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Anonymity versus Punishment in Ultimatum Bargaining*

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Previous investigations have shown that laboratory play of the ultimatum game differs from the perfect equilibrium prediction. The anonymity hypothesis attributes this to a distortion of subject objectives caused by the act of experimental observation. An alternative hypothesis attributes the phenomenon to the willingness of some subjects to punish those who treat them "unfairly," independent of any experimenter influence. We test these hypotheses. In a control cell, 30% of play is in equilibrium. In a second cell, played under strong experimenter–subject anonymity conditions, 46% of play is in equilibrium. A third cell, in which subject capacity to punish has been removed, exhibits equilibrium play approaching 100%. The evidence supports the conclusion that the punishment hypothesis explains much more of the deviation from perfect equilibrium than does the anonymity hypothesis. *Journal of Economic Literature* Classification Numbers: C78, C92.

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INTRODUCTION

The ultimatum game is perhaps the simplest possible bargaining game: Two players, a first mover and a second mover, must come to mutual agreement on how to share a pie of *k* dollars. The first mover proposes a division to the second mover. If the second mover "accepts," the money is divided accordingly. If the second mover "rejects," both players receive nothing.

Perfect equilibrium for this game has the first mover offering the second mover no more than the smallest monetary unit allowed, followed by the second mover playing accept. Previous laboratory investigations of the ultimatum game, however, report behavior that differs both significantly and systematically from the perfect equilibrium prediction. We report here on an experiment designed to test the explanatory power of two distinct hypotheses, each an explanation for this disparity between theory and data. The *anonymity hypothesis* asserts that the very act of experimental observation influences play away from the perfect equilibrium and towards "fair" outcomes. In contrast, the *punishment hypothesis* asserts that subjects have a propensity to punish those who treat them "unfairly," independent of any influence exerted by the experimenter, and that this is what moves play towards fair outcomes. So the explanation offered by both hypotheses derives from a propensity for fairness which finds no reflection in the theory. The hypotheses differ, however, on *why* there is a propensity for fairness as well as on the exact form this propensity takes (desire for fair outcomes as opposed to a desire to be treated fairly).

A test of this kind is important for at least two reasons. First, it contributes to the current debate on the nature of lab ultimatum game play, a debate which involves foundational behavioral assumptions of economic theory. Advancing the empirical description of human motives and behavior provides direction for refining old theories and grist for new ones.

Second, testing the anonymity hypothesis provides evidence on a fundamental question concerning the use of experimental methods to study human behavior. If it is true that experimenter observation plays an obtrusive role in data collection, there are potentially serious methodological ramifications. There is an analogy here with experimental chemistry: a test of the anonymity hypothesis explores the question of whether economics experiments are being conducted in clay pots (a medium which interacts with various chemicals, thereby biasing experimental results) or in glass (a medium which does not interact and therefore causes no bias).[1]

Testing the anonymity hypothesis also presented an interesting experimental design challenge. It required a treatment in which we, the experi-

[1] This analogy appears in Roth (in press).

menters, would be unable to attribute individual actions to individual subjects. Direct observation of the experiment was therefore ruled out, along with direct payment of game earnings, since either would require individual subjects to reveal their actions to the experimenter. It was therefore necessary for both play and payments to proceed without the monitoring that direct observation makes possible. This, however, creates several problems. First, how could we be certain that the game rules would be adhered to? Second, how could we control for the moral hazard problem that arises from not having a supervisor to ensure that payments are consistent with game outcomes? Third, how would we retrieve the data if we observed neither play nor payments? Finally, there was the general problem of making the anonymity convincing to subjects; that is, it had to be plain that the experimenters lacked the information necessary to attributed individual actions to individual subjects.

Resolution of these problems was the guiding consideration in our experimental design. Detailing the experiment and its results, however, requires a prior discussion of the hypotheses together with some background on the ultimatum game literature.

Ultimatum Game and the Perfect Equilibrium Analysis

The (standard) perfect equilibrium analysis of the ultimatum game begins with three well defined postulates:

P1: Each player prefers having more money to having less.

P2: First movers know P1.

P3: First movers can calculate the optimal offer.

The perfect equilibrium prediction is then obtained as follows: Since the second mover prefers more money to less (P1), the first mover, who knows this (P2), offers the second mover an amount equivalent to the smallest monetary unit allowed, allocating the balance to himself (P3). The second mover accepts (P1 again).

While the analysis has some intuitive appeal, the laboratory evidence for the perfect equilibrium prediction has been broadly negative (for literature reviews see Güth and Tietz, 1990, and Roth, in press). Specifically, first movers tend to offer amounts significantly higher than the minimum possible (although rarely more than 50% of the pie), and second movers frequently reject positive-valued offers. Consequently, a substantial percentage of games end in disagreement, and those that do not tend to exhibit divisions that are closer to equal than perfect equilibrium predicts. This characterization of the data has proven robust to cultural (Roth *et al.*, 1991; Carter and Irons, 1991) and framing perturbations (Hoffman *et al.*, 1994), as well as other minor variations (Forsythe *et al.*, 1994; Weg and Smith, 1993).

Why then are the laboratory results contrary to perfect equilibrium? Note how the analysis uses the postulates in a cumulative manner. In particular, we would not expect P3 to yield perfect equilibrium offers unless P1 and P2 are valid. Similarly, P2 cannot be expected to apply unless P1 is valid. For this reason, explaining deviations from perfect equilibrium in terms of violations of P2 or P3 is unsatisfactory, if in fact players do not comply with P1. In particular, we would not expect first movers to make the perfect equilibrium offer if second movers will not accept it.

In fact, the data on second movers directly contradicts P1: a substantial number of offers possessing positive value are turned down. To complicate matters, the extent to which first movers behave in accordance with P1 is in dispute. According to one interpretation (Roth *et al.*, 1991), most first movers are searching for the offer which will net them the highest expected value, thereby suggesting first mover consistency with P1. According to another interpretation (Hoffman *et al.*, 1994), first mover offers are often more generous than the amount necessary to induce second movers to accept, thereby suggesting first mover objectives different than P1. So the data—or at least the second mover data—imply that an explanation for the departure from perfect equilibrium must delineate a substitution for, or a modification of, P1.

The Anonymity Hypothesis

In most human behavior research, the participants know that they are serving as subjects in an investigation. The concept of *demand characteristic*, introduced by Orne (1962), recognizes that a subject may care about the outcome of the investigation or may want to show the investigator that she is behaving as a "wise" problem solver. Such reactions may render the results unrepresentative of the field situation which is of ultimate interest.

In virtually all ultimatum experiments reported in the economics literature, subjects were told that they would be paid on the basis of game performance, and they received their payment directly from the experimenter. So it must have been clear to subjects at the time they were playing that the experimenter would be able to accurately link individual subjects to actions taken. Roughly, the anonymity hypothesis states that, given that the experimenter can make this link, subjects believe that the experimenter's assessment of them will be influenced in a negative way if they exhibit the type of self-interested behavior inherent in P1. The modification in subject behavior that this induces then pushes observed outcomes in the direction of equal division.

Hoffman *et al.* (1994) provide a detailed version of the anonymity hypothesis. They argue that subjects may be sensitive to the experimenter's assessment of them for several reasons. One possibility is that subjects believe that their actions during the game will influence their future dealings with the experimenter. For instance, it may influence whether the experimenter has them participate in future experiments. Note that this is essentially a game-theoretic explanation. Second—this is more a psychological (or at least not game-theoretic) explanation—they may simply be concerned about being judged as greedy by an observer.

