at least it is fair! p=0.4 for each
9	**reject C**				

Treatment 2 Session 2 Round 2 — Pair 7

12	**A**	I want to take something risky we are 4 rounds	11	**B**	Let's cooperate and in this way next roud somebody will help you whit an option like B. Everibody win!
12	**C**	why you ask me to coperate if you dont if you dont coperate with me I think t he best is this easy option	11	**accept C**	

Treatment 2 Session 2 Round 2 — Pair 8

3	**A**	This is the bag. All or nothing.	15	**reject A**	

Treatment 2 Session 2 Round 3 — Pair 1

16	**C**	C the fairway disagree to disagree?	8	**accept C**	

Treatment 2 Session 2 Round 3 — Pair 2

1	**A**	It's stupid to have any red balls in there. We should agree this, and trade off in the last round.	6	**reject A**	

Treatment 2 Session 2 Round 3 — Pair 3

10	**C**	Equal chance for both of us - and are we really going to agree on anything 14else?	7	**accept C**	

Treatment 2 Session 2 Round 3 — Pair 4

2	**C**	it's more equal, isn't it?	5	**reject C**	

Treatment 2 Session 2 Round 3 — Pair 5

14	**A**		11	**B**	Last round I coperate with my partner please this time coperate with me, in this way every body win something.
14	**accept B**				

Treatment 2 Session 2 Round 3 — Pair 6

4	**A**	i need a successful round. have faile d he other 2 as the person would not accept the fairest, so have gone for one better for me!	3	**C**	Let's make a compromise. It's not the best of days for me as well. What do you reckon?
4	**accept C**				

Treatment 2 Session 2 Round 3 — Pair 7

12	**C**	reject if you have a better idea for us	13	**accept C**	

Treatment 2 Session 2 Round 3 Pair 8

15	**C**	this is the fairest bag - we obviously wont agree on the other 2 - pick this one	9	**accept C**	

Treatment 2 Session 2 Round 4 Pair 1

14	**A**		16	**C**	who ever wins, buy us a pint!
14	**accept C**				

Treatment 2 Session 2 Round 4 Pair 2

6	**C**	I'm staying principled. It's my best offer. Also I think somebody's a computer. : -]	4	**accept C**	

Treatment 2 Session 2 Round 4 Pair 3

10	**C**	Equal chance for both of us - and are we ever going to agree on anything else?	13	**accept C**	

Treatment 2 Session 2 Round 4 Pair 4

9	**A**	I`ve just lost 2 rounds. Yellow has a first mover advantage in this game (it is structured in this way!). If we agree now is better for both	2	**accept A**	

Treatment 2 Session 2 Round 4 Pair 5

8	**C**	The only fair way to do things... If you disagree we could both get nothing	11	**accept C**	

Treatment 2 Session 2 Round 4 Pair 6

1	**C**		3	**accept C**	

Treatment 2 Session 2 Round 4 Pair 7

12	**C**	Just reject if you have a better idea	7	**accept C**	

Treatment 2 Session 2 Round 4 Pair 8

5	**A**	no reds which are a waste for us	15	**C**	we wont agree on the other 2 - reds are a fair price to pay for equality !
5	**accept C**				

Treatment 3 $\theta = 0.15 \quad \gamma = 4/9$

Treatment 3 Session 1 Round 1 — Pair 1

7	**C**	just to have equal chance	1	**accept C**

Treatment 3 Session 1 Round 1 — Pair 2

9	**A**	next you will be yellow, think!	5	**accept A**

Treatment 3 Session 1 Round 1 — Pair 3

10	**C**	Are you agree?	15	**accept C**

Treatment 3 Session 1 Round 1 — Pair 4

11	**C**	this gives us more chances to agree	12	**accept C**

Treatment 3 Session 1 Round 1 — Pair 5

1	**A**		4	**accept A**

Treatment 3 Session 1 Round 1 — Pair 6

8	**A**	This is gambling, consider it	3	**reject A**

Treatment 3 Session 1 Round 1 — Pair 7

13	**A**		16	**accept A**

Treatment 3 Session 1 Round 1 — Pair 8

6	**C**		14	**accept C**

Treatment 3 Session 1 Round 2 — Pair 1

5	**A**	If u reject, u don't win any money...	7	**reject A**

Treatment 3 Session 1 Round 2 — Pair 2

9	**A**	next round you will be yellow, think!	1	**reject A**

Treatment 3 Session 1 Round 2 — Pair 3

10	**C**	It's Ok bag C?	12	**accept C**

Treatment 3 Session 1 Round 2 — Pair 4

15	**C**	Its50/50forboth,unlessred-ariskforbot	11	**accept C**

Treatment 3 Session 1 Round 2 Pair 5

3	**C**	Obviously the friendliest option - what have you got to lose? I'm offering equal chances...	4	**reject C**

