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Nonbinding Recommendations: The Relative Effects of Focal Points versus Uncertainty Reduction on Bargaining Outcomes

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ABSTRACT

This paper focuses on the effects of nonbinding recommendations on bargaining outcomes. Recommendations are theorized to have two effects: they can create a focal point for final bargaining positions, and they can decrease outcome uncertainty should dispute persist. While the focal point effect may help lower dispute rates, the uncertainty reduction effect is predicted to do the opposite for risk-averse bargainers. Which of these effects dominates is of critical importance in the optimal design of alternative dispute resolution (ADR) procedures, which are becoming increasingly utilized to help resolve disputes in a variety of settings. We theoretically examine the effects of recommendations on the bargaining contract zone. Our theoretical framework, which allows bargainers' final positions to influence a binding outcome should negotiations fail, provides for a more stringent test of focal points than previously considered. We also present data from controlled laboratory bargaining experiments that are consistent with our model of recommendation effects. Recommendations are empirically shown to influence final bargaining positions and negotiated settlement values. Furthermore, dispute rates are significantly lower when one includes recommendations, even where the recommendation is *completely* ignored in final-stage arbitration. This highlights a potentially significant role for the use of nonbinding procedures, such as mediation, as a preliminary stage in developing more efficient ADR procedures.

JEL Key Words: Bargaining, Experiments, Dispute Resolution, Focal Points, Arbitration
JEL Codes: C78, C92, J52

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1. Introduction

A significant institutional trend of the last 20-30 years has been the increased emphasis on alternative dispute resolution (ADR) programs, such as arbitration and mediation, to help resolve disputes. ADR programs currently operate in a wide variety of contexts that include, among others, union-management negotiations, commercial contract disputes, divorce negotiations, college campus conflict, and civil/community (neighborhood) disputes. In the U.S., community mediation programs are estimated to have almost 20,000 active volunteer community mediators nationwide in programs that now receive over 97,000 annual case referrals.[1] Though only available in about 15% of U.S. colleges, campus mediation programs experienced a ten-fold increase during the 1990s (from around 20 to over 200).[2] Tort reform in several states has included implementing court-annexed ADR procedures prior to litigation. Also, the Federal Mediation and Conciliation Service (FMCS)—an independent U.S. government agency created to promote labor-management peace—has an annual mediation intake of nearly 40,000 cases and receives nearly 20,000 annual arbitration panel requests.[3]

In short, the volume of its use now makes ADR a significant institution in the U.S., not to mention elsewhere, and the trend towards increased ADR use appears persistent. Any improvements in ADR institutional design could significantly reduce dispute costs and promote improved bargaining relationships, which are likely to further reduce dispute rates. An examination of the key characteristics of different ADR procedures is necessary in order to design the most effective dispute settlement institutions.

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[1] Statistics are from the National Association for Community Mediation (NAFCM), and are available at the NAFCM website at www.nafcm.org.
[2] Data reported can be found on www.campus-adr.org, funded in part by a grant from the federal Fund for the Improvement of Postsecondary Education (FIPSE).
[3] Data is from the annual reports available on the FMCS website at www.fmcs.gov.

An ADR procedure can be generally classified as binding (e.g., litigation or arbitration) or nonbinding (e.g., mediation). Binding procedures guarantee a settlement, but nonbinding procedures allow the bargainers to retain more control over the settlement, which increases bargainer satisfaction with the outcome. Some procedures are hybrids, where a nonbinding procedure is utilized initially, and then a binding procedure follows if needed. This is the case, for example, with court-annexed ADR that might compel the use of mediation prior to litigation.[4] There is a general consensus that bargainers typically prefer mediation to binding arbitration or litigation, but it is unclear whether settlement rates are uniformly higher under mediation. In naturally occurring bargaining data, only the most serious disputes are handled with a binding procedure. The resultant sample selection implies that comparing settlement rates from field data across various ADR procedures cannot identify the most effective procedure for settling *comparable* disputes. Because it is often difficult to quantify factors that make one dispute more serious than another, econometric tools used to address sample selection are at a disadvantage.

This paper focuses on the use of nonbinding recommendations to improve binding dispute settlement procedures (e.g. arbitration, litigation, or legislation) in a controlled bargaining environment. A nonbinding recommendation has two potential effects on bargainers. First, through its influence on bargainer beliefs, a recommendation may serve as a focal point (see Schelling, 1957), thereby helping to reduce the multiplicity of potential bargaining outcomes and improving the chance of voluntary settlement. That is, bargainers' expectations of what is considered a "fair" outcome may converge upon the recommendation, which can help eliminate

[4] For example, Wisconsin arbitrators for public sector labor disputes first *mediate* the cases, and they only use arbitration in the event that mediation fails (see Babcock and Taylor, 1996). Also, Hebdon (2001) notes that New York state public policy allows certain disputes to utilize a formal fact-finder recommendation, which is nonbinding, prior to implementation of a legislated (binding) settlement. As another example, many counties in Utah and North Carolina now require that divorce and custody cases be mediated before they proceed to trial.

bargainer optimism that is likely to otherwise increase dispute rates (Babcock and Loewenstein, 1997). On the other hand, a recommendation may reduce uncertainty surrounding the likely outcome from litigation or arbitration, thereby increasing dispute rates for risk-averse bargainers (see Farber and Katz, 1979). Which of these two effects dominates is of critical importance in evaluating whether nonbinding ADR improves bargaining effectiveness. The initial results in Dickinson and Hunnicutt (2005) indicate that the focal point effect likely dominates the uncertainty effect. However, the present paper contributes to this literature in several ways. First, Dickinson and Hunnicutt (2005) did not formally model a focal point, which we do as a sort of Bayesian updating process with respect to bargainer expectations. Final bargaining positions are examined, in addition to dispute rates, in assessing the effects of suggestions. We also include a treatment with a zero-weighted recommendation (i.e., $\gamma=0$), which allows for a much cleaner and direct test of the focal nature of the recommendation. Finally, we compare a no-arbitration (NA) treatment, where the pie is destroyed with certainty at impasse, and a NA-suggestion treatment, which together allow us to examine whether suggestions work via the hypothesized expectations revision or via simple psychological anchoring (Tversky and Kahneman, 1974). Lower dispute rates in NA-suggestion compared to NA is consistent only with the anchoring hypothesis, because there is no expectation of (the non-existent) arbitrator preferences to revise.