As indirect evidence, Hoffman *et al.* point to the dictator game studied by Forsythe *et al.* (1994).[2] In the dictator game, the first mover chooses how to divide the money; the second mover has no say, no veto power. If P1 holds, the first mover should keep the entire sum. However, Forsythe *et al.* report that, in the lab, a substantial portion of the money is frequently allocated to second movers. Moreover, Hoffman *et al.* report that when the dictator game experiment is conducted in such a way that the experimenter cannot attribute specific actions to specific individuals (that is, individual actions are anonymous to the experimenter), then the amount allocated to second movers diminishes substantially. The conjecture then is that a similar type of phenomenon will hold if the ultimatum game is conducted under conditions of experimenter–subject anonymity. That is, if their actions are anonymous, first movers will make less generous offers.

Recall that lab ultimatum game investigators consistently report that second movers reject money. Even if first movers do act to maximize their personal earnings, they will not want to make the perfect equilibrium offer if a large enough proportion of second movers are going to reject it. So we cannot expect perfect equilibrium play unless second movers exhibit preferences that accord with P1, which has not heretofore been the case. We extend the anonymity hypothesis to second movers by adopting the analog to the first mover version: Second movers avoid taking small offers because it makes them look greedy in the sense that it reveals that they value small amounts of money over other considerations. This may affect the experimenter's actions toward them in the future (game theoretic explanation). Second, second movers may simply be embarrassed to accept the equilibrium offer, either because it is so small or because their partner's share is so much larger (psychological explanation).

Consider the following alternative to P1:

[2] The dictator game was first studied by Kahneman *et al.* (1986).

P1′: A player's preference for more money is tempered by a desire to appear to prefer equitable outcomes.

The anonymity hypothesis can be expressed as follows: When subject actions can be viewed by the experimenter, P1′ applies. Combining this with P2 and P3 explains previously observed ultimatum play. On the other hand, when subject actions are anonymous to the experimenter (i.e., there is subject–experimenter anonymity), then P1, together with P2 and P3, applies, and it is predicted that perfect equilibrium play will result.

The Punishment Hypothesis

An alternative explanation can be developed from a refinement of the comparative model introduced by Bolton (1991). That analysis demonstrates that, in the context of a two-period shrinking pie game, strategic considerations can explain observed behavior once agent preferences over the relative division of the pie are properly taken into account. For our purposes we can translate these preferences into a statement of subject objectives. Specifically, as an alternative to P1, consider

P1*: A player's preference for more money is modified by a preference for disagreement over amounts he perceives as small *relative* to his playing partner's share.

Intuitively, P1* asserts that second movers would prefer that both players receive nothing (disagreement) to accepting a division which they perceive to be "very unfair" in the sense that the first mover receives a disproportionately large share of the pie. Note the distinction between P1* and P1′. By P1* a subject is not concerned with behaving fairly per se (as he is by P1′); rather, he is averse to others behaving unfairly toward him. Observed ultimatum play is therefore attributed to the second movers' willingness to end the game in disagreement if the share offered is deemed disproportionately small.[3] Both P2 and P3 are still assumed to hold. In particular, first movers offer more, not because they wish to be fair but because higher offers have higher expected value.[4]

[3] A more detailed translation of comparative model preferences would explicitly state that the proportion at which the second mover is just indifferent between accepting and rejecting may vary with the size of the pie. However, the simpler statement, P1*, is sufficient for our purposes.

[4] Bolton (1991), Roth *et al.* (1991), and Zwick *et al.* (1992) argue that first movers search for the optimal offer.

The punishment hypothesis stipulates that the second mover's objective in ending the game in disagreement is to punish the first mover for an unfair offer. In the ultimatum game, rejecting a proposal is a punishment strategy in the sense that rejection leads to lower payoffs—for *both* first and second movers—than does accepting. By the punishment hypothesis, if the second mover were unable to make the first mover forfeit his share of the proposed division, the second mover would lack a reason to play reject and forfeit the proposed second mover share. We might then state the punishment hypothesis as follows: In the ultimatum game, second mover rejection constitutes a punishment strategy. Consequently P1* applies, and together with P2 and P3 this explains previously observed results. On the other hand, if rejection did not imply that the first mover would forfeit his share of the proposed division, then P1 (together with P2 and P3) would apply, and it is predicted that perfect equilibrium play will result. The Impunity cell of our experiment (described below) concerns a game in which second mover rejection leads only to the second mover, and not the first mover, forfeiting his share of the proposed division.[5]

Experimental Design

In principle, our experimental design could be used to test the anonymity hypothesis on an ultimatum game featuring a full complement of first and second mover actions. However, we judged the resources necessary for such a test—in terms of both time and money—to be exorbitant (this should become clear below). Second, because of our experience with lab tests of similar games, we were cognizant of a (potential) problem with comparing the explanatory power of competing hypotheses in the full

[5] The reader might wonder why we do not take P1* by itself as the hypothesis, without incorporating the punishment aspect. P1* alone might be referred to as the envy (or jealousy) hypothesis because it suggests that a player always prefers disagreement to the other player obtaining a much larger share, independent of the game being played. The envy hypothesis, however, is inconsistent with the data, particularly that for the best shot game (Harrison and Hirshleifer, 1989; Prasnikar and Roth, 1992). In best shot, the first mover makes a "social contribution." After viewing the first mover's choice, the second mover also makes a contribution. The maximum of the two contributions determines the total cash to be divided; the larger the maximum contribution, the larger the pie. The largest share of the pie, however, is allocated to the player who contributes the smallest amount. The perfect equilibrium allocation looks very much like that for the ultimatum game, with the second mover receiving a very small payoff relative to the first mover. (In the Prasnikar and Roth study, the perfect equilibrium division was $3.70–$0.42.) In addition, the second mover has the opportunity to end the game in disagreement. If the envy hypothesis were valid, we should see substantial deviations from equilibrium play; but in fact, both best shot studies find that, in the lab, perfect equilibrium play approaches 100%.

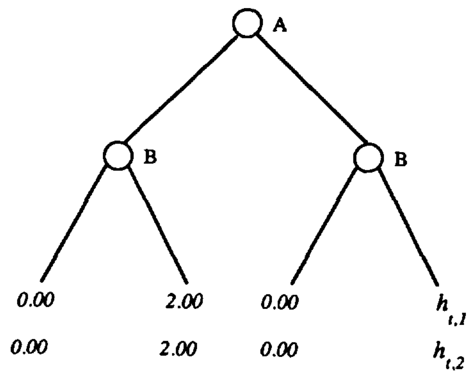


FIG. 1. Cardinal Ultimatum Game.

ultimatum game: game paths taken by subjects usually exhibit a fair amount of dispersion, leading to some ambiguity when comparing path distributions to predictions. This is particularly problematic when testing an hypothesis which makes a point prediction, as does the conventional perfect equilibrium analysis. Rejecting the hypothesis on the basis that the data displays a non-trivial distribution would make for a very demanding test of the theory—so demanding that it is probably uninteresting, at least at this stage in theory development. On the other hand, establishing a benchmark for when the distribution is "close" to the prediction point necessarily involves a certain arbitrariness.[6] Our simplified ultimatum game avoids these problems by establishing an unambiguous measure of "success." We are then able to compare competing hypotheses by comparing their success rates.