Treatment 3 Session 1 Round 2 Pair 6

8	**B**	I give your color more chances	2	**accept B**

Treatment 3 Session 1 Round 2 Pair 7

14	**A**	I choose bag A again, agree?	16	**accept A**

Treatment 3 Session 1 Round 2 Pair 8

6	**C**		13	**accept C**

Treatment 3 Session 1 Round 3 Pair 1

7	**A**	if you reject,u won't win any money	10	**accept A**

Treatment 3 Session 1 Round 3 Pair 2

15	**C**	50/50,unless red,a 1in9 chance forboth	1	**accept C**

Treatment 3 Session 1 Round 3 Pair 3

5	**C**	Fair?	12	**accept C**

Treatment 3 Session 1 Round 3 Pair 4

11	**C**	Is fair for both of us	9	**accept C**

Treatment 3 Session 1 Round 3 Pair 5

16	**A**	agree, or noone gets anything, sorry!	4	**reject A**

Treatment 3 Session 1 Round 3 Pair 6

13	**A**		2	**reject A**

Treatment 3 Session 1 Round 3 Pair 7

3	**C**	Equal chances... you're obviously not going to get a better offer, and if yo u reject, we'll most likely get nothing...	14	**accept C**

Treatment 3 Session 1 Round 3 Pair 8

6	**C**		8	**accept C**

<u>Treatment 3 Session 1 Round 4</u> Pair 1

4	**C**	equal chance!	7	**accept C**

Treatment 3 Session 1 Round 4 Pair 2

1	**C**	we will have equal chance. ***	2	**accept C**

Treatment 3 Session 1 Round 4 Pair 3

3	**C**	equal chances... you're obviously not going to get a better offer, and if you reject, we'll most likely get nothing...	5	**accept C**

Treatment 3 Session 1 Round 4 Pair 4

8	**C**	Let's play it fair	9	**accept C**

Treatment 3 Session 1 Round 4 Pair 5

10	**A**	If you rej you will not receive money	16	**reject A**

Treatment 3 Session 1 Round 4 Pair 6

13	**A**		15	**reject A**

Treatment 3 Session 1 Round 4 Pair 7

12	**A**	Prob. of Suc> Accept-2/8 Reject-15/160	14	**accept A**

Treatment 3 Session 1 Round 4 Pair 8

11	**A**	lets take some risks	6	**accept A**

<u>Treatment 3 Session 2 Round 1</u> Pair 1

13	**C**		8	**B**
13	**reject B**			

Treatment 3 Session 2 Round 1 Pair 2

10	**B**	there is a large chance if we negotiat e that we will lose so i think we shou ld go with blue	2	**accept B**

Treatment 3 Session 2 Round 1 Pair 3

14	**A**	You know it makes sense!	1	**C**	This is much more sensible... I am a bit lucky that it landed on green tho aren't I?!
14	**accept C**				

Treatment 3 Session 2 Round 1					Pair 4
12	**C**	because there are equal yellow & blue so we'd have an equal chance	15	**accept C**	

Treatment 3 Session 2 Round 1					Pair 5
11	**C**	There is an even chance of either of us winning	4	**accept C**	

Treatment 3 Session 2 Round 1					Pair 6
3	**C**		6	**accept C**	

Treatment 3 Session 2 Round 1					Pair 7
9	**C**	please choose Bag C as we both have equal chances of winning. The risk of the spin being terminated (85%) is too great.	5	**accept C**	

Treatment 3 Session 2 Round 1					Pair 8
16	**C**	I think we should pick this bag becaus it's fair, and it's the only way we're going to agree.	7	**accept C**	

Treatment 3 Session 2 Round 2					Pair 1
13	**A**		10	**accept A**	

Treatment 3 Session 2 Round 2					Pair 2
8	**A**		2	**accept A**	

Treatment 3 Session 2 Round 2					Pair 3
14	**C**	This is the best way for both of us to get money methinks!	15	**accept C**	

Treatment 3 Session 2 Round 2					Pair 4
1	**C**	Fair's fair!	12	**accept C**	

Treatment 3 Session 2 Round 2					Pair 5
3	**C**		11	**accept C**	

Treatment 3 Session 2 Round 2					Pair 6
6	**A**	hi, I chose bag a, do you agree?	4	**reject A**	