Our approach includes both theory and data from controlled laboratory bargaining experiments that generally support the hypothesized beneficial effects of recommendations: lower dispute rates and convergent final offers. Lower dispute rates reduce the need to invoke a binding settlement procedure, and convergent final offers lead to less variable (i.e., more acceptable) outcomes in the event that binding ADR is needed.[5] Overall, the data also indicate that suggestions work not because of simple psychological anchoring, but rather due to their usefulness in belief-revision of bargainers.

The potential benefit of recommendations in ADR procedures is significant, especially given the relative ease with which *any* binding settlement procedure could be amended to allow for a preliminary recommendation. As such, this research is also more general than existing work that focuses on specific binding procedures. If nonbinding recommendations can increase voluntary settlement rates—generally considered a measure of ADR success—this could help minimize the costly use of litigation, binding arbitration, and legislatures in determining settlements. To the extent that voluntary settlements are considered more efficient than mandated settlements (see Crawford, 1979), this would also improve the efficiency of bargaining outcomes in many contexts.

2. Theoretical Framework

The model is an extension of Farber and Katz (1979) that incorporates a fact finder and also utilizes a "sophisticated" arbitrator similar to that used by Farber (1981). We model a nonstrategic arbitrator in a framework that is is not specific to arbitration--any binding decision authority (e.g., courts, legislative bodies) could be modeled in the same way. Consider two bargainers B and S engaged in zero-sum bargaining over one dollar (or any fixed amount of

[5] A separate strand of experimental economics research is starting to identify the potentially important effects of "advice" on behavior and outcome efficiency (e.g., Schotter, 2003: Schotter and Sopher, 2007). These emerging studies of intergenerational games are innovative but quite distinct from our interests. The recommendations that we consider are not passed down from a previous generation of players, and our recommenders do not have a financial interest in the bargaining outcomes—in fact, we mechanize the implementation of recommendations as random draws from a settlement distribution. The recommendations we examine therefore come from a *disinterested* third-party, which is modeled after neutral ADR agents who have no authority to issue binding settlements.

money). For simplicity, we will often refer to bargainer B (S) as the buyer (seller). Bargainer utility depends on risk preferences, c, and the fraction of the "pie" received:

$$U_S = \frac{1-\exp(yc_s)}{1-\exp(c_s)} \qquad \text{and} \qquad U_B = \frac{1-\exp(zc_b)}{1-\exp(c_b)}$$

where y is the amount player S receives, and $z=1-y$ is the amount that player B receives. Utility increases in the fraction of the dollar received, with $U(0)=0$ and $U(1)=1$. Risk preferences are defined solely by $-c_i$ for $i=b,s$, the Arrow-Pratt measure of absolute risk aversion (see Farber and Katz, 1979). As such, player i is risk-averse (loving) when $c_i <$ (>) 0.

Bargaining impasse is ultimately settled by a binding decision-maker known here as the arbitrator. Bargainers are uncertain about the settlement preferences, D, of the arbitrator, and this uncertainty is modeled by assuming bargainers know the distribution function from which settlements are drawn. Let y_{iF} and σ_i^2, for $i=b,s$, be the bargainer's expectation of the mean and variance of the arbitrator's preference over the amount the *seller* receives. Experimental and field evidence suggests that bargainers are optimistic with respect to likely outcomes from arbitration[6], which implies that y_{bF} will be less than, and y_{sF} greater than the actual mean of the arbitrator's preferences. Farber and Katz (1979) examine the contract zone—the region of settlements both bargainers prefer over arbitration—assuming that the settlement is a random draw, D, from the distribution of the arbitrator's preferred settlements.

Now suppose that a recommendation, R, is given to bargainers prior to declaration of impasse. The recommendation is nonbinding, but bargainers are aware that the arbitrator's binding settlement includes a weight, $\gamma \in [0,1]$, placed on the recommendation. Dickinson and Hunnicutt (2005) show that a non-binding recommendation reduces the size of this contract zone both before and after the recommendation is given, under what we will call "naïve" arbitration, in which the arbitrator ignores (or does not know) the bargainers' final offers. This naïve framework seems unrealistic, as the arbitrator is assumed to know and consider one piece of information (the recommendation), but not others (the final positions).

In contrast, we consider a sophisticated arbitrator who weights both the recommendation and the midpoint of the bargainers' final offers, x_b for the buyer and x_s for the seller, in his settlement choice. Specifically, final settlement awarded to the seller is now

$$y_S = (1-\delta)\cdot\left(\frac{x_b + x_s}{2}\right) + \delta\cdot[\gamma R + (1-\gamma)D] \tag{1}$$

where $\delta = \frac{x_s - x_b}{\Psi}$, and Ψ is the size of the total bargaining range.[7] This δ captures the intuition of Farber (1981) in that the arbitrator places increasingly more weight on the bargainers' final offers the more they converge (as δ approaches zero, the weight on the final offers approaches one). Alternatively, the farther apart are the final offers—in this case δ approaches 1—the more the arbitrator ignores the final offers. The idea is that bargainers who are "close" to agreement ought to have a settlement that reflects their stated preferences (offers), while offers that diverge suggest that settlement is unlikely and final offers are less informative.[8]

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[6] See, for example, Babcock and Loewenstein (1997) and Dickinson (2006).

