Amended Final Offer Arbitration is Promising: Evidence from the Laboratory

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Abstract

Arbitration is frequently utilized to settle disputes. Much research has focused on the properties of final offer arbitration (FOA) relative to conventional arbitration. Both mechanisms should encourage settlement in standard environments, previous empirical work finds that impasses are common. A modification of FOA, amended final offer arbitration (AFOA), has been proposed as an alternative mechanism. This paper compares the theoretical and behavioral properties of AFOA and FOA. Based on controlled laboratory experiments, AFOA outperforms FOA, generating significantly greater pre-arbitration settlement. Consistent with the theoretical predictions, offers converge under AFOA; however, FOA offers neither converge nor are consistent with theoretical predictions.

1. Introduction

Given its lower costs relative to litigation, arbitration is rapidly increasing as a mechanism to settle disputes. Many contracts include clauses stipulating that disputes will be resolved via arbitration.[1] Corporations often prefer arbitration since there is limited discovery. The U.S. Supreme Court has ruled that employers can force employees to use arbitration to settle labor disputes (Circuit City Stores Inc. vs. Saint Clair Adams). The increased prominence of arbitration in our economy has led many researchers to study the properties of the various forms of arbitration that are available.

Currently, conventional arbitration (CA) and final offer arbitration (FOA) are the most commonly used methods, and thus have been the most extensively studied. CA is a traditional mechanism under which the arbitrator is free to choose any settlement. In contrast, FOA was proposed by Steven (1966), and limits the arbitrator to choosing one of the final offers presented by the two disputants. Theory suggests that unless asymmetric information is present, any form of arbitration should generate settlement within a contract zone that is generated by the presence of arbitration costs. Unfortunately, neither mechanism has been successful at eliminating disputes in practice. Even in cases where information is widely available, such as baseball labor negotiations, the disputants often fail to settle.[2] The question why there is ever disagreement in cases where agreement appears to be in the interests of both parties is an enduring puzzle which researchers have attempted to address (see Farber and Bazerman 1987, Bloom and Cavanagh 1987 and Babcock and Loewenstein 1997). This inability for arbitration to generate settlement has

[1] For example, on its website, http://www1.us.dell.com/content/topics/global.aspx/policy/en/policy?c=us&l=en&s=bsd&~section=012&cs=04, Dell Computers states:
ANY CLAIM, DISPUTE, OR CONTROVERSY (WHETHER IN CONTRACT, TORT, OR OTHERWISE, WHETHER PREEXISTING, PRESENT OR FUTURE, AND INCLUDING STATUTORY, COMMON LAW, INTENTIONAL TORT AND EQUITABLE CLAIMS) BETWEEN CUSTOMER AND DELL, its agents, employees, principals, successors, assigns, affiliates (collectively for purposes of this paragraph, "Dell") arising from or relating to this Agreement, its interpretation, or the breach, termination or validity thereof, the relationships which result from this Agreement (including, to the full extent permitted by applicable law, relationships with third parties who are not signatories to this Agreement), Dell's advertising, or any related purchase SHALL BE RESOLVED EXCLUSIVELY AND FINALLY BY BINDING ARBITRATION ADMINISTERED BY THE NATIONAL ARBITRATION FORUM (NAF) under its Code of Procedure then in effect (available via the Internet at http://www.arb-forum.com, or via telephone at 1-800-474-2371).

[2] Farmer, Pecorino and Stango (2004) reject asymmetric information as a source of bargaining failure in Major League Baseball salary negotiations.

also been demonstrated in the laboratory (see Ashenfelter, Currie, Farber, and Spiegel 1992, Bolton and Katok 1998, Deck and Farmer 2003a,b, and Dickinson 2004). Laboratory results typically find that both FOA and CA generate settlement rates of about 50%, which is less than what is observed in the absence of any arbitration method.

For these reasons, researchers have developed various alternative mechanisms, including tri-offer arbitration in which a third party submits an offer (Ashenfelter, Currie, Farber, and Spiegel 1992) and combined arbitration which uses a mix of CA and FOA depending upon where the offers lie (Brams and Merril 1986). However, these mechanisms have not succeeded in generating a substantial increase in settlement rates.[3] More recently, Zeng (2003) proposed a simple amendment to FOA, referred to as amended final offer arbitration (AFOA). The primary difference between AFOA and other mechanisms is that the individual's bid affects the probability that he or she wins, but the award amount is determined by the deviation of the opponent's bid from the arbitrator's value.

The general theoretical properties of FOA and AFOA under symmetric information have been analyzed previously. Farber (1980) and Brams and Merrill (1983) originally worked out equilibrium behavior in FOA when the arbitrator's distribution is continuous. In general, a disputant in FOA has to balance two counteracting incentives. Since the arbitrator is constrained to pick one of the offers, disputants have an incentive to make more extreme offers. But, the more extreme the offer, the less likely the arbitrator is to implement it. This leads to divergent offers. However, in AFOA a disputant making an extreme offer is unlikely to win and is likely to be penalized; specifically, the more the losing party's bid deviates from the arbitrator's value, the higher the winner's payout. As a result, an individual has an incentive to be reasonable in order to win, but the final payout amount is not lessened by the decision to be reasonable. As a result, as Zeng (2003) demonstrates, theoretically AFOA improves upon FOA in that the offers that parties submit once they reach arbitration should converge to the expected value of the dispute.

However, AFOA is new, and despite its attractive theoretical properties it remains untested. It is understandable that disputants in the naturally occurring economy would be reluctant to try an unproven mechanism. As detailed by Smith (1994), one of the reasons for conducting experiments is to use "The laboratory as a testing ground for institutional design." This paper reports a series of laboratory experiments designed to test AFOA as a mechanisms for resolving disputes and compares observed behavior to the attractive theoretical properties.

For a more robust evaluation of AFOA this study alternatively models the arbitrator as having a continuous distribution of preferred outcomes and a binary distribution of preferred outcomes. In many real world situations, modeling the arbitrator preference distribution as continuous is appropriate. How much alimony should a divorcée receive? How much pain and suffering compensation should a victim receive? What is the appropriate compensation for an employee in a labor dispute? However, in some cases the question may be better modeled using a binary distribution. Should parents be awarded joint custody or not? Is the defendant liable or not? Alternatively, there might be two types of arbitrators, one likely to rule one way and another likely to rule the other. Is the arbitrator male or female? Is the arbitrator well informed or not? Is the arbitrator experienced or not? Thus, far from being an interesting theoretical side note, studying mechanism performance with discrete arbitrator distributions is critical for our general understanding of arbitration. However, most of the literature including all of the experimental work has focused on the continuous case only. Interestingly, Kilgour (1994) analyzed FOA using a binary distribution and found that optimal behavior changes significantly; specifically, when the arbitrator's distribution is binary, no pure strategy equilibrium exists. However, AFOA is theoretically robust to such changes.