We call our simplified game *Cardinal Ultimatum*. It was derived by first abstracting the crucial features of the full ultimatum game ("crucial" relative to observed patterns of lab play) and then assembling these in such a way that it allows for a distinguishing test. Play observed in previous ultimatum experiments can be rudimentarily described as falling into two categories: (1) the first mover offers close to an equal division and the second mover accepts with high probability; or (2) the first mover offers close to a perfect equilibrium division and the second mover rejects with high probability. Cardinal Ultimatum allows for both of these basic patterns of play and is displayed in Fig. 1. Here $h_t = (h_{t,1}, h_{t,2})$ is a payoff vector with an unequal split, $h_{t,1} > h_{t,2} > 0$ and $h_{t,1} + h_{t,2} = 4$, where the subscript t denotes the game trial (Binmore *et al.*, 1995, offer an evolution-

[6] For a discussion of the statistical issues surrounding ultimatum games, see Forsythe *et al.* (1994).

ary analysis of a similar game when $h_t = (3, 1)$). Assigning a value to h_t presents a bit of a dilemma. For one, if the division is not extreme enough Cardinal Ultimatum may represent only the type of play described in (1). On the other hand, if the division is too extreme we may not be able to detect a dramatic shift in rejection thresholds. So, for instance, perhaps it is impossible—under any conditions—to induce the second mover to take \$0.20 when the first mover receives \$3.80. But perhaps, under certain (sufficient) conditions, the second mover would take \$0.60 when the first mover receives \$3.40. Supposing that the hypothesis being tested provides the sufficient conditions, if we set $h_t = (3.80, 0.20)$, we would miss this phenomenon.

Our solution was to run the game under several alternative values of h_t. In each cell of the experiment there were 10 trials. The

$$\begin{pmatrix} h_{1,1} \\ h_{1,2} \end{pmatrix}, \ldots, \begin{pmatrix} h_{10,1} \\ h_{10,2} \end{pmatrix}$$

sequence we chose is as follows:

$$\begin{pmatrix} 2.20 \\ 1.80 \end{pmatrix}, \begin{pmatrix} 2.60 \\ 1.40 \end{pmatrix}, \begin{pmatrix} 3.00 \\ 1.00 \end{pmatrix}, \begin{pmatrix} 3.40 \\ 0.60 \end{pmatrix}, \begin{pmatrix} 3.80 \\ 0.20 \end{pmatrix}, \begin{pmatrix} 2.20 \\ 1.80 \end{pmatrix}, \begin{pmatrix} 2.60 \\ 1.40 \end{pmatrix}, \begin{pmatrix} 3.00 \\ 1.00 \end{pmatrix}, \begin{pmatrix} 3.40 \\ 0.60 \end{pmatrix}, \begin{pmatrix} 3.80 \\ 0.20 \end{pmatrix}.$$

Our choice of this sequence was guided by two considerations. First is the observation made by several investigators that first movers experiment with offers in particular patterns. The sequence we chose mimics a common pattern.[7] Second, by repeating the pattern of trials 1 through 5 in trials 6 through 10, we allow for a learning stage in which subjects gather information on the behavior of the pool of playing partners. (In particular, first movers need this sort of information to fulfill P2.) The last five trials, the repetition stage in which subjects have better information about fellow subject behavior, are then used to test hypotheses.

Game Procedure

The experiment involved three cells. In the *Cardinal Ultimatum* cell, the game played was Cardinal Ultimatum without subject–experimenter anonymity. In the *Zero Knowledge* cell, Cardinal Ultimatum was played

[7] Casual observation suggests that subjects experiment in one of basically two patterns. A few start with very extreme proposals and then gradually pull back. Most, however, start out proposing close to 50–50 and gradually make their offers more extreme. The sequence adopted reflects the more common (and more cautious) approach on the theory that all first movers who wish to experiment will find this an acceptable way of doing so.

with subject–experimenter anonymity. Last, in the *Impunity* cell, the game played was the Cardinal Ultimatum game minus the second mover punishment strategy, without subject–experimenter anonymity. Twenty subjects participated in each cell (no one participated in more than one cell). Subjects were divided into equal groups of first and second movers, the roles being fixed for the entire session. Each first mover sequentially played each second mover exactly once, over the 10 trial sequence discussed above. The game procedure for each cell is detailed below. Because the need to create experimenter–subject anonymity decisively affected our choices in so many areas, Zero Knowledge is described first.

Zero Knowledge. The use of computers was ruled out on the grounds that assurances of anonymity must be apparent to subjects.[8] We used a very large room that has a portable 7′-high blind. As a result, playing partners could be separated visually, thereby providing between-subject anonymity, without separating them audibly, thereby bestowing credibility on the common knowledge aspect of instructions. We placed first movers (Players A) on one side of the blind, and second movers (Players B) on the other. Each subject sat at a cubicle, enclosed on three sides as well as on top, providing a private area for decision making. Players communicated their moves to their game partner via mailboxes situated at the top of the blind.

Because the control of information passing between experimenter and subject is crucial, we conducted the entire experiment from a script, the "Laboratory Protocol" (see the Appendix). It includes all verbal statements made to participants by the monitor (with the exception of answers to individual questions) as well as the written instructions read by subjects.[9] Here we provide a synopsis of the game procedure used to create experimenter–subject anonymity:

At the beginning of the game, Player A receives two (empty) boxes, one labeled square (■), one labeled triangle (▲), each thereby corresponding to one Player A move. The reverse side of each box is labeled "Player A Box" (see Fig. 2(i)). Player B receives four boxes, two labeled with a square and two labeled with a triangle. The reverse side of each box is labeled with the player payoffs corresponding to the geometric label (Fig.

[8] Use of secret computer i.d.'s would probably not resolve this problem since subjects could not be sure about what information the computer is recording. More importantly, the use of computer i.d.'s would not resolve the payment problem. That is, since our computers do not dispense cash, a monitor would have to do so, thereby requiring at least partial revelation of individual subject actions.

[9] The authors served as monitors for all treatments, and each read an identical section of the protocol across treatments. Graduate students performed manual tasks (they had no speaking role).