[7] In the experiments described below, we restrict the buyer to offering the smallest value of the bargaining range or more and the seller to offering the largest value of the bargaining range or less. While it is possible that an especially aggravated buyer might offer even less than the lowest value of the bargaining range as a signal of his or her displeasure, this sort of behavior will not be considered in theory nor in the experiments. We also rule out the possibility that δ is negative, since this means the seller would accept less than the buyer is willing to pay, which implies that an agreement will have been reached. Thus, δ is bounded between zero and one.

[8] It would be possible to consider bargainer strategy in choice of final offer (following Farber, 1981). Indeed, optimizing the award by choice of final offers yields optimal final offers of $x_s = \frac{\Psi}{2} + (\gamma R + (1-\gamma)D)$ and

This formulation allows us to consider cases where the recommendation exists but is completely ignored (γ=0), as well as cases where the arbitrator completely ignores her own preferences in deciding the final outcome (γ=1). We focus on the more interesting case of $\gamma < 1$. There is empirical evidence that recommendations, such as those given by formal fact-finders, can have widely varied effects (γ) on binding settlement procedure outcomes (see Karper, 1994). As long as some positive weight is placed on the recommendation (i.e., $0 < \gamma < 1$), uncertainty surrounding arbitration is reduced but not removed by the recommendation. If uncertainty encourages risk-averse bargainers to settle, then a recommendation may be counterproductive for voluntary settlement. Ashenfelter et al. (1992) and Babcock and Taylor (1996) report laboratory evidence confirming that, ceteris paribus, decreased outcome uncertainty increases dispute rates. On the other hand, because the recommendation reduces the size of the contract zone, it also gives the bargainers less over which to dispute, thereby reducing the number of potential equilibria. Further, the recommendation may (through updating of beliefs) lead to more accurate bargainer expectations and/or convergent final offers. Thus, the recommendation could improve settlement rates.

Finally, it is also possible to consider bargaining situations in which no recommendation exists. In this case, the arbitrator, having no recommendation to consider, would award the seller a weighted average of final offers and the arbitrator's own preferences, $y_S = (1-\delta)\cdot\left(\frac{x_b + x_s}{2}\right) + \delta \cdot D$. Notice that there is no standard theoretical difference between

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$x_b = -\frac{\Psi}{2} + (\gamma R + (1-\gamma)D)$. As in Farber (1980), this indicates that the average offer is the expected outcome from the arbitrator, who in this case is influenced by the suggestion.

situations in which the recommendation is ignored (γ=0) and those in which it fails to exist. This fact will enable us to test the focal nature of the recommendation, as its presence, even when completely ignored, may affect settlement rates through its influence on bargainer optimism.

The boundaries of the contract zone are defined by the certainty equivalent of each bargainer, or the minimum (maximum) amount that the seller (buyer) would be willing to accept (pay) to avoid the uncertainty of arbitration. Our theoretical framework assumes that the focal point effect comes mainly through its direct effect on bargainer beliefs, although bargainer final offers may also be affected by recommendations. We show in Appendix A that the size of the contract zone, Δ, of mutually acceptable outcomes is given by

$$\Delta = \delta \cdot (1-\gamma) \cdot (y_{bF} - y_{sF}) - \left[\frac{c_b \sigma_b^2 + c_s \sigma_s^2}{2} \right] \cdot (1-\gamma)^2 \cdot \delta^2 \tag{2}$$

This reduces to the Dickinson and Hunnicutt (2005) post-recommendation contract zone when δ=1 (the arbitrator ignores final offers), and to the Farber and Katz (1979) contract zone when both δ=1 and γ=0 (the arbitrator ignores – or is unaware of – the recommendation). The uncertainty effect of recommendations occurs through the second term in (2), where any recommendation given weight (γ>0) will reduce the size of the contract zone for risk averse bargainers, ceteris paribus.[9]

With optimistic expectations, $y_{bF} < y_{sF}$, and the first term in (2) is negative. Assuming that bargainers are on average risk averse, $-(c_b \sigma_b^2 + c_s \sigma_s^2) > 0$, the second term is positive.[10] It

[9] This is a formal statement of how recommendations can actually damage prospects for voluntary settlement, as has been suggested "….., in order to preserve the uncertainty surrounding the arbitration process and to encourage real bargaining, allowing the arbitrator to act as a mediator *and other mechanisms that provide flows of information* from the arbitrator to the parties will be counterproductive." Farber and Katz (1979), p. 63 (emphasis added).

[10] We consider joint risk aversion a reasonable assumption. This assumption is supported by data in Holt and Laury (2002), who find that experimental subjects responding to non-hypothetical lottery questions are typically risk

is therefore possible (given optimistic expectations) that the contract zone fails to exist even for risk averse bargainers, since optimism may outweigh risk aversion. In this case, the most the buyer is willing to pay is less than the least the seller would accept. In such instances, a settlement *after* the recommendation is attributable to the influence the recommendation has on bargainer optimism.[11]

3. Focal Point Effects of Recommendations

Dickinson and Hunnicutt (2005) show that the presence of the recommendation reduces bargainer uncertainty and therefore shrinks the contract zone. Following one branch of the literature, they further claim that a smaller contract zone will "chill" bargaining and thus make negotiated agreements less likely. However, their empirical results suggest that the recommendation has the opposite effect, in that it significantly increases the likelihood of negotiated settlement. They claim that this result is due to the focal nature of the recommendation, although their theoretical model does not formalize a focal point effect.