The experimental results confirm the theoretical merits of AFOA. AFOA tends to produce bids that converge to the expected value of the dispute, and it generates greater pre-arbitration settlement than does FOA; specifically, settlement rates are 93% in AFOA as compared to 75% in FOA. Finally, AFOA tends to conform to its theoretical predictions more closely than does FOA suggesting that it is a more predictable and stable mechanism that is worthy of greater attention from both scholars and practitioners alike.

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[3] See Dickinson (2004) for a laboratory test of combined offer arbitration.

2. Theoretical Properties of the Mechanisms

Consider two risk neutral disputants deciding how to allocate a known fixed sum of money, Π. As is standard in this literature, we assume that the disputants' game consists of two stages. In the first stage the players can bargain with each other and reach a mutually agreeable resolution. If the disputants fail to reach an agreement they proceed to a second stage in which costly arbitration occurs. Applying backward induction, we first consider the strategies of both players in arbitration.

2.1 Arbitration

The arbitrator is assumed to have a belief regarding her notion of a fair share for disputant 1, which we denote by z. Thus the fair share for disputant 2 is $\Pi - z$. Neither disputant knows the value of z, but the distribution from which it is drawn, $f(z)$, is common knowledge.[4] As described above, different arbitrator distributions may be more or less appropriate in different circumstances. For robustness we consider two alternative specifications for the arbitrator's beliefs, a uniform distribution and a binary distribution. The uniform distribution is $z \sim U[0,\Pi]$ and the binary distribution is

$$z = \begin{cases} .25 \times \Pi \text{ with probability } 0.5 \\ .75 \times \Pi \text{ with probability } 0.5 \end{cases}$$

Note that for both of these symmetric distributions $E(z) = \Pi/2$. As an assumption, offers are constrained to be in the interval $[0,\Pi]$.[5]

Case 1. FOA

Under FOA, disputants 1 and 2 provide final offers for the share of disputant 1, denoted x

[4]The randomness in the arbitrator's behavior might be explained by the fuzzy sensation of fairness and the indeterminacy in selecting arbitrators (Bloom and Cavanagh, 1986). The assumption regarding arbitrator behavior is standard in the law and economics literature, but there have been a few papers in which the arbitrator may learn some information from disputants' behavior (see Ashenfelter and Bloom 1984, Ashenfelter 1987 and Gibbons 1988). For simplicity, we do not include this learning process in the model.
[5]As discussed below this is a non-trivial assumption for FOA which differs from Kilgour (1994). The mixed strategy equilibrium of that paper places positive weights on offers outside this interval.

and y respectively. If the offers are compatible (i.e., $y \geq x$), the final result is the average of their offers. That is disputant 1 receives $(x+y)/2$ and disputant 2 receives $\Pi-(x+y)/2$. If the offers are not compatible, then the arbitrator must choose one of the offers as the final result. Under FOA the decision rule is as follows. If $|x-z| < |y-z|$ then disputant 1 receives x and disputant 2 receives $\Pi-x$. If $|x-z| > |y-z|$ then disputant 1 receives y and disputant 2 receives $\Pi-y$. If both disputants are equally distant from the arbitrator's notion of fair settlement, then the arbitrator randomly picks one of the two offers, each with probability 0.5.

In the case of uniform distribution, the Nash equilibrium is for disputant 1 to offer $x = \Pi$ and for disputant 2 to offer $y = 0$. The case of discrete distribution of z is more difficult to analyze. As shown by Kilgour (1994), if offers are unconstrained then only a mixed-strategy Nash equilibrium exists. However, for the given binary distribution, limiting the offers to $[0,\Pi]$ creates a situation in which a pure strategy Nash equilibrium exists. As it turns out, the Nash equilibrium is the same for both the uniform distribution and the binary distribution, a feature that is exploited in the experimental design.

Proposition 1. Under FOA, there is a unique pure-strategy Nash equilibrium in which both disputants ask to receive everything, regardless of which of the two distributions is used.

Proof: The case of uniform distribution can be found in Brams and Merrill (1983); therefore, we only need to show the case of binary distribution. Given disputant 1's offer of Π, if disputant 2 offers $y \in [0,\Pi/2)$ then he/she wins when $z = .25 \times \Pi$ but loses if $z = .75 \times \Pi$. Thus, the expected payoff to disputant 2 is $(\Pi-y)/2$, which is maximized when $y = 0$; the maximal expected payoff is $\Pi/2$. If disputant 2 instead offers $\Pi/2$, then she wins with probability 1/2 when $z = .75 \times \Pi$, and wins with probability 1 when $z = .25 \times \Pi$. This will give her an expected payoff of $.75 \times \Pi/2$, which is less than $\Pi/2$. Finally, if disputant 2 offers $y \in (\Pi/2, \Pi]$, then the disputant 2's offer will be implemented and her payoff is $\Pi-y < \Pi/2$. In summary, given disputant 1's offer of Π, disputant 2's best reply is to offer 0. A similar argument holds for disputant 1. Hence, asking to receive everything is a Nash equilibrium. ■

Case 2. AFOA

Under AFOA, the two disputants again place offers denoted by x and y, respectively. If the offers are compatible (i.e., $y \geq x$), then the average is the final settlement. That is disputant 1 receives $(x+y)/2$ and disputant 2 receives Π-$(x+y)/2$. If the offers are not compatible, then, as with FOA, the arbitrator chooses the disputant whose offer is closer to the arbitrator's notion of fair settlement, as the winner. Similar to the second-price auction, the final result is determined by the arbitrator's fair settlement and the loser's offer (instead of the winner's offer). Specifically, if disputant 1's offer is more similar to the arbitrator's belief (i.e., $z > (x + y)/2$), then disputant 1 obtains $z + | z - y| = 2z + y$, leaving disputant 2 the remaining $\Pi - 2z - y$. If disputant 2's offer is more similar to the arbitrator belief (i.e. $z < (x + y)/2$), then disputant 1 receives $z – (x - z) =2z – x$, leaving Π - $2z – x$ for disputant 2. If both offers are equally distant from the arbitrator's notion of a fair settlement, then the arbitrator selects one of the two preceding outcomes each with probability 1/2 .

Proposition 2. Under AFOA, there is a unique pure-strategy Nash equilibrium in which both disputants ask to evenly divide the surplus, regardless of which of the two distributions is used.

Proof: See Theorem 1 in Zeng (2003). ■

FOA and AFOA generate very different bidding strategies. Specifically, FOA predicts extreme offer while AFOA predicts that offers converge at the expected value of $\Pi/2$. The convergence of offers is an attractive property of AFOA. This holds true regardless of which of the two arbitrator's distributions is considered. However, it should be noted that more generally, optimal offers in FOA are dependent upon the distribution of the arbitrator's beliefs, while optimal offers in AFOA depend only on the mean of the arbitrator's distribution.