Treatment 3 Session 2 Round 2 — Pair 7

9	**C**	Please choose Bag C since we have equa al chances of winning. The risk of a spin being terminated (85%) is too gre at.	16	**accept C**

Treatment 3 Session 2 Round 2 — Pair 8

7	**C**	I think we should chose this one because it is fair	5	**accept C**

Treatment 3 Session 2 Round 3 — Pair 1

14	**C**	Equal chances (apart from red) so its fair. have fun!	13	**accept C**

Treatment 3 Session 2 Round 3 — Pair 2

1	**C**	It's the right thing to do...	8	**reject C**

Treatment 3 Session 2 Round 3 — Pair 3

15	**C**	hey this is just like that gameshow wi Nasty Nick off of Big Brother isn't it ? Go C Share the wealth!!!	10	**accept C**

Treatment 3 Session 2 Round 3 — Pair 4

2	**A**	've been blue the last two times so ha ve been unlucky - but its still better for you to accept than decline chance wise... please...	12	**accept A**

Treatment 3 Session 2 Round 3 — Pair 5

9	**C**	Please choose bag C since we have equal chances of winning. The risk of a spin being terminated (85%) is too great	11	**accept C**

Treatment 3 Session 2 Round 3 — Pair 6

5	**C**	I think that this one is fair. Why not accept it (otherwise the game might be terminated-chances are not really in o ur favour-15%)	4	**accept C**

Treatment 3 Session 2 Round 3 — Pair 7

3	**A**	be kind	16	**reject A**

Treatment 3 Session 2 Round 3 — Pair 8

6	**A**	hi, I choose bag a, do you agree?	7	**reject A**

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 1</u>

13	**A**	Final offer. I don't mind risk. it's A or nothing. Better to have a small chance than no chance.	11	**reject A**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 2</u>

8	**A**		4	**reject A**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 3</u>

3	**A**	if you relect negotiations may fail leading to you having no chance in this round, accept and it will at least be 1 in 4	10	**accept A**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 4</u>

2	**A**	I've been blue in all my previous rounds and have had to accept the worst deal, so please accept it - give me a chance... its stil better to accept than decline	6	**C**	hi, how about bag c
2	**accept C**				

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 5</u>

9	**A**	probability that spin is green is 15% probability that you will win on bag A is 25%. You have better odds by agreeing.	14	**accept A**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 6</u>

5	**C**	I think that this one is fair. Why not accept it (the odds are against us aft er all, 85% risk of termination) ?	1	**accept C**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 7</u>

16	**C**	I think we should choose this bag because it makes it fair between us.	15	**reject C**	

<u>Treatment 3 Session 2 Round 4</u> — <u>Pair 8</u>

12	**C**	fair's fair!!! better to accept than reject	7	**accept C**	

Treatment 4 $\theta = 0.15$ $\gamma = 4/10$

Treatment 4 Session 1 Round 1 Pair 1

9	**A**	looks promising	2	**accept A**

Treatment 4 Session 1 Round 1 Pair 2

1	**C**	tHIS GIVES US BOTH THE FAIREST CHANCE	3	**accept C**

Treatment 4 Session 1 Round 1 Pair 3

16	**A**	go on, makes sense	15	**accept A**

Treatment 4 Session 1 Round 1 Pair 4

12	**A**	Is bag a ok by you	7	**accept A**

Treatment 4 Session 1 Round 1 Pair 5

5	**A**	I think this is the best chance we get	10	**reject A**

Treatment 4 Session 1 Round 1 Pair 6

6	**A**	The prob is higher for me	11	**accept A**

Treatment 4 Session 1 Round 1 Pair 7

8	**A**	4y 2b- acceptable?	14	**accept A**

Treatment 4 Session 1 Round 1 Pair 8

4	**A**	2 more yellow instead of the 2 blue?	13	**reject A**

Treatment 4 Session 1 Round 2 Pair 1

2	**A**	if it's rejected then we both lose out	3	**accept A**

Treatment 4 Session 1 Round 2 Pair 2

1	**A**	FROMS A STRATEGY FOR THE FOUR SECTIONS	9	**accept A**

Treatment 4 Session 1 Round 2 Pair 3

12	**A**	Is bag a ok by you?	15	**accept A**

Treatment 4 Session 1 Round 2 Pair 4

7	**A**	Is bag a ok with you?	16	**accept A**

Treatment 4 Session 1 Round 2					Pair 5
11	**A**	If you reject then you have very littl chance, by accepting it is still possi ble to win	10	**reject A**	