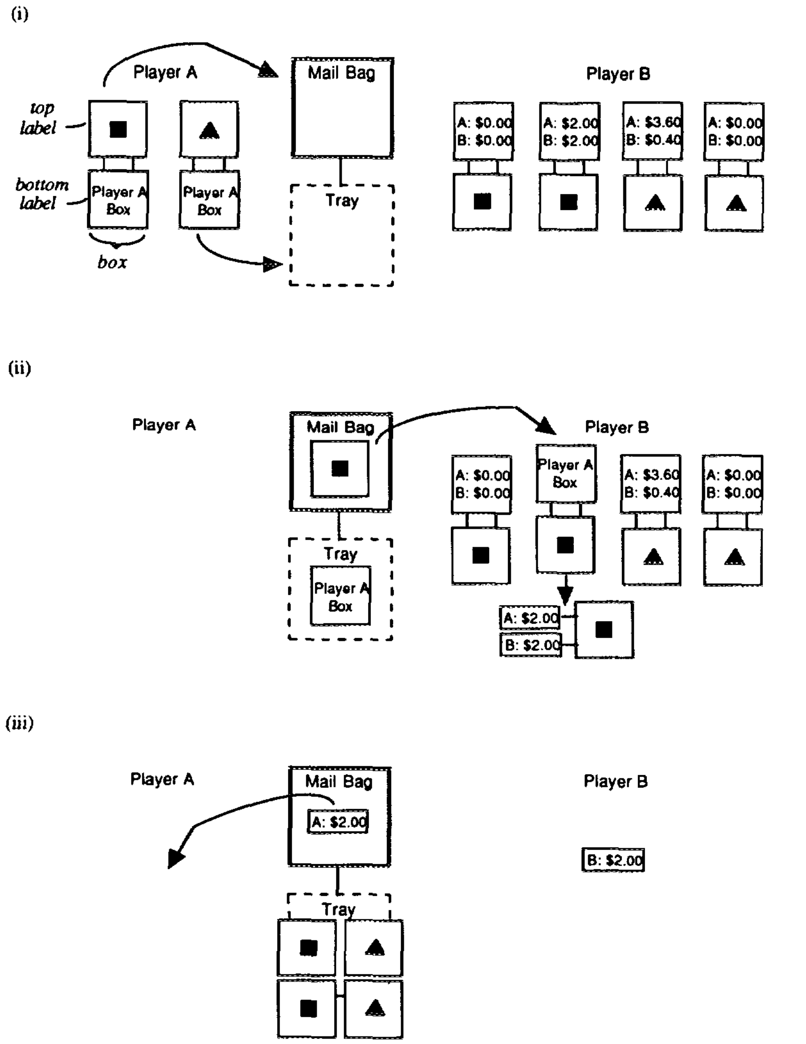


FIG. 2. Zero Knowledge Game procedure. Experimenter views only what is displayed in dashed Tray area. (i) Initial setup of game followed by Player A decision. (ii) Monitor inspection of tray followed by Player B decision. (iii) Monitor inspection of tray followed by Player A retrieval.

2(i)). Each box contains payoff envelopes (cash enclosed) consistent with the box label. For example, a box labeled "Player A Receives $2.00. Player B Receives $2.00" contains two sealed envelopes, one labeled "Player A" and one labeled "Player B," each containing two one-dollar bills. The reverse side of this box would be labeled with a square, since this is the Player A action that would have to be taken to get to the \$2.00–\$2.00 payoff.

The game (Fig. 1) was then described to subjects as one in which playing partners must choose which payoff box in Player B's possession to open (a list of box contents was distributed prior to each game, and read aloud to make them common knowledge). Player A gets to choose whether the box is a square or triangle. He indicates his choice by sending the appropriate Player A box to Player B, who then selects from the two appropriate options. For example, if Player A sends the box marked square, then Player B can choose to open either of his payoff boxes marked with a square, one containing \$2.00 for each player, the other containing nothing for either. The selected box is opened and the payoff envelopes are distributed.

The procedure for exchanging boxes and payoff envelopes is illustrated in Fig. 2. It is in the exchange procedure that the anonymity and monitoring problems are resolved. First, all boxes, whether originating with Player A or B, are identical up to the labeling.[10] In addition, geometric labeling is identical across boxes in the sense that it would be impossible to determine whether a box labeled triangle, say, originated with Player A or B without turning the box over to see if it is labeled with a payoff node or with "Player A Box." In addition, the geometric label is placed on the side of the box which opens, and all boxes are identically sealed with a small tab of paper in the same manner that whiskey bottles in the United States are sealed with a tax stamp. To open the box one must break the seal.

The exchange procedure works as follows: In the privacy of his cubicle, Player A selects a move by placing the corresponding square or triangle box into an opaque mailbag. The remaining box is placed on a tray, geometric label side down ("Player A Box" side up). When all Players A have completed this task, a monitor comes by to check that one box is on the tray (see Fig. 2(i)). The monitor does this without touching or otherwise disturbing either box or mailbag (the player watches the inspection). Player A then places the mailbag into the designated mailbox and places the other box into a large Discard Box, used for the same purpose by all Players A.

Player B retrieves the mailbag, takes it back to her private cubicle, and checks to see which box Player A has sent. Player B then selects an appropriate box and opens it. She keeps the payoff envelope marked for

[10] All boxes used were identically white with dimensions $8\frac{1}{2}'' \times 3\frac{1}{2}'' \times 1\frac{3}{4}''$. Boxes open from the top only and are the style known in the box business as a "mailer." Running this experiment required us to fold, stuff, label, and seal 720 boxes (6 boxes per game, 10 games per trial, 10 trials plus two practice trials). To see why it was necessary to restrict the number of moves in the game, the reader need only note that each additional move would require an additional 3 boxes per game or 360 boxes for the experiment.

herself and puts the other one into the mailbag (see Fig. 2(ii)). The open, now empty, box is placed in an opaque trash bag. The four remaining boxes—the box sent by Player A being one of them—are then placed on a tray, geometric label side up. Once all Players B have completed this task, a monitor comes by to inspect. Note that if the rules have been adhered to, the Player A box will have the same geometric label as the one Player B chose to open. The tray should therefore display four sealed (i.e., unopened) boxes, two labeled square and two labeled triangle. The monitor can perform this inspection without touching or otherwise disturbing any of the boxes (the player watches the inspection). Player B then places the mailbag into the designated mailbox and discards the four sealed boxes along with the trash bag into a Discard Box, used for the same purpose by all Players B. The game ends when Player A retrieves his enveloped from the mailbox (see Fig. 2(iii)).

This design yields the desired anonymity because what the inspecting monitor sees (displayed in the dashed Tray areas of Fig. 2) is invariant to the choices made by the players. On the other hand, the monitor has enough information to determine if any game rule has been violated. For example, if Player B were to open more than one payoff box, she would not be able to present four sealed boxes for inspection, thereby alerting the monitor.[11]

But how is data collected? The answer is by going through the trash. At the end of each trial, the contents of both Player A and Player B Discard Boxes are emptied into a storage bag. Examination of which boxes have and have not been opened reveals the distribution of actual playing paths taken. (The only non-retrievable information is the link between individual player actions across trials.) Note that there is no deceit involved here—player actions are indeed anonymous in the sense that individual actions cannot be attributed to individual subjects.[12] In

[11] The one violation that the monitor would not be able to *directly* observe would be any type of tampering with the payoff envelopes on the part of Player B. However, note that once Player A has taken an action, he expects to receive one of two possible payoffs (0–0 payoff boxes contained a coupon which Player B was required to send to Player A). If there was any tampering, Player A could detect it, and since the tampering would be to Player A's disadvantage he would have every incentive to alert the monitor (as was instructed in the directions).

[12] Of course, if all subjects take the same action, the experimenter will be able to say what each individual subject did. Recall, however, that the anonymity hypothesis conjectures that subjects are concerned about experimenter observation because it might influence the experimenter's assessment of the subject. Even if everyone takes the same action, this action cannot be used by the experimenter to discriminate among subjects. Further, the Zero Knowledge design prevents a subject from distinguishing himself to the experimenter by choosing a different action. So even if Zero Knowledge subjects expect everyone else to choose the same action, they have little incentive to modify their behavior on the basis of this expectation.

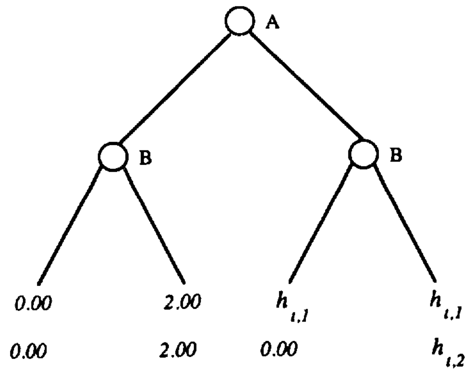


FIG. 3. Impunity Game.

fact, the data retrieval procedure was explained to subjects prior to play (see Appendix).