2.2 Pre-Arbitration Bargaining

We assume that agents have the opportunity to negotiate a settlement prior to going to arbitration. If no settlement is reached, both parties incur a cost c for proceeding to arbitration. Given the equilibrium offers from Propositions 1 and 2, the expected payoff of going to arbitration is $\Pi/2 - c$ for both disputants, for either arbitration mechanism with either distribution. Therefore, the contract zone is the interval $[\Pi/2 - c, \Pi/2 + c]$. Theory predicts that there will be 100% settlement, and the allocation should lie within this contract zone.

3. Experimental Design

A series of laboratory experiments was conducted to compare the performance of AFOA with FOA. To evaluate the robustness of behavior in AFOA and FOA we systematically vary the distribution of the arbitrator's beliefs about the appropriate allocation. Specifically, we observed four replicates in each cell of a 2×2 design, where the first dimension refers to the arbitration mechanism (AFOA vs FOA) and the second dimension is the arbitrator's distribution (uniform vs binary).

Arbitration researchers are concerned primarily with the frequency with which parties settle and with how people behave in arbitration. Experiments using ultimatum and other fairness games have found a strong attraction to the equal split outcome. However, to observe behavior in arbitration, disputants must first reach arbitration through a failure to settle. In order to observe arbitration behavior, previous researchers have either intentionally or inadvertently introduced asymmetric information into their experimental designs. While this has the positive benefit of increasing the amount of data a researcher observes from disputants in arbitration, it introduces a confounding factor in evaluating the performance of an arbitration mechanism. To avoid this situation, each of our experimental sessions is composed of two phases. In the first phase, subjects are not allowed to bargain and instead are forced to enter arbitration. In the second phase subjects were allowed to bargain with each other, with arbitration being used only when a settlement was not reached. The first phase of the experiment affords a comparison of bidding behavior in arbitration while the second phase enables a comparison of settlement rates with participants who are familiar with the arbitration procedure and information that is truly symmetric.

In each period subjects were randomly matched with a counterpart[6] and had to decide how to allocate Π = EXP$100.[7] In the first phase of the experiment, subjects privately and independently submitted offers between $0 and $100 inclusive on their respective computers. As opposed to the discussion in the previous section, in the experiments an offer referred to how much money the disputant would receive, thus leaving 100 minus the offer for their counterpart.[8] Available to all subjects was an onscreen tool that calculated the payoffs to both parties for a given pair of offers and arbitrator realization. Since in this round the subjects were forced to allocate the money using arbitration, the cost of arbitration was zero, $c = 0$, for both parties.[9] If the two proposals were compatible, i.e. summed to $100 or less, then each person received his own offer plus half of the residual money. If the two offers were not compatible, i.e. summed to more than $100, then the arbitrator's preferences were determined according to the appropriate distribution and the payoffs were calculated. In the uniform condition, the arbitrator's preferences were uniformly over the interval [$0, $100]. In the binary condition, the arbitrator's preference equaled $25 with probability 0.5 and $75 with probability 0.5. Each period subjects received feedback in the form of the two offers and payoffs, but subjects were not informed about the realization of the arbitrator's draw.[10] As discussed in the previous section, the optimal offer in AFOA is $50 while the optimal offer in FOA for disputant 1 is FOA is $100; these offers are optimal regardless of the arbitrator's distribution.

During the second phase of the experiments, subjects were again randomly assigned a counterpart each period and had $100 available to divide. In this phase the two parties had one minute in which they could bargain. At any point during the minute, either person

[6] In the experiments, potentially loaded terms such as disputant and arbitrator were avoided.
[7]The exchange rate of EXP$100= US$1 was common information among the subjects.
[8]The terminolgy of the previous section is more consistent with the law and econoics literature; however, it is easier to explain the decision faced by "dispuant 1." Also, framing the task from disputant 1's position allows all subjects to be treated identically in terms of instructions, decision presentation, etc.
[9]Once in arbitration c represents a fixed cost and theoretically should not influence behavior.
[10]The table which showed each round's results was color coordinated to indicate if the offers were

could propose a division. There was no forced sequence of proposals and there was no requirement that a proposal improve upon a standing proposal. At any point, either party could accept the proposal being made by their counterpart. If neither party accepted their counterpart's proposal during the minute, then the allocation was determined via the same procedure the subjects had experienced in the first phase. However, the cost of arbitration was $c = 15$ for both players.[11] Regardless of the distribution used by the arbitrator, the expected payoff is \$50. In FOA if both parties behave optimally, each will ask for \$100 and, given the symmetric distribution of the arbitrator, each will win half of the time. In AFOA, each party should ask for \$50, yielding compatible offers. Thus in all four treatments, the contract zone is [\$35, \$65]. Theoretically both AFOA and FOA should lead to 100% settlement; however, both mechanisms are silent as to where the two parties will settle within the contract zone.

In each laboratory session, four unique[12] undergraduate students entered the lab, read a set of directions specific to the arbitration mechanism and arbitrator distribution that would be used throughout the experiment, and then completed a short quiz.[13] After each subject's responses were checked and everyone was allowed to ask questions, the first phase of the experiment began. After the initial 15 period phase, subjects received additional directions regarding the bargaining procedure that would be in place for the final 10 periods.[14] The experiments lasted one hour and the subjects received an average salient payment of \$12.26 in addition to a \$5.00 show-up fee.

4. Behavioral Results

The results are based upon 1280 individual allocation decisions.[15] The data indicate that

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compatible or not.

[11]Studies of dispute resolution have estimated costs at between 9% and 80%. A cost of 15 per player represents a welfare loss of 30% which is in the middle of this range. This cost is comparable to other experimental studies of arbitration, see Deck and Farmer (2003a,b).

[12] A subject could only participate in one session. For many subjects this was their first experiment, but some had participated in previous unrelated experiments. All subjects were undergraduate students recruited from business courses at the University of Arkansas.

[13]Appendix A contains a copy of the directions and the handouts.

[14]Subjects did not know how many periods were in each phase of the experiment.

[15]Data were collected on 800 pairs of subjects. To control for learning effects, data from the initial 5 periods of each session were not included in the analysis. Thus our results are based upon 320 pairs that are forced to use arbitration and 320 pairs that could reach mutual agreement pre-arbitration. The bargaining pairs were not independent.

AFOA outperforms FOA in two important ways. First, the offers that disputants place in AFOA conform to the theoretical predictions. In contrast, the offers of FOA disputants are not consistent with the theoretical predictions. Second, AFOA leads to greater pre-arbitration agreement than does FOA.

4.1 Offers in Arbitration

Recall that the theoretical prediction for offers made under AFOA is 50 for both the uniform and binary distributions. Figures 1 and 2 plot the actual offers made in the AFOA treatments during the first phase of the experiment when subjects had to enter arbitration. For the binary and uniform distributions, the average offers were 51.5 and 50.6, respectively. Visually apparent for these figures is the tight, symmetric clustering about the theoretical prediction with AFOA.