While not the main focus of our paper, it is interesting to consider what features of the recommendation, *R,* make it a focal point. According to Bacharach and Bernasconi (1997), an outcome is "salient" if it is unique, obvious to both parties, and commonly known.[12] Both in theory and in our experiments, the recommendation may be one of many focal points (the mid-

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averse, even over "normal" laboratory payoffs. The assumption of risk aversion also seems realistic in application to real-world negotiations. Though risk preferences were not measured here, Dickinson (2005), using the same general student subject pool, finds both Players B and S to be slightly risk averse. Many of these results would be reversed if bargainers are risk-loving, but the laboratory data do not support this hypothesis.

[11] The existing literature is not in complete agreement over the effect of uncertainty and contract zone size on dispute rates. While some argue that larger contract zones imply lower dispute rates (e.g., Crawford, 1982; Farber and Bazerman, 1987), others argue that larger contract zone imply that there is more over which to dispute, thereby increasing dispute rates (e.g., Tracy, 1986, 1987; Crampton, 1992). Our model allows for both possibilities, although, consistent with the results in Ashenfelter et al. (1992), we maintain the position that lower dispute rates should follow from larger contract zones, ceteris paribus.

point of the bargaining range is another candidate). Our key point is that the obvious and unique nature of the recommendation (both in theory and in the experiments) grants it special status (salience). While other focal points may be present in the bargaining experiments (although the experimental design is set to minimize their presence), our work tests whether the addition of the recommendation (a new and possibly different focal point) influences bargaining.

The focal point effect can be formalized by considering the influence of the recommendation on bargainer beliefs about the arbitrator's preferences. Several papers have demonstrated that bargainers tend to have optimistic or self-serving beliefs in bargaining situations, both in similar laboratory settings (Dickinson, 2005 and 2006) and in naturally occurring settings (see Babcock and Loewenstein, 1997). Within this model, optimism with respect to the arbitrator's preferences translates to $y_{bF} < \mu_D < y_{sF}$, where μ_D is the true mean of the arbitrator's settlement preferences. Given optimism, the buyer and seller have divergent beliefs as to what the arbitrator considers is a fair settlement, so that $y_{bF} - y_{sF} < 0$. This makes the contract zone smaller than it would be if bargainers had perfectly rational assumptions about the arbitrator.

When a recommendation is given weight in the final settlement (i.e., γ>0), our framework implies an enlarging of the contract zone for optimistic bargainers through the first term in (2). However, our proposed focal point mechanism assumes that bargainers update their beliefs about the arbitrator once they have received a recommendation—after all, bargainers are aware that the recommendation is drawn from the same distribution as the arbitrator's notion of a

[12] We do not further explore in this paper the mechanism by which recommendations may serve as focal points, although existing research has made progress in this area (see, for example, Janssen, 2001; Bacharach and Bernasconi, 1997; and Sugden, 1995).

fair settlement. In particular, let $y_{iF} = y_{iF}(R - E_i R)$, where $i=b,s$ and $R - E_i R$ is the distance between the actual recommendation, R, and what bargainer i expected the recommendation to be, E_iR. Further suppose that $y'_{iF} > 0$, and $y''_{iF} > 0$. If both parties are optimistic, then they expect the recommendation to be closer to their preferred position than it will actually be. That is, for the buyer $R - E_b R > 0$, while the opposite will be true for the seller. Thus, a recommendation that is close to the actual mean of the fact-finder/arbitrator distribution will help correct buyer and seller optimism, and pull y_{bF} and y_{sF} closer together, which *directly* ameliorates the negative effect of optimism on the contract zone. If the recommendation is focal, it therefore reduces optimism, and directly enlarges the contract zone. One may also assume that a recommendation serves as a simple psychological anchor. Our experimental design is set up to be able to discriminate between the hypotheses of anchoring versus belief updating, because we also include recommendations within a "no arbitration" environment, where there is no opportunity for belief revision. If recommendations still lower dispute rates, even when the impasse outcome is known with certainty, then such would be evidence for simple anchoring.

Recommendations may also have an *indirect* effect on the contract zone, through their influence on bargainer final offers and the sophisticated arbitrator. If final offers converge due to a recommendation, then this reinforces the dichotomy that our framework highlights. Convergent final offers reduce the size of the sophisticated arbitrator weight δ, which reduces the impact of bargainer optimism thereby enlarging the contract zone (the first term in equation 2 above) while also reducing the uncertainty effects of arbitration, thereby shrinking the contract zone (the second term in equation 2). The added complication of these indirect effects does not substantially add to our theoretical framework, though the data will show that final bargaining positions do appear to converge towards a recommendation. This serves to highlight the robustness of the model's predictions with respect to the focal point effect, as even with apparent indirect effects, settlement is generally more frequent with a recommendation.[13]

4. Experimental Environment

We generate data from a controlled laboratory bargaining environment to empirically examine the effects of focal points and outcome uncertainty. The experiment uses a computer interface to randomly and anonymously match subjects—disputant *B* (the buyer) and disputant *S* (the seller)—with the same anonymous counterpart for twenty 3-minute rounds, with subjects bargaining over the value of a variable, *x*.[14] Payoff information is private, but subjects are aware that counterpart earnings move opposite own-earnings (i.e., win-loss bargaining as assumed in Section 2). Thus, subjects are aware that their own gain is their counterpart's loss, and private payoff *level* information simulates the real world asymmetry that exists in assessing the value your bargaining counterpart places on the object of negotiations. Given this, our environment is one in which the exact size of the contract zone is uncertain.[15] The disputants bargain in each round over a $2.00 pie, which (unknown to the disputants) would be equally split at *x*=500. Dollar payoffs for disputant *B* are given by $P_B(x)=1.00+.005*(500-x)$. For disputant *S*, payoffs

[13] Suppose that a recommendation is "extreme" in the sense that it is above (below) the seller's (buyer's) prior belief y_F. In this case, recommendations will still cause beliefs to converge if we assume that the adjustment in beliefs is greatest for the party whose prior belief was farthest from the recommendation.