Treatment 4 Session 1 Round 2					Pair 6
6	**A**	The prob is higher for me	5	**reject A**	

Treatment 4 Session 1 Round 2					Pair 7
13	**C**	This make the most sense for both of o us: we both have equal chance	14	**accept C**	

Treatment 4 Session 1 Round 2					Pair 8
4	**B**	4 more yellow in bag B?	8	**reject B**	

Treatment 4 Session 1 Round 3

Treatment 4 Session 1 Round 3					Pair 1
15	**A**	A?	2	**accept A**	

Treatment 4 Session 1 Round 3					Pair 2
16	**A**	go on, say ok. if i win, my round	9	**reject A**	

Treatment 4 Session 1 Round 3					Pair 3
3	**C**	it is fair choice	12	**accept C**	

Treatment 4 Session 1 Round 3					Pair 4
1	**A**	IS QUITE STRATEGIC	7	**accept A**	

Treatment 4 Session 1 Round 3					Pair 5
10	**C**	Hi! We both have 2 out of 5 chances of winning, despite the red balls. With the other bags it's only 1 out of 4 for the "second" higher chance.	14	**accept C**	

Treatment 4 Session 1 Round 3					Pair 6
5	**C**	It is fair for both of us..	8	**accept C**	

Treatment 4 Session 1 Round 3					Pair 7
11	**A**	By rejecting you have a 85% chance of nothing, and even if i can remake the decision ill still go for A. Accepting still gives you the only chance	13	**accept A**	

Treatment 4 Session 1 Round 3					Pair 8
6	**A**	don't reject, 85% rejection remember	4	**accept A**	

Treatment 4 Session 1 Round 4					Pair 1
10	**C**	Both have equal chances (2/5) with C. Otherwise, it's 3/4 for one but only 1/4 for the other!	2	**accept C**	

Treatment 4 Session 1 Round 4					Pair 2
9	**C**	Let's reach an agreement. same risk. same pay, what do you think?	5	**accept C**	

Treatment 4 Session 1 Round 4					Pair 3
3	**C**	it gives fair chance	11	**accept C**	

Treatment 4 Session 1 Round 4					Pair 4
1	**A**		6	**accept A**	

Treatment 4 Session 1 Round 4					Pair 5
15	**A**	A?	14	**accept A**	

Treatment 4 Session 1 Round 4					Pair 6
16	**A**	your best statistical chance is accept	8	**accept A**	

Treatment 4 Session 1 Round 4					Pair 7
13	**A**	By going with Bag A you have a 25% cha nce of winning. By going with the wheel oyu have an 85% chance of losing. I will always choose bag A no matter what. This is your be	12	**accept A**	

Treatment 4 Session 1 Round 4					Pair 8
4	**C**	Add 2 more yellow? 85%rej if lose!	7	**accept C**	

Treatment 4 Session 2 Round 1					Pair 1
1	**B**	How about more yellow, to make it equal?	8	**accept B**	

Treatment 4 Session 2 Round 1					Pair 2
4	**A**	if it goes again - this will be reject	14	**reject A**	

Treatment 4 Session 2 Round 1 Pair 3

12	**C**	we've both got a better chance this way	11	**accept C**	

Treatment 4 Session 2 Round 1 Pair 4

5	**A**		16	**reject A**	

Treatment 4 Session 2 Round 1 Pair 5

6	**B**	Most blues it has to be this.	13	**accept B**	

Treatment 4 Session 2 Round 1 Pair 6

10	**C**	This gives us both a fair chance of winning something	9	**accept C**	

Treatment 4 Session 2 Round 1 Pair 7

7	**A**	pick bag a	2	**C**	This is the safest bet, we both have a n equal chance of winning, so i sugges t that u pick bag c
7	**accept C**				

Treatment 4 Session 2 Round 1 Pair 8

3	**A**		15	**accept A**	

Treatment 4 Session 2 Round 2 Pair 1

14	**C**	don't you think we should maximise our chances of winning some money and always choose bag c?	8	**accept C**	

Treatment 4 Session 2 Round 2 Pair 2

1	**A**		4	**accept A**	

Treatment 4 Session 2 Round 2 Pair 3

12	**C**	We've got a better chance with this option	5	**accept C**	

Treatment 4 Session 2 Round 2 Pair 4

11	**A**	You have more of a chance with bag A then if it is rejected...	16	**accept A**	