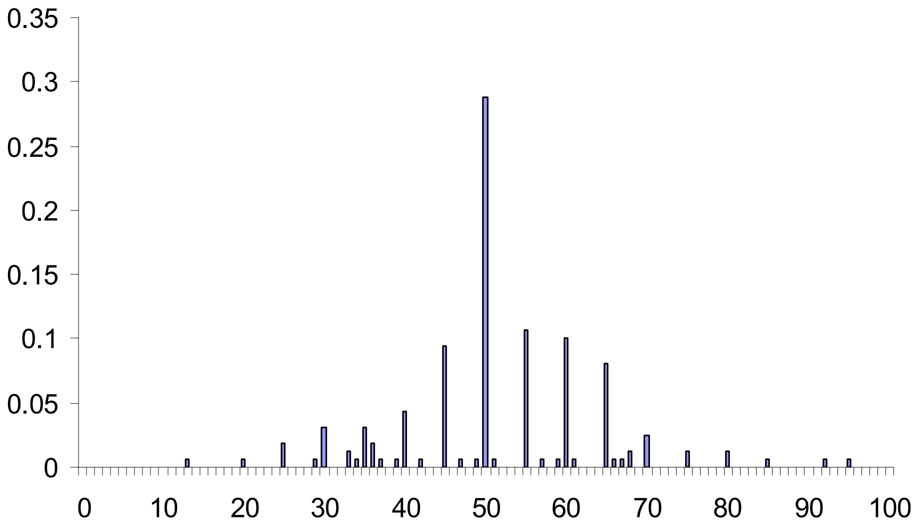

Figure 1. Distribution of Offers in AFOA with Binary Distribution

Figures 3 and 4 plot offers made by disputants in the FOA treatments during the first phase of the experiment. Regardless of the arbitrator's distribution, disputants should make an offer of 100 in FOA. The average offer in the binary and uniform treatments are 56.1 and 56.4, respectively, which are higher than that of AFOA, but much smaller than 100. Therefore, this prediction does not begin to capture disputant behavior. Visually, although there is increased weight on higher offers relative to the AFOA sessions, there is also considerably more weight on low offers. Thus, on average, FOA offers and AFOA offers are not as different as the theory predicts. This is summarized in the following finding.

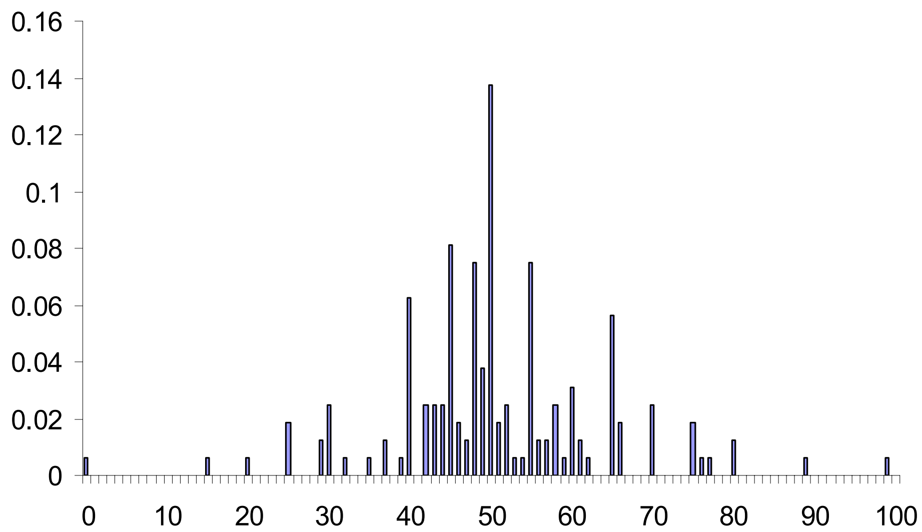

Figure 2. Distribution of Offers in AFOA with Uniform Distribution

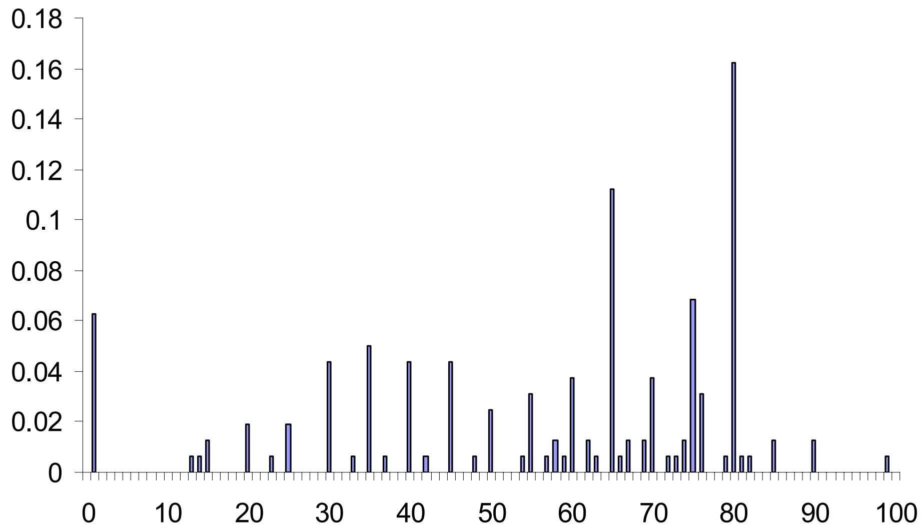

Figure 3. Distribution of Offers in FOA with Binary Distribution

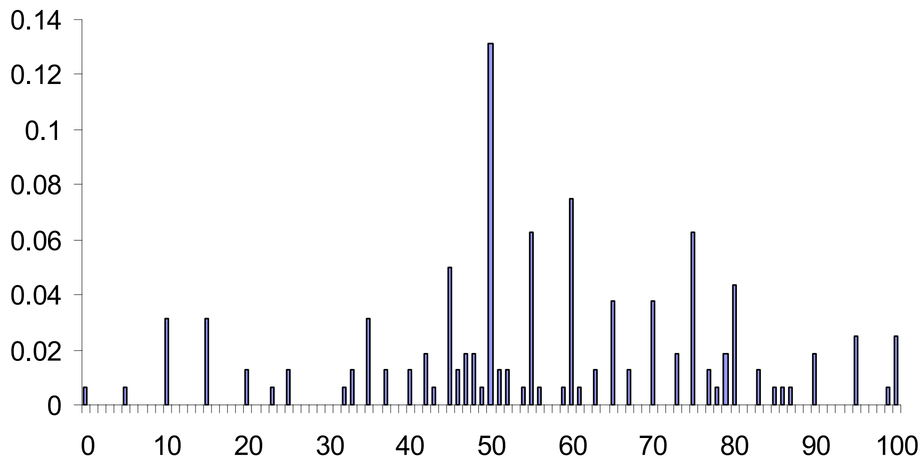

Figure 4. Distribution of Offers in FOA with Uniform Distribution

Finding 1. Observed behavior in AFOA is consistent with the theoretical predications of the model. However, behavior in FOA is not consistent with the theoretical prediction for the mechanism.