[14] The experimental environment is motivated by the design of Ashenfelter et al (1992), and is an extension of the bargaining-with-arbitration application used in Dickinson (2004).

[15] Additionally, subjects may not make offers outside of their bargaining range. Disputant *B* is instructed to bargain for *x* between 200 and 700, and disputant *S* for *x* between 300 and 800. The theoretical predictions are silent as to the effects of this detail, but it is meant to improve the validity of the data since real-world bargainers would likely not have full information on their counterpart's target range. Further, asymmetric ranges should help avoid the 50-50 split focal point (an issue mentioned in Ashenfelter et al., 1992, though they deal with it in a different way).

are given by $P_S(x)=1.00+.005*(x-500)$. This private payoff information is presented to the subjects by means of payoff tables.

The experiment does not allow communication other than the numeric messages transmitted through the subjects' computer terminals. The bargaining environment is relatively unstructured. Offers can be exchanged freely, and there is no requirement that offers must "improve" upon previous offers, or that there be counteroffers, or that there be any offer at all. The most recent offer of either disputant is displayed at the top of the offer queue, and either disputant can accept his/her counterpart's standing offer at any time.

Subjects proceed at their own pace through on-screen instructions that explain in detail all aspects of the experimental bargaining environment. Sample bargaining screens are displayed to the subjects in the general instructions to highlight important details (instructions available on request). Across all experiment groups we utilized eight different dispute resolution treatments: NA, NAsugg, CAnaive, CAsoph, CAsugg(0), CAsugg(.20), CAsugg(.50), and CAsugg(.80). The "sugg" treatments are those that implement a recommendation or "suggestion". The design is a combination of a within- and across-subjects design, because each group of subjects participates in four of the eight distinct treatments over the course of a 20-round experiment (5 rounds of each treatment).[16]

In the NA (No Arbitration) treatment subjects are allowed to bargain for the entire 3-minute round, and should they reach the end of the round without agreeing on the value of *x*, payoffs to both bargainers are zero. NAsugg is similar except that a nonbinding suggestion is

[16]Subjects were unaware that 5 rounds of each treatment would be completed, which helps control for strategic play across multiple rounds. Also the specific ordering of the treatments was varied for different bargaining pairs (although each treatment consisted of five consecutive rounds) - this was to control for potential ordering effects.

given halfway through the round (at 1.5 minutes). CAnaive and CAsoph are conventional arbitration (CA) treatments that do not provide a suggestion, but rather let subjects bargain for the entire 3 minutes prior to implementing a settlement. This settlement is a draw from a normal N(500,60) distribution of potential arbitrator settlements. Subjects receive prior information on the computer "decision-maker" by viewing a table of 100 previous draws from the distribution in the instructions (see Ashenfelter et al., 1992, for the use and justification of this form of mechanizing the arbitrator for experimental purposes), along with viewing the density function and being given information on central tendencies from the distribution. Though we do not generate direct data on bargainer expectations, we are confident that bargainers are still optimistic, even with such information. In related research, bargainers are statistically significantly optimistic when asked to report expectations on y_F in the same experimental bargaining-with-arbitration environment ($\bar{y}_{bF} = 484, \bar{y}_{sF} = 516$, reported in Dickinson (2004), and available on request).[17]

The CAnaive arbitrator implements a random draw from the arbitrator distribution as the binding settlement, whereas the CAsoph treatment weights the bargainers' final offers as per equation (1), though without a suggestion. The various CAsugg treatments implement settlements based on equation (1) (with $\gamma \geq 0$), and the number in parenthesis refers to the gamma-weighting of the suggestion. In these treatments, a suggestion was given halfway through each round (at 1.5 minutes). In all treatments with a suggestion, recommendations were draws from the same N(500,60) distribution as for the arbitrator, and subjects were given the

[17] Dickinson (2004), finds that additional information on the arbitrator distribution reduces optimism, but a significant amount remains nonetheless. Because this additional information *includes* the mean of the arbitrator distribution, which was originally intended to remove all optimism, one might hypothesize that subjects were

same information on the computer "suggestor" distribution as they were given for the computer arbitrator. The use of the exact same distribution for both the suggestion and arbitrator settlement preferences parallels the real world in the sense that arbitrators, mediators, and fact-finders often come from the same pool of neutral dispute resolution agents in the field. In all treatments subjects were allowed to submit final offers at impasse, and the binding settlement was only implemented if final offers were still in disagreement (i.e., $x_b < x_s$).

In utilizing an anonymous, no-communication experiment, we trade off some external validity (i.e., real world parallelism) for a higher level of internal control in our experiments. This approach is meant to address the main weakness of field data on negotiations and dispute settlement—the lack of comparability of data across dispute resolution conditions. While the external validity of laboratory bargaining data may be a concern, there is precedence in the literature supporting the usefulness of experiments when subjects are economically motivated, as ours are (see Bolton and Katok, 1998; Roth et al., 1988). Finally, we must address certain data issues given that our subjects are matched as bargaining counterparts for the entire 20-round experiment. As a result, the econometric analysis of the data controls for potentially interdependent error terms for a given subject-pair across rounds, and it also controls for the bargaining history of the subject-pair to address the concern of subject-learning.