Cardinal Ultimatum. The only substantive feature (minor differences are indicated in the Appendix) distinguishing this cell from Zero Knowledge is that, in Cardinal Ultimatum, cards were substituted for boxes. Each card had top and bottom labels identical to a corresponding box. Instead of removing payoffs directly from a box, Player B cuts the selected card in two, each half indicating one playing partner's payoff. Card halves were redeemed at the end of the experiment for their cash value. So in order to be paid, a subject had to present (reveal) his game actions to the experimenter. In this way, the lack of experimenter–subject anonymity was rendered apparent to subjects.

Impunity. The game played in this cell differs from the Cardinal Ultimatum treatment by just one feature: if the second mover rejects a first mover's offer of $h_{t,2}$, the first mover still receives $h_{t,1}$; i.e., the second mover's punishment strategy is removed (see Fig. 3). Impunity was *not* subject–experimenter anonymous.

PREDICTIONS

The games in all three cells have the same perfect equilibrium prediction: games played in trial t will result in an allocation of h_t. Both anonymity and punishment hypotheses agree on the Cardinal Ultimatum cell (see Fig. 4).

Application of the anonymity hypothesis to Zero Knowledge, and of the punishment hypothesis to Impunity, is straightforward. In addition, Cell

	Cardinal Ultimatum	*Zero Knowledge*	*Impunity*
ANONYMITY HYPOTHESIS	q_{Ult}	$P = 1$	$1 > P \geq q_{Ult}$
PUNISHMENT HYPOTHESIS	q_{Ult}	$P = q_{Ult}$	$P = 1$

FIG. 4. Predictions: P = predicted proportion of games played on perfect equilibrium path and q_{Ult} = proportion of Cardinal Ultimatum games played on perfect equilibrium path.

each hypothesis makes a cross-prediction: because experimenter–subject anonymity is not a factor, by the punishment hypothesis there should be no difference between Cardinal Ultimatum and Zero Knowledge cells. Application of the anonymity hypothesis to Impunity is somewhat more complex: to the extent that second movers are responsible for non-perfect equilibrium outcomes in cardinal ultimatum, some movement towards perfect equilibrium can be expected in Impunity, although first mover tendencies towards equitable divisions should substantially dampen this trend.

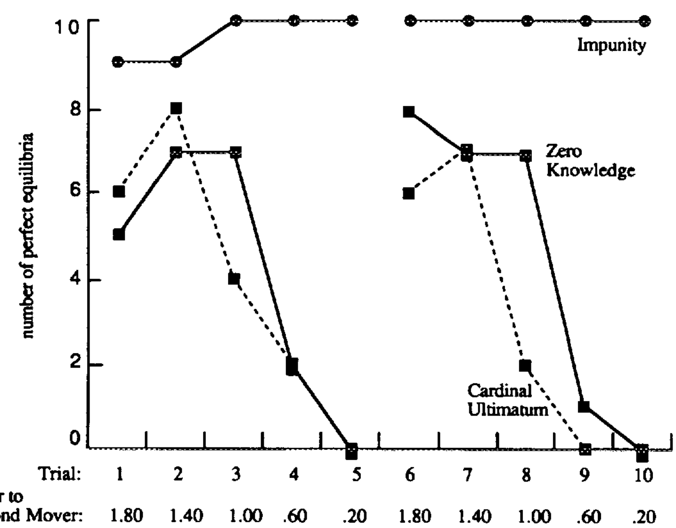
RESULTS

Subjects were recruited from undergraduate business courses at Pennsylvania State University, as well as through billboards posted around campus. Participation required the subject to appear at a special place and time.[13] The chance to earn cash was the only incentive offered. Subjects were paid for all 10 games played (two practice games were not included). There was no participation fee. Altogether there were 60 subjects, 20 in each cell.

Figure 5 presents the number of perfect equilibria observed per trial per cell. For reasons noted above, we restrict our analysis to the last 5 trials (although as it turns out, it would not change matters much if we examined all 10 trials). First consider the Cardinal Ultimatum game. Aggregating across the last 5 trials, only 30% of play is on the equilibrium path.

[13] The Cardinal Ultimatum experiment ran on Thursday, April 23, 1992, Impunity ran on Friday, May 29, and Zero Knowledge ran on Thursday, July 16. All sessions began at 6 PM and lasted approximately 1 hr and 45 min. The average earning was $17.25, which is approximately $11.90 per hour.

(i)



(ii)

	Trials 1 to 5		*Trials 6 to 10*		*All Trials*	
	X	Y	X	Y	X	Y
Cardinal Ultimatum	.62	.40	.50	.30	.56	.35
Zero Knowledge	.60	.42	.66	.46	.63	.44
Impunity	.96	.96	1.0	1.0	.98	.98

X = Player A equilibrium actions (%)

Y = Equilibrium outcomes (%) [=Player B on-path equilibrium actions (%)]

FIG. 5. Comparison of perfect equilibrium play: (i) by trial, (ii) proportions aggregate across trials.

Fifty percent of the first mover offers are equilibrium offers, so 20% of all offers are rejected by second movers (equal division offers were never rejected). These rates are similar to those reported in previous ultimatum studies (compare, for instance, with Roth *et al.*, 1991). Finally, rejection rates rise as offers become more extreme (see Fig. 6). In summary, the Cardinal Ultimatum data exhibit the same qualitative characteristics observed in full ultimatum games.

	Offer to Second Mover ($)				
	1.80	1.40	1.00	.60	.20
Cardinal Ultimatum	7.7	11.8	57.1	77.8	100.0
Zero Knowledge	13.3	7.1	6.7	70.0	100.0

FIG. 6. Boxed numbers are percentages of perfect equilibrium offers rejected by second movers.

Figure 5 shows that the punishment hypothesis explains more of the deviation from perfect equilibrium than does the anonymity hypothesis (compare with Fig. 4). Specifically, Impunity exhibits 100% perfect equilibrium over the last five trials, while Zero Knowledge has a rate of just 46%.

Zero Knowledge does, however, exhibit a small increase in perfect equilibrium outcomes, rising from 30% in Cardinal Ultimatum to 46% (comparing the last 5 trials). Statistical testing yields some qualified support for the conclusion that the shift is significant,[14] but at most this suggests that the anonymity hypothesis explains a relatively small fraction (about 23%) of the non-equilibrium play. Further, close scrutiny of the data suggests that, even if the shift is due to the effect of experimenter observation, the anonymity hypothesis must nevertheless be modified in a manner that pushes it closer to the punishment hypothesis.

First, the data suggests that second mover violations of P1, not first mover violations, drive non-perfect equilibrium play. The Impunity cell provides strong evidence that first movers act in a manner consistent with

[14] We can get some feel for the statistical significance of this difference by testing the null hypothesis $p_{c,t} = p_{z,t}$ against the alternative $p_{c,t} \neq p_{z,t}$ for each trial t, where $p_{c,t}$ is the proportion of perfect equilibria observed in Cardinal Ultimatum trial t and $p_{z,t}$ is the proportion in Zero Knowledge trial t. Application of Fisher's exact test (see for example Pratt and Gibbons, 1981) yields p-values greater than 0.3 for all trials, with the exception of trial 8 where it is 0.035. So, by this test, the evidence for a significant difference is tenuous. On the other hand, testing each trial separately might underplay the difference. For instance, it fails to take into account that the difference between sample proportions is non-negative for all t. Ideally, we would test the null hypothesis $p_{c,t} = p_{z,t}$ *for all* t, but we know of no classical test to accomplish this given the conditions of the experiment. However, see Fong and Bolton (1993). They extend a Bayesian technique for handling bioassay problems to an analysis of the data presented here. They conclude that the evidence supports an anonymity effect, although the effect is weaker than the raw data suggest.