Support: For support we offer the estimation of a mixed effects model.[16] In this model, the treatments are assumed to have fixed effects while each session and each subject within a session is modeled as a random effect. Specifically we estimate

$$Offer_{ijt} = \mu + e_i + \zeta_{ij} + \beta_1 FOA_i + \beta_2 Uniform_i + \beta_3 Uniform_i \times FOA_i + \varepsilon_{ijt}$$

where $e_i \sim N(0,\sigma_1^2)$, $\zeta_{ij} \sim N(0,\sigma_2^2)$, $\varepsilon_{ijt} = \rho\varepsilon_{ij(t-1)} + u_{ijt}$, and $u_{ijt} \sim N(0,\sigma_3^2)$.

Offer_{ijt} is the offer made by subject j which is indexed from 1 to 4 within session $i \in \{1, 2,\ldots, 16\}$ in period $t \in \{6, 7, ..., 15\}$. FOA_i and $Uniform_i$ are dummy variables that take on the value 1 if session i employed FOA or modeled the arbitrator's preferences with a uniform distribution, respectively. Table 1 gives the results of the estimation for the fixed effects. The point estimate of the average offer by subjects in AFOA with a binary distribution is 51.6, which is not significantly different from 50 (p-value = 0.5933). The

[16] See Longford (1993) for a discussion of the procedure commonly used with repeated measures.

lack of an arbitrator distribution effect on offers in AFOA is evidenced by the *p*-value of 0.8164 for β_2. The failure of the theoretical predictions for FOA to describe behavior is evidenced by the lack of significance for β_1 and β_3. ■

Table 1. Estimated Treatment Effects

Parameter	Value	Std. Error	DF	t-value	p-value
β_0	51.58480	2.966176	576	17.39101	<.0001
β_1	4.65417	4.253991	12	1.09407	0.2954
β_2	-0.99731	4.202240	12	-0.23733	0.8164
β_3	1.08503	6.118946	12	0.17732	0.8622

The randomness of behavior in FOA is considered a weakness. Kilgour (1994) states (P.291):

> *[I]t is hardly consistent with the disputants being drawn smoothly and inexorably toward each other, and implies that only on average, rather than inevitably, does the arbitrator's decision reflect equitably the underlying situation and the respective side's choices during the process.*

4.2 Pre-arbitration Settlement

For both AFOA and FOA, the two disputants are predicted to reach settlement, thus avoiding the costs associated with going to arbitration. Empirical estimates using field data suggest that settlement rates are in fact quite high. However, previous laboratory studies have found somewhat lower settlement rates, typically about 40% under FOA.[17] Across all bargaining pairs, our observed settlement rate in FOA was 75% and in AFOA it was an astounding 93%, a significant improvement discussed formally in Finding 2.

Finding 2. AFOA generates greater pre-arbitration settlement than does FOA.

Support: Figure 5 provides the qualitative support for this finding. Plotted are the average settlement rates by session for each treatment. Notice that the solid AFOA

[17] Many previous studies have involved asymmetric information or other additional forms of uncertainty.

markers are above the hollow FOA markers. Given the limited number of independent sessions, for quantitative support we rely upon the Mack Skillings procedure to test the null hypothesis that settlement rates are the same in FOA and AFOA vs the two sided alternative. This non parametric test uses the session settlement rate as the unit of observation and simultaneously controls for the arbitrator distribution. With a test statistic of 6, the approximate p-value is 0.014 and thus we conclude that the settlement rates differ by arbitration mechanism. ■

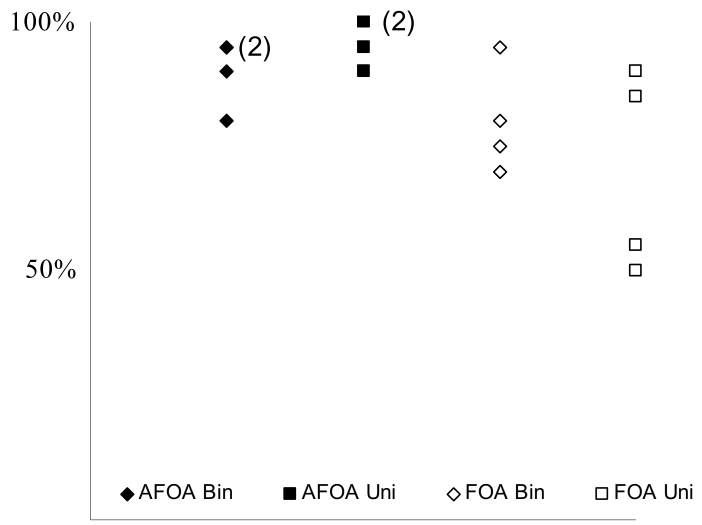

Figure 5. Average Settlement Rates

In every treatment a subject who reaches arbitration expects to receive a payoff of 50 *minus* the arbitration cost of 15. Therefore, the contract zone is [35, 65] in all four cases. Consistent with previous laboratory findings, the contract zone describes observed agreements. Figures 6 and 7 show the distribution of the largest amount received by one of the two parties in the agreement.[18] NA indicates the percentage of bargaining pairs that failed to settle. In all four treatments, over 80% of the agreements fell inside the contract zone. Not surprisingly, the majority of agreements were at or near the equal split, the center of the contract zone.

[18]Given the constant sum nature of the task, if one party receives 70 the other receives 100-70=30. In the case of a 50-50 split the largest and smallest payoff is 50 and the figures give the percentage of pairs that resulted in a 50-50 split not the percentage of subjects who received 50.