5. Results

We report results from 77 bargaining pairs, each completing a 20-round experiment. Subjects earned, on average, \$20 for participation in the 90-minute experiment. Summary data on dispute rates and arbitrated settlement (for the subset of disputed rounds within a treatment)

provided too much information to process (or they did not understand the statistical information provided). In such cases it is reasonable to think that subjects form beliefs that display typical self-serving biases.

are shown in Table 1. Relative to destroying the pie (NA), dispute rates rise with arbitration of any sort, which is not surprising given our use of zero monetary cost arbitration—our focus is on uncertainty costs of arbitration as highlighted in Stevens (1966). Relative to the naïve arbitrator, the sophisticated arbitrator treatment increases dispute rates, which is what we predict for risk averse bargainers given that outcome uncertainty is reduced when final offers are known to influence binding settlement outcomes. A key result of this paper is that dispute rates fall when nonbinding recommendations precede arbitration. The difference in dispute rates from *CA soph* to *CA sugg*(0) measures the pure treatment effect of adding recommendations, since the arbitrator's decision, given by equation (1), is the same in either case, with the only difference being the recommendation (which the arbitrator ignores in *CA sugg*(0)). We find no such effect when adding suggestions to *NA*, consistent with the hypothesis that recommendations help improve bargainer expectations of likely settlement outcomes, rather than serving as simple anchors. In short, the recommendations appear to be effective in that they help bargainers update their beliefs about the arbitrator's decision, rather than simply serving as anchors around which bargainers craft a settlement.

Of course, Table 1 does not control for potential confounds in the aggregate data. The controlled econometric results are summarized in Tables 2 and 3, which analyze the determinants of dispute rates, final bargaining positions, and settlement outcomes. Though the computer application did not allow submission of offers outside one's suggested bargaining range, it did allow a bargainer to agree to an offer outside of the bargaining range. As such, a small number of observations are omitted from this analysis (40 out of 1540), leaving us with 1500 total rounds of bargaining data.

5.1 Dispute Rates

Dispute rates are often considered the most important factor in evaluating the effectiveness of an ADR procedure. Table 2 shows the results from a binomial probit model of dispute rates. Here, we code Dispute=1 when the bargaining pair utilizes the dispute resolution mechanism in a given round. If the pair agrees before the end of the round, or their final offers converge (such that $x_b \geq x_s$), it is coded as a voluntary settlement (i.e., Dispute=0). The model estimates treatment effects of the various dispute resolution procedures, as well as the effects of two bargaining experience variables, *Round* and *Dispute History*. The variable *Round* takes on values between one and twenty, and measures the effect of the bargaining round, to control for learning or experience within the experiment. *Dispute History*, which ranges from one to nineteen, is the cumulative *previous* number of disputes in which the pair has engaged, and accounts for pair-specific bargaining history. We report the estimated marginal effects in Table 2, and the covariance matrix is adjusted for data clustering by bargaining pair. The clustering correction, along with the variables *Round* and *Dispute History*, help control for the likely effects of our fixed-pairs experiment design. The model correctly predicts 77% of the dispute outcomes.

In reviewing the treatment variable marginal effects it is clear that the use of arbitration significantly increases the likelihood of dispute relative to the NA treatments (the omitted treatment variable category is NA). This is not surprising giving that arbitration reduces the direct monetary cost of dispute to zero. Because our focus is not on monetary costs of dispute settlement procedures, we chose to implement zero-cost dispute settlement procedures in the lab.[18] It is the difference across CA treatments that are of primary interest in this paper.

[18] Others have already shown disputes to be inversely related to the monetary costs of an arbitration procedure (Ashenfelter et al., 1992), and so a fixed cost of arbitration would only parametrically shift the level of disputes. We chose to simplify our design by omitting such direct monetary costs of arbitration/recommendations throughout.

Relative to the naïve arbitrator treatment (*CAnaive*), *CAsoph* increases the likelihood of dispute by a statistically insignificant amount (Wald test of the two coefficients, p=.47). In comparing the suggestion treatments, the pattern of the estimated marginal effects indicates a peak in the marginal increase in dispute rate probability at *CAsugg*(.50). The coefficient on *CAsugg*(.50) is significantly larger than the coefficient on CAsugg(0) (p=.06 for the Wald test) and the coefficient on *CAsugg*(.80) (p=.01).

In comparing arbitration with a recommendation versus without, recall that *CAsugg*(0) is identical to *CAsoph*, except that *CAsugg*(0) includes a zero-weighted mid-round suggestion. Because the recommendation is *completely* ignored in *CAsugg*(0), it has no effect on the size of the contract zone through the parameter γ.[19] This elimination of the influence of uncertainty and makes the comparison of *CAsoph* and *CAsugg*(0) a relatively pure test of the effectiveness of suggestions. The marginal effect on *CAsoph* is significantly larger than the marginal effect on *CAsugg(0)* (Wald test, p=.06). Thus, the parties are significantly more likely to dispute without a recommendation (when compared to NA – the baseline treatment) than they are when they receive a recommendation that the arbitrator subsequently ignores. The mechanism we give in theory is that suggestions help correct the optimism of the average subject (i.e., belief revision). This hypothesis is supported more specifically by the result that suggestions do *not* significantly decrease the likelihood of dispute in NA*sugg* relative to NA. Impasse outcomes are known with certainty in *NA* treatments, and there is no opportunity to revise beliefs about the likely impasse outcome in NA*sugg*. Anchoring would still predict lower dispute rates in NA*sugg* than in NA,

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The result is an increase in disputes with arbitration that certainly overstates what one would predict in a naturally occurring setting.

[19] In fact, if the suggestion is focal and influences bargainer expectations, then this actually expands the theoretical contract zone.

because final offers would move towards the anchor, but our results do not show this. In sum, both the aggregate data averages and the controlled econometric analysis support the conclusion that suggestions made prior to a binding settlement procedure significantly increase settlement rates.