P1 even when the experimenter observes their actions.[15] On the other hand, differences in second mover rejection rates—rejections clearly being in violation of P1—explain the bulk of the difference in equilibrium rates between the two ultimatum cells: Note that second movers are somewhat less likely to reject in Zero Knowledge than in Cardinal Ultimatum games (see Fig. 6). Very specifically, they are less likely to reject an offer of $1 (trial 8), rejection rates being quite similar for other offers. Now observe that trial 8 is also responsible for over 60% of the difference in equilibrium rates over the last 5 trials. It appears then that second mover violations of P1, not first mover violations, drive non-perfect equilibrium play.

Now recall that the anonymity hypothesis offers essentially two distinct reasons why anonymity might matter to second movers. One is that second movers are trying to deliver fair outcomes for the experimenter because they believe that such behavior might benefit them in the future. However, we have plainly rejected this explanation so far as it applies to first movers—the Impunity data imply that first movers are not interested in demonstrating a concern for fairness to the experimenter. Moreover, we have not been able to think of a rationale for why second movers should be interested when first movers are not. So attributing this motive to second movers seems arbitrary and therefore unsatisfactory. The remaining tenet of the anonymity argument, the psychological one, states that second movers reject simply to avoid embarrassment in front of the experimenter. But what act causes the subject embarrassment? Rejection rates rise sharply as the amount of money going to the second mover falls. But rejections cannot be explained solely in terms of embarrassment over taking a small amount of money. This is refuted by the Impunity cell

[15] As an alternative explanation, we might consider the notion that the demand characteristic of Impunity is different from that of Cardinal Ultimatum, thereby influencing first mover play in a distinct way. Note that the experimental protocols for these cells are *identical* (see the Appendix). The sole difference between the two games is the first mover payoff associated with a rejection of the triangle offer (compare Figs. 1 and 3). So the demand characteristic argument would have to be that these different payoffs somehow emit different signals about the experimenter's intentions or expectations; that is, the payoff value in question must somehow signal that the experimenter (perhaps implicitly) wants to observe a concern for fairness in the case of Cardinal Ultimatum and a concern for self-interest in the case of Impunity. The difficulty here, however, is that the explanation is arbitrary in the sense that we could just as convincingly argue it the other way around: precisely because Impunity puts all of the onus on the first mover, the fairness demand characteristic is more pronounced in Impunity. We might also consider the argument that first movers desire fairness but that they opt for the higher payoff in Impunity because they fear that second movers will turn down an offer of the equal split, a risk that is not taken if the higher payoff is chosen. But we see no reason why the first mover would think that the second mover would turn down the equal split.

where no second mover turned down any offer, not even one of $0.20. In fact, recall that the Impunity game differs from Cardinal Ultimatum only in that a second mover rejection in Impunity does not effect the first mover's payoff. Therefore, if second movers in Cardinal Ultimatum and Zero Knowledge cells are trying to avoid embarrassment by rejecting, the embarrassment must involve accepting a small *share* of the pie when the alternative is for both players to forfeit the pie.

The upshot here is that even if we believe that anonymity is responsible for the somewhat higher rates of equilibrium in Zero Knowledge, our data, taken as a whole, implies that the anonymity hypothesis must be modified by substituting P1* for P1′; that is, the data argues that a (second mover) desire to be treated fairly, not a (first and second mover) desire for fair outcomes, is responsible for the observed deviations from perfect equilibrium in ultimatum games. It should be emphasized that, as shown in Fig. 6, a substantial proportion of equilibrium offers are turned down even in the Zero Knowledge cell. So this desire to have others act fairly toward one's self appears to go well beyond what the anonymity hypothesis can explain; that is, this desire goes well beyond any concern for appearances in front of the experimenter.

It is also possible that explanations not involving anonymity explain the difference in second mover behavior across Zero Knowledge and Cardinal Ultimatum. For instance, in spite of our effort to present the game in both treatments in as similar a manner as possible, there are small framing differences that could conceivably make a difference. One possibility is that placing the money on the table in front of second movers, as opposed to paying at the end of the experiment, influences rejection rates.

Discussion

Human behavior is no doubt influenced by many, many factors. As social scientists, we seek to identify those factors that have the greatest influence or the most explanatory power. The data we have analyzed here provide evidence that "punishment for unfair treatment," the punishment hypothesis, explains more of the deviation from perfect equilibrium play in ultimatum games than "obtrusive effects of experimenter observation," the anonymity hypothesis. This is not to say that anonymity has no explanatory power. In fact, it appears to have some. But this power appears relatively weak in the sense that anonymity can explain only a small fraction—while punishment can explain almost all—of the observed deviations from perfect equilibrium.

In terms of experimental methodology, our data are reassuring: the small distortion of subject behavior that may be attributed to experimenter observation is not decisive in the sense that the basic character of the data is unchanged when the distortion is filtered out. Specifically, regardless of whether we examine the Zero Knowledge or Cardinal Ultimatum data, we find that first movers tend to offer more than the minimum positive amount, and that second movers tend to reject offers that are small relative to the first mover's share.

This description of play is consistent with previous studies of ultimatum games. Our data also confirm other reported lab findings, some of which concern different, but related, games. For instance, as implied by the best shot game studies of Harrison and Hirshleifer (1989) and Prasnikar and Roth (1992), our data confirm that second movers do not reject small amounts of money simply because they prefer disagreement. As does Forsythe *et al.* (1994), we conclude that first mover behavior per se cannot explain deviations from perfect equilibrium play in the ultimatum game. Finally, as in the shrinking pie game studies of Ochs and Roth (1989) and Bolton (1991), our evidence implies that the desire to have one's self treated fairly, rather than a desire to treat others fairly, drives the observed deviations from perfect equilibrium play.

There may appear to be some differences between our data and previous lab studies of the dictator game, and these are worth commenting on. For one, Hoffman *et al.* (1994) report a somewhat larger anonymity effect in the context of the dictator game than we find in the context of the ultimatum game. One possible explanation is that, in the Hoffman *et al.* experiments, the subject directions for the anonymity treatments differed from those for the non-anonymity treatments. In fact, a dictator game study in which directions are held fixed (Hoffman *et al.*, 1993) reports an anonymity effect similar in magnitude to that reported here. Also, at first glance our impunity game data might appear to involve significantly less first mover giving then that reported for the (non-anonymity) dictator game (e.g., Hoffman *et al.*, 1994, and Forsythe *et al.*, 1994), even though dictator and impunity games have a similar strategic complexion. Note, however, that first movers in the impunity game were forced to leave a minimum of 25% ($10 out of $40) of the aggregate 10-game pie. Taking this into consideration, the difference is not so clearly significant—particularly so, if we further factor in the differences in lab procedures (an example is differences in instructions to subjects) that exist between dictator and impunity studies. Evidence supporting this explanation is reported in Bolton *et al.* (in press).