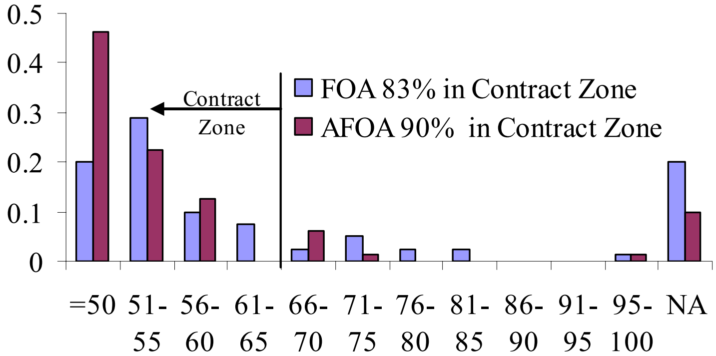

Figure 6. Frequency of Settlements in Bargaining with Binary Distribution

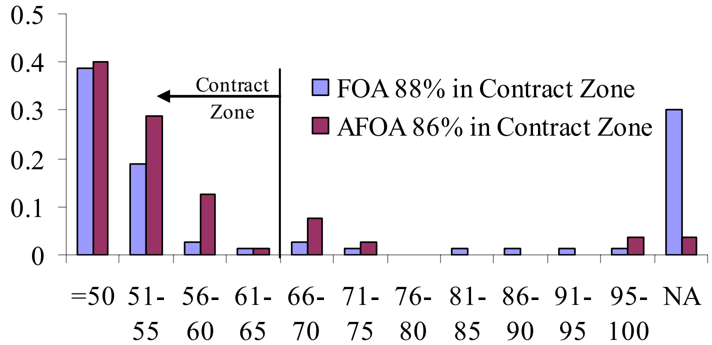

Figure 7. Frequency of Settlements in Bargaining with Uniform Distribution

5. Conclusion

This paper shows that AFOA outperforms standard FOA in several ways. The model is a simple, symmetric information case in which both arbitration bidding behavior and pre-arbitration settlement rates are examined. First, as is predicted by theory, AFOA generates offers in arbitration that tend to converge. Using either a uniform distribution or a binary distribution for arbitrator's preferences, subjects' offers converge to the midpoint of that distribution. This finding is in contrast to FOA which is predicted by theory to produce offers at the endpoint of the distribution; experimentally, the offers do not conform to theory and diverge to the endpoints, instead they are spread across the distribution. Thus, not only is AFOA successful in generating converging offers where FOA is not, it also produces more predictable results that correspond to the theoretical predictions.

When pre-arbitration bargaining is permitted, AFOA generates greater settlement than FOA. Given that information is symmetric and there are costs associated with using arbitration, theory predicts that 100% settlement will take place. While we do observe a great deal of settlement in both cases, it is much more likely with AFOA. We believe that the convergence of bidding behavior in arbitration generates a focal point upon which parties can more easily agree in pre-arbitration negotiations. Thus, it is not only the convergence of bidding behavior, but the overall predictability of bidding behavior it generates that make this mechanism a promising alternative to FOA for future practice.

Finally, as indicated in Zeng (2003), the basic idea of AFOA comes from that of a second-price auction. While theory predicts truthful-revelation in the second-price auction, laboratory behavior does not conform to this prediction (see Harstad 2000). Therefore, the success of AFOA is somewhat surprising. Harstad (2000) explains the inconsistency by the existence of a *positive feedback*, meaning that a bidder may make money even when overbidding if the bidder would have won with truthful revelation.. However, in AFOA such a positive feedback is eliminated because an overbid strategy imposes a loss on the disputant.

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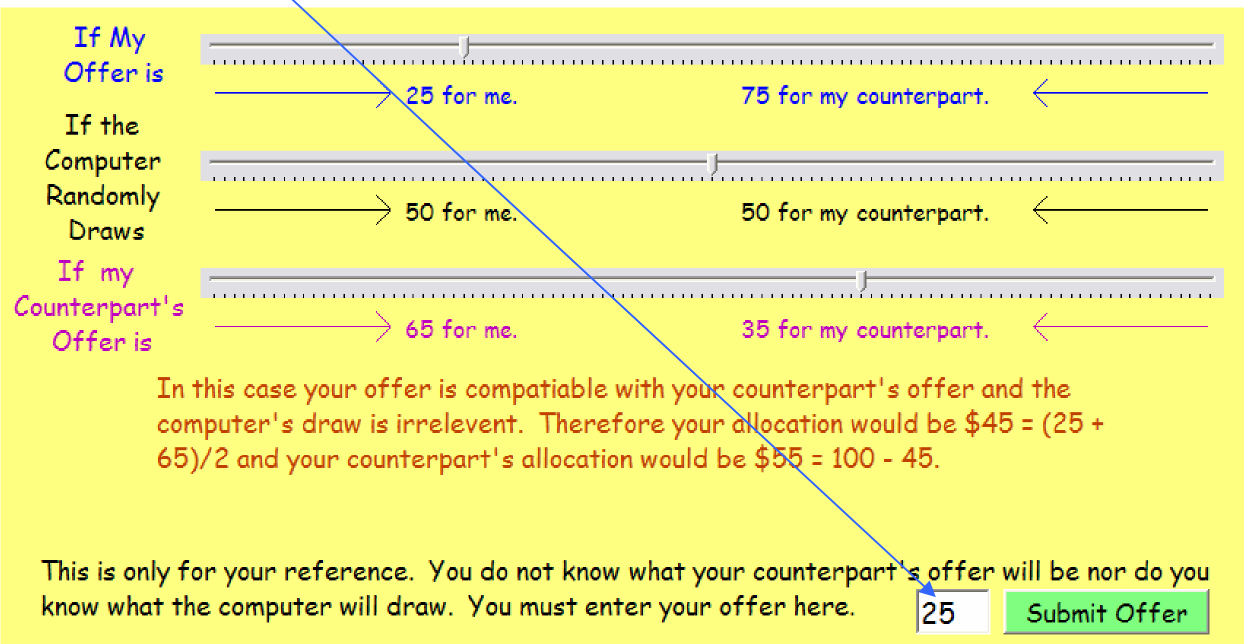
Appendix: Experiment Directions

[Note: These directions are for AFOA in the uniform condition. The other sets of directions involved minimal changes. Copies of all of the directions are available from the authors upon request.]

You are participating in a research experiment through IDEA (Interactive Decision Experiments at Arkansas). At the end of the experiment you will be paid your earnings in cash. Therefore, it is important that you understand the directions completely before beginning the experiment. If at any point you have a question, please raise your hand a lab monitor will approach you. Otherwise you should not communicate with others (please turn off all cell phones, pagers, etc.).

The computer will randomly assign you a counterpart each period. During each period there is $EXP 100 to be allocated between you and your counterpart. The amount allocated to your counterpart is $EXP 100 minus the amount allocated to you. At the end of today's experiment you will be paid the sum of your allocations from each period at the rate $US 1 = $EXP 100.

How is the money allocated? Good Question. Each period you will make an offer, an amount of money you keep. This amount has to be an integer between 0 and 100 inclusive. That is your offer can be 0, 1, 2, … , 99, 100. You counterpart will also make an offer from 0, 1, 2, … , 99, 100. To make an offer you must type it in this box and press the "Submit Offer" button.

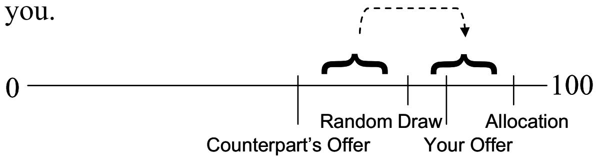


In this example you are making an offer of $25, meaning you would keep $25 leaving your counterpart $75. Since you have not pressed "Submit Offer" you can still change your offer. However, once you press "Submit Offer" you cannot change your offer.