Our results also indicate that when suggestions are used, settlement rates are highest when the suggestion is either weighted little or much. There is no significant difference in the coefficients on *CAsugg*(0) and *CAsugg*(.80) (Wald test p=.27), but the significantly larger marginal effect on *CAsugg*(.50) indicates that subjects are more likely to dispute in this treatment compared to other *CAsugg* treatments. We cannot explain this result within our existing theoretical framework. We might only hypothesize that *prior* to the recommendation, the dispute outcome is least uncertain when an equally-weighted suggestion and arbitration preference are anticipated—a sort-of diversified portfolio argument of lowering dispute risk. This may tend to discourage early settlements for risk-averse bargainers, such that dispute rates might increase in *CAsugg*(.50) in spite of the beneficial effects of the recommendation once it is issued. Not only are dispute rates highest in *CAsugg*(.50) (Table 1), but additional results on settlement timing (available on request) show the cumulative settlement frequency early in a bargaining round is *lowest* in *CAsugg*(.50) when compared to other *CAsugg* treatments. This is roughly consistent with the notion that risk-averse bargainers want to avoid risk and choose to settle more quickly when a recommendation is to be weighted on one extreme or another.

Finally, the Table 2 results also identify bargaining experience effects in *Round* and *Dispute History*. Disputes are less likely the higher the round number, but more likely with each previous round of dispute history for the pair. This result highlights the distinct effects of good versus bad history on dispute rates, and is consistent with prior research (Dickinson, 2004).

5.2 Bargaining positions and Settlement Values

The first two columns of Table 3 show the results of a model of buyer and seller final bargaining positions. Final offers generated at impasse are a measure of theoretical final offers, but our experimental bargaining program does not collect "final offer" data when agreement occurs prior to the end of the round. For this reason, we code the final bargaining position to equal the final offer, when given at the end of the round, or the agreement x-value in the event that the subjects do not reach the end of the round due to settlement.

Our theoretical model yields testable predictions in terms of the effects of a recommendation on final bargaining positions and settlement x-values. We therefore estimate three models in Table 3: Buyer and Seller final bargaining positions, and agreement x-value. For the model of agreement x-values, we restrict our attention to the subset of rounds in which a voluntary settlement occurred (N=1038), and we correct for sample selection for that model using the two-stage Heckit procedure with the first-stage probit regressors of Table 2.

The independent variables in Table 3 are mostly similar to those in Table 2. One important distinction is in the use of variables to identify the impact of the specific suggestion on final bargaining positions. *Past Mid-round* is a dummy variable that equals one when bargainers make it past the mid-point (90 seconds) in a round. *Suggestion Value* measures the effect of the specific suggestion on bargaining positions and settlement values, with a squared term included to allow for nonlinear effects. The variable is interacted with the NA treatment to again assess the effects of suggestions on bargaining with arbitration versus without.

Another main result of this paper is that final bargaining positions and settlement (agreement) x-values are all positively related to suggestions. The pattern of coefficient estimates indicate a relationship shown in Figure 1—for the range of suggestions in our experiments, the data lie on the upward sloping portion of the estimated quadratic relationship. This result is consistent with our modeling of focal suggestions. If suggestions are focal and, through expectations, alter the location of the contract zone, then one would predict that agreement x-values would be positively related to suggestions. This is precisely what we estimate in Table 3, when considering both the linear and squared terms on *Suggestion value* for the relevant range of suggestions (i.e., 200<R<800). Of course, this result is also consistent with an anchoring hypothesis of suggestions, but the interactive terms indicate behavior consistent with anchoring only among the buyers. That is, buyers' final bargaining positions are influenced by suggestions no differently in *NA* treatments than in CAsugg treatments.

In the buyer and seller equations in Table 3, there is some evidence that final bargaining positions are more highly divergent in *CAnaive* and *CAsoph* compared to when suggestions are used in *CAsugg* treatments, due mainly to the buyer (Player *B*).[20] One can further evaluate this result by examining the variance of arbitrated outcomes in the *CAsugg* treatments, which should be consequently lower. The Table 3 results should then imply a larger variance of arbitration settlements when there is no suggestion. Table 1 shows arbitration settlement variance for each arbitration treatment. Except for *CAsugg*(.50), the arbitration settlement variance is larger in *NAnaive* and *NAsoph* compared to the CAsugg treatments. As noted before with dispute rates, it appears to be somewhat counterproductive to equally weight the recommendation and the arbitrator settlement preference. Not only are dispute rates higher in *CAsugg*(.50), but the variance of the arbitrated settlements is higher as well.

[20] Given that we use data from all voluntary settlement rounds *and* disputed rounds, our coding of final bargaining positions in the voluntary settlement rounds necessarily implies convergent final bargaining positions. This may seem to bias our Table 3 results towards convergent final positions in CAsugg treatments due to their higher settlement rates. The results are, however, unchanged if one considers only the subsample of data where the outcome is dispute.

This is an important secondary result, because a smaller variance of arbitrated settlements may be important for the procedure to be considered acceptable (see Farber, 1980). In sum, with a sophisticated arbitrator, not only do recommendations lower dispute rates (Table 2), but in most cases they also reduce the variance of arbitration settlements by drawing offers together (Tables 1 and 3). Finally, the estimated coefficients on *Round* and *Dispute History* are consistent with the Table 2 results. They indicate that round experience brings bargainers together, while dispute history does the opposite. In fact, one round of bad history (i.e., dispute) offsets the positive effects of over two rounds of general bargaining experience as measured by *Round.*

The *Agreement x-value* model in Table 3 indicates that certain ADR treatments significantly increase settlement values, and that the general positive influence of suggestions does not apply in *NA* treatments. The pattern of coefficients in the Agreement x-value tests is consistent with the hypothesis that the average buyer is more risk-averse than the average seller in our data. Incidentally, our subjects responded to a hypothetical lottery question meant to elicit risk preferences prior to our experiments. We do not consider their responses an accurate enough measure of risk preferences to include the variable in our formal analysis—subjects exhibited some confusion over the presentation of the lottery question—but average responses do indicate a slightly more risk-averse buyer than seller, on average.[21] Buyers should then give away more to sellers in negotiated settlements when the ADR procedure is considered riskier, which may be the case with extreme weighted suggestions in the CAsugg treatments. The predicted settlement values shown in Figure 1 are closer to predicted seller final bargaining positions than buyer final bargaining positions, which is also consistent with buyers being more

[21] Dickinson (in press) implements the less-confusing Holt and Laury (2002) lottery choice task in the same bargaining-with-arbitration environment and he also finds that buyers are slightly more risk averse than sellers.

risk averse than sellers. In short, the results from the Agreement x-value model in Table 3 are suggestive of bargaining power differences in our data, but a more detailed analysis can only be conducted with an experimental design that generates better measures of risk preferences.