Treatment 4 Session 2 Round 2 Pair 5

10	**C**	We both stand a better chance of winning some money this way	6	**accept C**	

Treatment 4 Session 2 Round 2 Pair 6

9	**A**	I know it doesn't sound fair but if you reject and the round is terminated (with 85% probability), th en we both receive 0. this way you stand a chance	13	**reject A**

Treatment 4 Session 2 Round 2 Pair 7

2	**C**	This is the safest bet for both of us, if u agree then we both have an equal chance of winning, if not the chance o f you getting to spin the wh eel and getting another go i	15	**accept C**

Treatment 4 Session 2 Round 2 Pair 8

3	**A**	more blue, or yeelow balls	7	**accept A**

Treatment 4 Session 2 Round 3 Pair 1

12	**A**	Sorry about this but this way we've got a one in four chance the other way its only 15 from a 100	8	**reject A**

Treatment 4 Session 2 Round 3 Pair 2

11	**A**	You have a better chance with Bag A then if it is rejected....	1	**reject A**

Treatment 4 Session 2 Round 3 Pair 3

14	**C**	I trust you!	5	**A**
14	**reject A**			

Treatment 4 Session 2 Round 3 Pair 4

4	**A**	hey - if you reject this, then none of win, but if you just say yes to this at least we will both have a chance	16	**reject A**

Treatment 4 Session 2 Round 3 Pair 5

6	**B**	Get as many blues in the bag as poss.	2	**accept B**

Treatment 4 Session 2 Round 3 Pair 6

13	**C**	better chance for us both	7	**accept C**

Treatment 4 Session 2 Round 3 Pair 7

10	**C**	With this bag we both have a fair chance of winning	15	**accept C**

Treatment 4 Session 2 Round 3 — Pair 8

3 **B** 5 yellow balls, 3 blue balls — 9 **accept B**

Treatment 4 Session 2 Round 4 — Pair 1

6 **B** Get as many blues in the bag as poss. — 8 **accept B**

Treatment 4 Session 2 Round 4 — Pair 2

13 **C** — 1 **accept C**

Treatment 4 Session 2 Round 4 — Pair 3

14 **A** — 10 **accept A**

Treatment 4 Session 2 Round 4 — Pair 4

4 **C** come on - say yes to this, we have an equal chance — 9 **accept C**

Treatment 4 Session 2 Round 4 — Pair 5

12 **C** go on please — 2 **accept C**

Treatment 4 Session 2 Round 4 — Pair 6

11 **A** You'll have a better chance with bag A then if you reject and get nothing.. — 7 **accept A**

Treatment 4 Session 2 Round 4 — Pair 7

15 **C** This is Macc Ladd pick bag c — 5 **accept C**

Treatment 4 Session 2 Round 4 — Pair 8

3 **B** 7 blue, 1 yellow — 16 **accept B**

[1] This has to be distinguished from individual rationality. If agreement (and thus the avoidance of z) requires unanimous individual assent, then each partner assenting to C is a Nash strategic equilibrium, even with five or more red balls.

[2] Actually the Nash theory does not require that individual utilities are vNM, in the sense of representing preferences under uncertainty, but only that they have (at least) the same degree of cardinality as vNM. In the present context, however, vNM is a natural interpretation.

[3] The seminal reference is Nash (1950). An exposition of the Nash theory can be found in Osborne and Rubinstein (1990, ch.2).

[4] For an individual we would expect the eligible subset not to depend on d, i.e., on the default outcome in the event of failure to choose. However in any well-defined individual choice problem there must always be such a default, even if only tacitly specified.

[5] Camerer (1995) provides an excellent survey.

[6] Two key references are Roth and Malouf (1979) and Roth and Murnighan (1982). For full references and an overview, see pp. 40-49 of Roth (1995a)

[7] There is a large body of experimental work on the Ultimatum Game, the evidence from which suggests that proposers frequently do not take full advantage of their strategic position. An early reference is Guth *et al* (1982). Roth (1995b) provides a survey and discussion.

[8] Note the significance here of the condition $\gamma < \hat{\pi}$, which in the Nash theory precludes agreement on Bag C. Given this condition, there is no value of θ for which agreement on C is the unique strategic equilibrium, whereas there are values of θ for which the equilibria include agreement on A or B but not on C. For a discussion of the relationship between the axiomatic (Nash) and strategic theories of bargaining see Osborne and Rubinstein (1990, ch4)

[9] A full record of the agreements and negotiations is available in Appendix C.