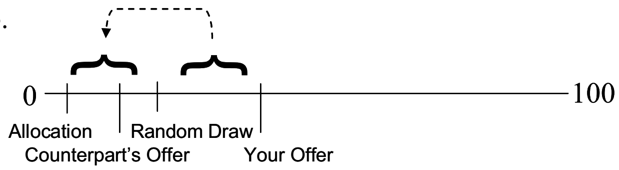
So once my counterpart and I have submitted offers, what happens? That depends on the actual amount of the offers. Suppose you were to click the "Submit Offer" button to submit the offer of keeping $25 and that your counterpart had offered to keep $35, leaving you $65. In this example, your offer to keep $25 is less than the $65 your counterpart offered to leave you, so your offers are compatible. When the offers are compatible, your allocation will be the average of what you offered to keep and what your counterpart offered to leave you. In this example your allocation would be the average of $25 and $65 which is $45. Your counterpart would receive $100-$45=$55. Of course, you do not know what your counterpart will offer. You will have a tool on your screen that allows you to see what would happen for different offers that you and your counterpart could make. Remember, your actual offer must be typed in the box.

So what if my offer and my counterpart's offer are not compatible? In that case the computer will randomly pick a number from 0, 1, 2, … , 99, 100 with each number being equally likely. You do not know what the computer will do, but the average from several draws should be 50. The allocation will depend on whose offer is closer to the computer's random number and the difference between the computer's random draw and the offer that is farther away from the random draw. Any tie is broken randomly.

- If your offer is closer to the randomly drawn number, then the allocation will be the randomly drawn number plus the difference between the random number and what your counterpart offered to leave you.

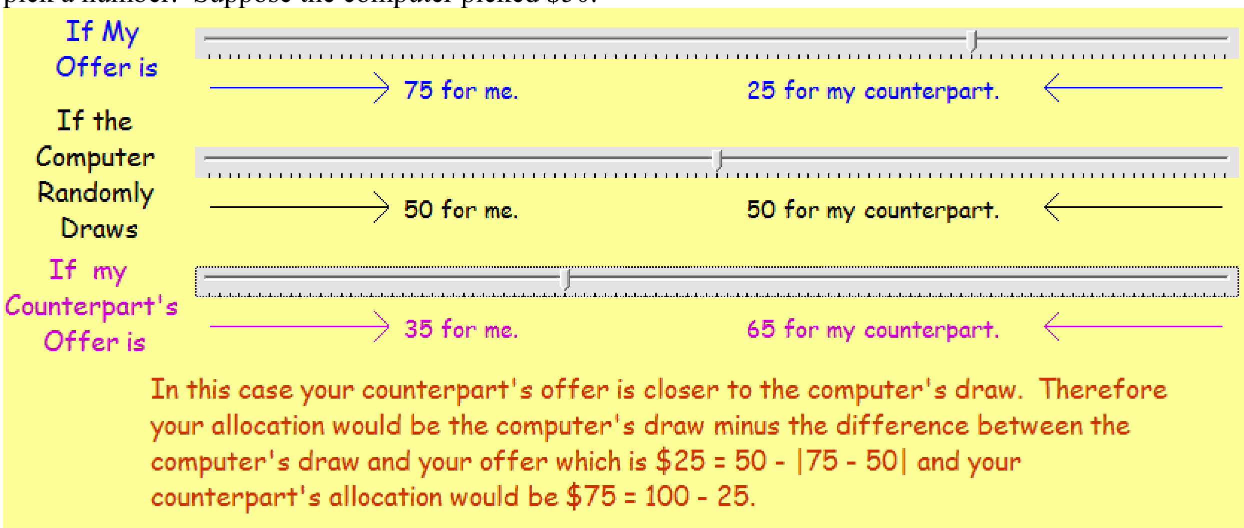


- If your counterpart's offer is closer to the randomly drawn number, then the allocation will be the randomly drawn number minus the difference between the random number and what you offered to keep.



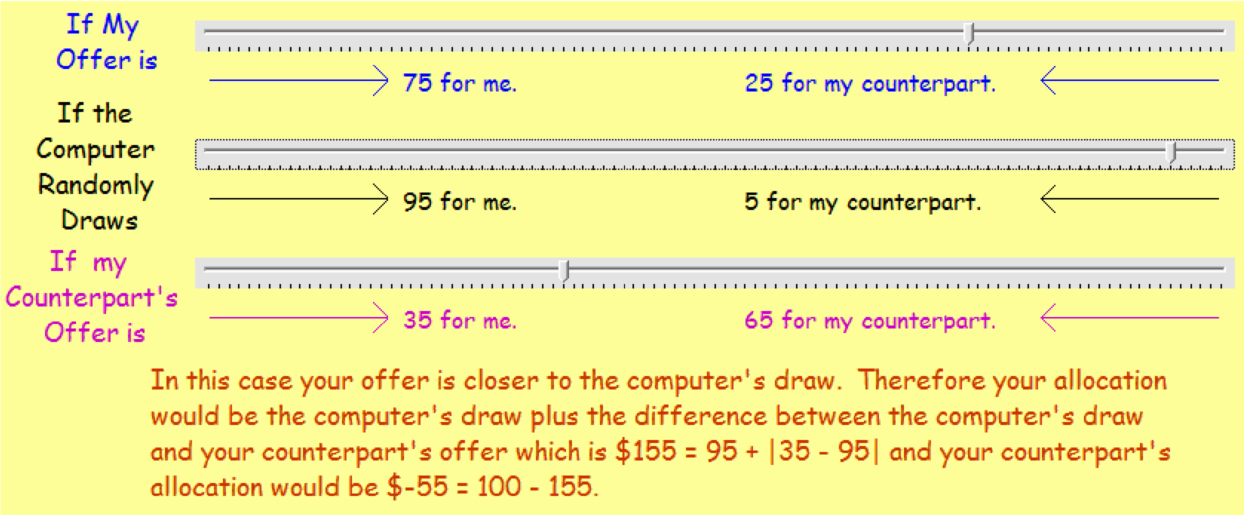
Please notice that the allocation only depends on the computer's random draw and the offer that is most unlike the computer's draw. The allocation takes the difference between the computer's draw and the offer that is furthest away from it and applies this difference to the random number, but in the opposite direction. The person making the offer most similar to the computer's draw will earn a profit at least as large as their own offer.

Let's look at another example. What would happen if you offered to keep $75 and your counterpart offered to leave you $35? In this case your offers are not compatible, so the computer would randomly pick a number. Suppose the computer picked $50.