Of course the punishment hypothesis, by itself, cannot explain why first movers give money in the dictator game. The basic thrust of the punishment hypothesis, however, is consistent with dictator game giving:

Comparison of Impunity and Cardinal Ultimatum treatments implies that the amount that second movers are willing to reject in the Ultimatum game is generally larger than what first movers would freely offer if not threatened with rejection. (This characterization also appears valid for giving in the aforementioned dictator studies.) This is consistent with the claim that second mover demands for fair treatment are responsible for ultimatum game outcomes. It should therefore be possible to account for the first mover propensity to give small amounts in the dictator game without changing the basic thrust of the punishment hypothesis as it pertains to the ultimatum game.

There has been considerable debate over the value of explanations such as the punishment hypothesis, explanations that assume that people have preferences over the equity or fairness of an allocation. A common criticism is that one can "always" explain behavior as optimizing by modifying preferences. We would argue, however, that it is the data that compel consideration of these modifications: second movers in the ultimatum game turn down positive amounts of money, in direct violation of the usual assumption that they prefer more money to less. Alternatively, one might argue that the standard preferences are accurate, but the optimization assumption is wrong; that is, one might argue that second movers are behaving "irrationally." But the difficulty with this argument is that it does not account for many of the regularities that we observe. For example, not a single offer was rejected by any second mover in the Impunity treatment, even though some of those very same offers were regularly rejected in Cardinal Ultimatum.

Recent theory papers suggest that learning may play a role in ultimatum game behavior (Gale *et al.*, 1995; Roth and Erev, 1995). These explanations pivot on the idea that bargainers learn by adaptation. The dynamic used by Roth and Erev implies that the rate at which a strategy is adopted depends on the strategy's past performance, a higher payoff implying a higher adoption rate. Consequently, second movers learn to accept small offers more slowly than large offers. First movers therefore have an incentive to move away from very small offers to obtain the higher expected value of larger offers. That is, Roth and Erev's model predicts that second movers will learn not to reject very small offers more slowly than first movers will learn not to make them. Binmore *et al.* propose a model with a somewhat different learning dynamic but a similar flavor. Simulations show that these dynamics tend to settle down for long periods of time in patterns of play similar to those observed in experiments. At this writing, however, actual experimental tests of these models have not yet been reported. Nevertheless, it seems quite plausible that learning plays a role in the ultimatum game. But it is not clear whether that role is complementary to, or in conflict with, fairness explanations. In particular, it is not clear whether, or in what sense, learning can explain why second movers sometimes leave money on the table.

Appendix: Laboratory Protocol

This section contains a record of the Zero Knowledge session. It includes all verbal statements made to participants by the monitor (with the exception of answers to individual questions) as well as the written instructions read by subjects. Directions for the monitor appear in italics. Underlined text was replaced with bracketed text for Cardinal Ultimatum and Impunity sessions. Also, in the latter two sessions, the word "card" was substituted for "box":

Seating. As participants enter the room, they are given a randomly chosen folder from a set of twenty. Ten folders are red and ten are blue. Reds are seated on one side of the partition, blues on the other side. At this point all of the partition is not in place, so participants can see one another along with the setup of the room.

May I have your attention please. We are ready to begin. Thank you for coming. With the exception of the folder, please remove all materials from your desk. Open your folder and take out the sheet marked 'Instructions' together with the sheet marked 'Consent Form'. At this time would you please read the instructions.

Allow subjects time to read, then read out loud.

Written instructions provided to participants begin here:

Instructions

General. The purpose of this experiment is to study how people make decisions in a particular situation. Feel free to ask the monitor questions as they arise. From now until the end of the session, unauthorized communication of any nature with other participants is prohibited.

During the session you will participate in a series of games. Each game gives you the opportunity to earn money. How much you earn will depend on the quality of your decisions.

You will be paid your total earnings in cash. Earnings are confidential: only you will know the amount of money you make. Not even the monitors will know this information.

[Immediately upon completion of the session we will pay you your total earnings in cash. Earnings are confidential: only you and the monitor will know the amount of money you make.]

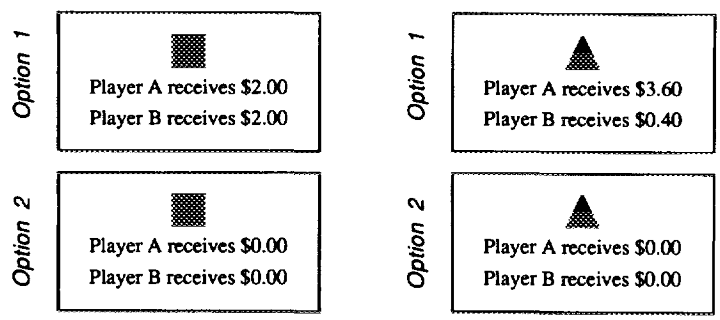


FIG. A1.

Description of the game. The game concerns two players, Player A and Player B, along with four boxes of the type displayed in the figure. Each box specifies a set of payments. Players must select one of these boxes.

This is how you select a box: Player A chooses whether the box will be a square (■) or a triangle (▲). After viewing A's choice, Player B chooses whether the box will be an *Option 1* or an *Option 2*. Each player receives the payment specified on the chosen box. For the figure:

If A chooses ■ and B chooses *Option 1*, then A receives $2.00 and B receives $2.00.

If A chooses ■ and B chooses *Option 2*, then A receives $0.00 and B receives $0.00.

If A chooses ▲ and B chooses *Option 1*, then A receives $3.60 and B receives $0.40.

If A chooses ▲ and B chooses *Option 2*, then A receives $0.00 and B receives $0.00.

Conduct of the Session. During this session you will play the game ten times (plus two practice games). Individual games may differ by the earnings specified on the boxes.

You will have the same role, Player A or Player B, for all games. Your role will be determined randomly after completion of the practice games.

You will play each game with a different player; never the same partner twice. You will not know your partner's identity, nor will they know yours. Nor will these identities be revealed after the session is completed.

Consent Forms. If you wish to participate in this study, please read and sign the accompanying consent form. We ask that you plan on staying until the end of the session, which will last no more than two hours. [Note: in order to collect your earnings you must stay until the end of the session, which will last no more than two hours.] Are there any questions?

Written instructions provided to participants end here.

General Procedure: On top of each cubicle is a tray. On each, place a sheet and boxes for Practice Game 1.

Each game, you will communicate your choice to the player you are matched with through one of the mailboxes located on top of the partition. Communicating in this way insures that you and the other player will be anonymous to one another.

We will play two practice games. For Practice Game 1, those with red folders will be Players A. Those with blue will be Players B. These roles will be reversed for Practice Game 2.

The purpose of the practice games is to familiarize you with the game procedure. The procedure is outlined on the back of the instruction sheet. You may wish to follow the outline as we play.

Practice Game. Set x = 1.

We will now play Practice Game 1. All players, please pull down the tray that is sitting on top of your cubicle. Look at the sheet titled "Practice Game x." It displays the set of boxes to be used for this game.

Read Practice Game x sheet.

The fruit is for the practice games.[A1] Real games will be played for money.

Players A, you will now perform your decision step. On your tray you will find two boxes. The backs of both boxes are identically labeled "Player A." The front of one box is labeled

[A1] Fruit stood in for practice game payoffs (although none was actually given out). This was to avoid any bias that might result from using numbers.

with a ■, the other with a ▲. You must decide which box to send to Player B. If you choose ■, then Player B will choose between the two boxes labeled ■. If you choose ▲, then Player B will choose between the two boxes labeled ▲. Players A, examine the Practice Game x sheet and make your decision.

Pause.

Players A, remove the Mail Bag from your folder.

Pause.

Insert the box you wish to send to Player B into the Mail Bag. Place the Mail Bag along with the remaining box on the tray as displayed on the tray placemat. Once you have completed this procedure, place the tray on top of your cubicle.

Wait.

Players A, at this time, please stand. We will now come around to inspect your trays. Placing the boxes on the tray as instructed allows us to check that you have followed directions without interfering with the privacy of your decision. Without turning the Player A box over, it is impossible to say which box you decided to send.

Inspect trays.

Players A, pull your tray down to the table. In the bottom left corner of your tray is a section titled "Mailbox Assignment." It has two columns, "Game" and "Mailbox." It tells you which mailbox to use in each game. Check which mailbox you use for Practice Game x.

Pause.

Players A, when I tell you to do so, please perform the mailing step: Carry the tray to your assigned mailbox for Practice Game x. Place the Mail Bag in the mailbox. Dump the remaining box, the one you don't want to send to Player B, into the Discard Box located at the center of the partition. When finished, return to your seat and place the empty tray on top of your cubicle. Are there any questions about this procedure? Please go to your mailbox.

Wait.

Players B, you will now perform your decision step. In the bottom left corner of your tray is a section titled "Mailbox Assignment." It has two columns, "Game" and "Mailbox." It tells you which mailbox to use in each game. Check which mailbox you use for Practice Game x.

Pause.

Please go to your assigned mailbox. Remove the Mail Bag and return to your seat.

Wait.

On the tray you will find four boxes. The backs of two of the boxes are marked ■, the backs of the other two are marked ▲. Now turn the boxes over. The face of each box corresponds to one of the boxes displayed on the Practice Game x sheet. Take a moment to examine these boxes.

Pause.

Now open the Mail bag and remove the box Player A sent you. Check to see whether it is marked ■ or ▲.

Pause.

Players B, your task is to select a box from the tray. If the box Player A sent you is a ■, you must select a box marked with a ■. If the box Player A sent you is a ▲, you must select a box marked with a ▲.

Pause.

Open the box you select. Open *only* that box. Remove the enclosed cards.

Pause.

Place the card marked for Player B into the Money Pouch provided for you in your folder. If this were an actual game, rather than a practice game, all boxes having positive cash value would contain envelopes with the actual money inside. You may open the envelope marked for you to check that the proper amount is enclosed. You may store your cash earnings in the provided Money Pouch, or in any other safe place such as your pocket or purse. Under no circumstances should you open an envelope marked for someone else.

Put the card marked for Player A into the Mail Bag sent to you by Player A.

Pause.

Place the Mail Bag, Trash Bag, and remaining boxes on the tray as displayed on the tray placemat. Once you have completed this procedure, place the tray on top of your cubicle.

[Using the provided scissors, cut the card you select along the serrated line.]

Pause.

Remove the Money Pouch from your folder. Place the card half marked for Player B into your Money Pouch. If this were an actual game, rather than a practice game, then, at the end of the session, the monitor would redeem your card for its stated cash value.

Put the card half marked for Player A into the Mail Bag sent to you by Player A.

Pause.

Place the Mail Bag along with the remaining card on the tray as displayed on the tray placemat. Once you have completed this procedure, place the tray on top of your cubicle.]

Wait.

Players B, at this time, please stand. We will now come around to inspect your trays. Placing the boxes on the tray as instructed, allows us to check that you have followed directions without interfering with the privacy of your decision. The four boxes look just like the four boxes you started with. Without turning them over, it is impossible to say which box Player A sent to you or which box you chose.

Inspect trays.

Players B, when I tell you to do so, please perform the mailing step: Carry the tray to your assigned mailbox for Practice Game x. Place the Mail Bag in the mailbox. Dump the remaining boxes into the Discard Box located at the center of the partition. When finished, return to your seat and place the empty tray on top of your cubicle. Are there any questions about this procedure? Please go to your mailbox.

Wait.

Players A, you will now perform the mail retrieval step. Go back to the mailbox corresponding to Practice Game x, take the Mail Bag and return to your seat.

Wait.

Players A, open the Mail Bag. There should be a card labeled 'Player A.' Place the card marked for Player B into the Money Pouch provided for you in your folder. If this were an actual game, rather than a practice game, all boxes having positive cash value would contain envelopes with the actual money inside. You may open the envelope marked for you to check that the proper amount is enclosed. You may store your cash earnings in the provided Money Pouch, or in any other safe place such as your pocket or purse. Under no circumstances should you open an envelope marked for someone else. [Remove the Money Pouch from your folder. Place the card half into your Money Pouch. If this were an actual game, rather than a practice game, then, at the end of the session, the monitor would redeem your card for its stated cash value.]

This ends Practice Game *x*.

If $x = 2$, stop practice games.

Any questions?

If $x = 1$:

We shall now play Practice Game 2. Roles are now reversed: the blue folder side will be Players A and the red side will be Players B. Please follow the game using the Game Procedure form located on the back of the Instructions.

Exchange trays. Distribute the Practice Game 2 sheet and boxes. Distribute a Mail Bag to each Player A. Set $x = 2$ and return to the beginning of the Practice Game section.

Explanation of Anonymity. The game procedure is designed to insure that your decisions and the money you make are confidential. Neither other participants nor the monitors will know this information. At the conclusion of the session, you will be free to leave. You will not have to report your earnings to us. You may be interested, then, to know how we will collect data from this session. We will do this by examining the boxes that are discarded at the end of each game. By counting the boxes we will be able to tell how the group played, but since your boxes are mixed with those of other participants, we will not be able to say how you, as an individual, played. This is fine, since our study concerns only how the group played as a whole, not how individuals play. Are there any questions?

This section not included in Cardinal Ultimatum and Impunity sessions.

Role Selection. First, we shall determine which side of the room shall be Players A and which side shall be Players B. I am holding in my hand two cards, one marked "A" and one marked "B." The participant nearest me will choose one of these cards. If it is marked A, then the chooser's side will be Players A. If it is marked B then the chooser's side will be Players B. *Have a subject choose a card and announce the role assignments.*

Actual Game (Game x). Distribute Game Sheets and boxes.

This is Game x. All players, please pull down your tray and examine the game materials.

Read the Game sheet aloud.

You will be matched with someone you have not previously played.

Player A chooses ■ or ▲. Players A, please carry out your decision step. Take your time. When you are finished, place your tray on top of your cubicle.

Wait until all trays are on top of the cubicles.

I will now inspect your trays.

Inspect trays.

Players A, carry out your mailing step.

Wait until everyone delivers the box, and discards the additional box.

Player B chooses Option 1 or Option 2. Players B, please carry out your decision step. Take your time. When you are finished, place your tray on top of your cubicle.

Wait until all trays are on top of the cubicles.

I will now inspect your trays.

Inspect trays.

Players B, carry out your mailing step.

Wait until everyone delivers the box, and discards the additional boxes.

Player A learns Players B's choice. Players A, please carry out your mail retrieval step.

Pause until all trays are placed on top of cubicles.

This concludes Game x.

At conclusion of each game, Discard Boxes are emptied into plastic bags marked with game number and player type.

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