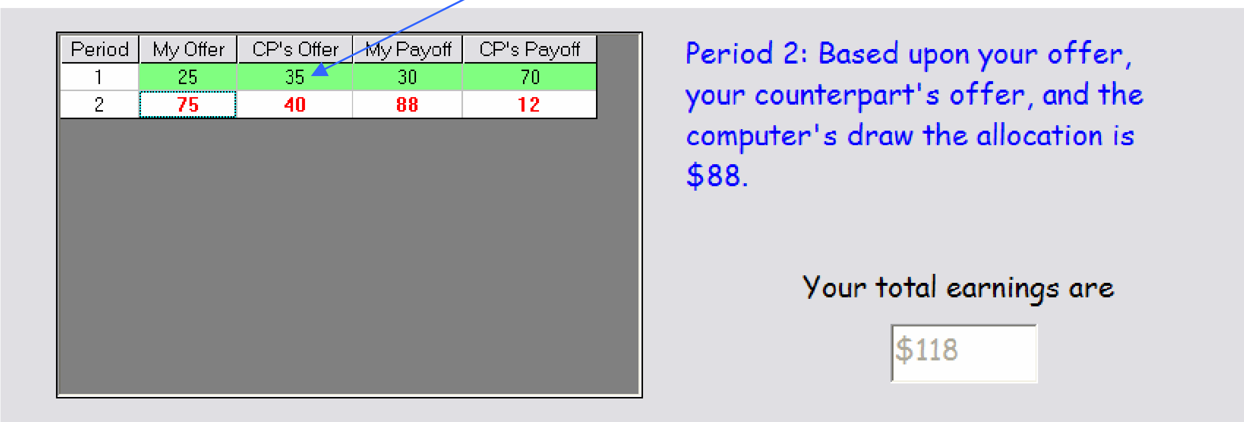


As you can see from the on screen tool, your counterpart's offer is closer to the computer's random draw, |$50-$35|=$15 and |$75-$50|=$25. Therefore, your allocation would be the random draw - |your offer – random draw| which is $50 - |$75-$50| = $25. Your counterpart's payoff would be $100-$25 = $75.

What if the computer had drawn \$95 instead? In this case your offer would be closer to the computers random draw, |\$95-\$35|=\$60 and |\$75-\$95|=\$20. Therefore, your allocation would be the random draw + |your counterpart's offer – random draw| which is \$95 + |\$95-\$35| = \$155. Your counterpart's payoff would be \$100-\$155 = -\$55. Please, notice that is possible for you to lose money in a period. Don't forget that you will be paid the sum of your period earnings, so losses in one period will be deducted from profits in other periods.



After each period you will receive feedback about the previous round's results. At the bottom of your screen you will see a table like the following. According to this table, in period 1 you submitted an offer to keep \$25 and your counterpart actually offered to leave you \$35 and keep \$65. Recall that before we were making guesses about what your counterpart would do. This table shows you what actually did happen. Since your \$25 is less than \$35, the offers are compatible and you receive the average of \$25 and \$35, which is \$30. Therefore your counterpart's payoff is \$100-\$30=\$70.



Period	My Offer	CP's Offer	My Payoff	CP's Payoff
1	25	35	30	70
2	75	40	88	12

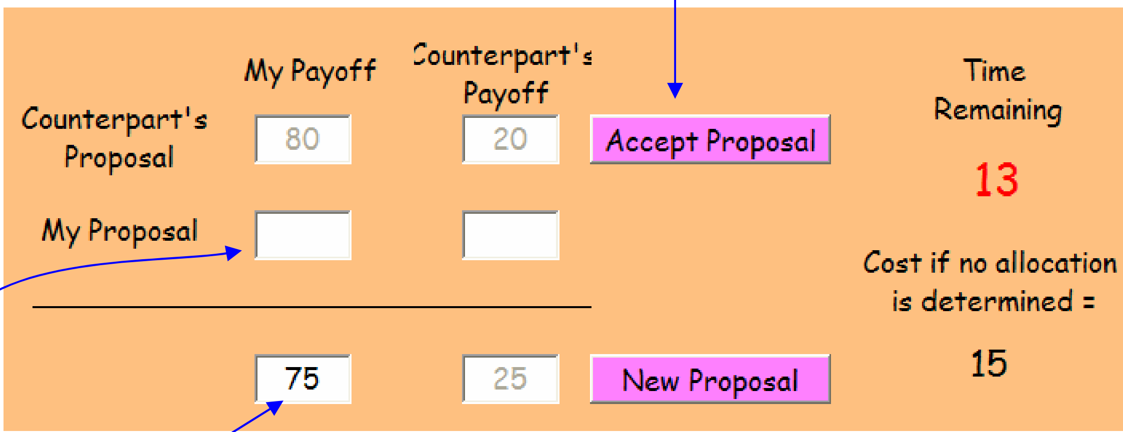
The green highlighting for period 1 indicates that the offers were compatible. In period two the offers were not compatible. You offered to keep \$75 which is more than the \$40 your counterpart offered to leave for you. Notice that you are not told what number the computer actually drew, but you do know that it must have been closer to your offer as your payoff is bigger than your offer of \$75.

If you have any questions, please raise your hand and a lab monitor will be glad to assist you. Once you have finished the directions, please quietly complete the handout.

[Note: Subjects read this page after phase 1 was complete but before phase 2 began]

In the remaining periods, you and your randomly selected counterpart for that period will again have the opportunity to allocate $EXP 100. What you earn in these periods will be added to your earnings from the previous portion of the experiment.

To determine the allocation, both you and your counterpart can make proposals for 1 minute. The amount of time remaining is shown in the top right portion of this screen. If your counterpart has made a proposal it will show up on your screen. In this example, your counterpart is proposing to keep $80 and leave you $20. If you wish to accept this proposal you simply need to click on the "Accept Proposal" button.



If you want to make a proposal, you simply type the amount you are proposing to keep in this box and press "New Proposal". The computer will automatically calculate that you are proposing to leave $100 minus your proposal for your counterpart. *Once you press "New Proposal" your proposal will be visible on your counterpart's screen and your counterpart will be able to accept it.* The proposal you currently have made to your counterpart is listed by My Proposal. In this example you have not made a proposal.

You cannot propose to keep less than the amount your counterpart has proposed to leave for you. In the example, you could not propose to keep $10 and leave $90. Instead, the computer will automatically accept your counterparts offer. Notice that this can never result in a lower payoff to you, than your having made the proposal and your counterpart accepting it.

If either you our counterpart accept a proposal, this period is over and your payoff will be based upon the accepted proposal. If neither you nor your counterpart accepts a proposal, then the allocation will be determined using the same process as in the first part of today's experiment. However, in this portion of the experiment, you and your counterpart will each have to pay a cost of $15 if you do not determine the allocation during the minute and have to use the process from the first part of today's experiment.

If you have any questions, please raise your hand and a lab monitor will assist you. Otherwise, please wait quietly for the others to finish these directions.