6. Conclusion

Dispute resolution procedures are intended to improve voluntary settlement rates, and nonbinding procedures generally boast high settlement rates. However, it is unclear from field data whether nonbinding procedures generate higher settlement rates for comparable disputes because *binding* procedures are often reserved for the most difficult disputes. A hybrid procedure could include a nonbinding procedure followed by a binding procedure if needed, and this paper has examined the effectiveness of implementing a nonbinding suggestion prior to binding dispute settlement. Such a procedure reflects important characteristics of real world dispute resolution, such as the use of a nonbinding recommendation prior to an arbitrated labor contract settlement, the use of parental input prior to resolving a sibling dispute, or the use of court-annexed mediation prior to a legal dispute proceeding to trial.

Theoretically, we analyze a model of sophisticated arbitrator decision-making that identifies the effects of recommendations on the bargaining contract zone. Our experiments are design to discriminate between competing hypotheses regarding the general effects of suggestions. Our results are consistent with the hypothesis that nonbinding suggestions improve bargaining outcomes, and the mechanism by which a recommendation may increase the bargainers' contract zone is through reducing optimism following a recommendation. A second mechanism supported by our results is that recommendations influence final offers and reduce the variance in arbitrated settlements, further improving bargaining outcomes. Dispute rates are significantly lower when a recommendation stage is included prior to arbitration, even when the recommendation is given no weight in the final arbitrated settlement. The most effective procedures at reducing dispute rates are those that weight recommendations by a lot or a little in determining final binding outcomes, perhaps because equally-weighted recommendation and arbitrator preferences seems less risky, ex ante, and discourages early settlements.

We empirically examine the effects of recommendations on other bargaining outcomes as well, and find that final bargaining positions and voluntary settlement values are positively related to recommendations. Because recommendations generally cause final bargaining positions to converge, relative to similar procedures with no suggestion, bargainers also retain more control over the outcome of an *arbitrated* settlement under our theoretical framework, and in our empirical results. This is likely an important additional consideration in improving the acceptability of binding settlement outcomes, because procedures that generate highly variable arbitrated outcomes are not likely to be considered acceptable by disputants (Farber, 1980).

The implications of this research are significant given the large sums of dollars in dispute in a variety of industries. Improved dispute resolution procedures can more efficiently allocate these amounts by increasing settlement rates, because voluntary settlements imply self-determined outcomes by the bargainers. There are also many informal settings in which nonbinding suggestions prior to mandated outcomes can lower dispute rates. Long-term relationships are likely to be healthier when dispute rates are low among bargainers who repeatedly interact. This research highlights the benefits that recommendations can have on improving bargaining outcomes, and these recommendations can be a simple and relatively inexpensive addition to any binding dispute resolution procedures.

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Table 1
Mean and variance of arbitrated outcomes by treatment

	Average Dispute Rate	Mean of arbitrated settlements	Variance of arbitrated settlements
NA Naïve (N=390)	0.11	---	---
NA Suggestion (N=180)	0.11	---	---
CA Naïve (N=100)	0.40	504.41	3264.21
CA Sophisticated (N=100)	0.50	498.68	2746.59
CA sugg(0) (N=284)	0.36	494.93	2465.79
CA sugg(20) (N=100)	0.42	500.95	1627.72
CA sugg(50) (N=184)	0.43	481.53	3546.93
CA sugg(80) (N=100)	0.37	495.88	1577.88

TABLE 2
Probit Model of Dispute Rates (MLE estimates)
Dependent Variable=*Dispute*
(marginal effects reported, calculated at the means of the X variables)

Independent Variable	**Marginal Effect (p-value)**
Constant	-.351 (.00)***
NAsugg	.06 (.37)
CAnaive	.46 (.00)***
CAsoph	.50 (.00)***
CAsugg(0)	.41 (.00)***
CAsugg(.20)	.42 (.00)***
CAsugg(.50)	.50 (.00)***
CAsugg(.80)	.35 (.00)***
Round	-.03 (.00)***
Dispute History	.07 (.00)***
N=1500	Model correctly predicts 1160/1500 (77%) of outcomes

*, **, *** indicates significance at the .10, .05, or .01 level, respectively, for the two-tailed test.
The covariance matrix is adjusted for data clustering by bargaining pair.

TABLE 3: Bargaining position and Agreement Value Models (OLS Estimates)

Variable	Dependent Variable= **Buyer Final Bargaining Position** p-value in parenthesis	Dependent Variable= **Seller Final Bargaining Position** p-value in parenthesis	Dependent Variable= **Agreement x-value** p-value in parenthesis (corrected for sample selection)
Constant	459.32 (.00)***	422.31 (.00)***	455.39 (.00)***
Past Mid-round	-29.85 (.00)***	37.30 (.00)***	4.88 (.43)
Suggestion	-0.195 (.07)*	-0.13 (.13)	-0.20 (.04)**
Suggestion^2	0.00039 (.06)*	0.00036 (.02)**	.00047 (.01)***
Suggestion*NAsugg	0.150 (.20)	0.09 (.29)	0.17 (.09)*
Suggestion^2*NAsugg	-0.0001 (.64)	-0.00034 (.05)**	-0.00035 (.07)*
NAsugg	-4.31 (.87)	47.92 (.01)***	7.67 (.07)*
CAnaive	-56.82 (.00)***	51.11 (.00)***	.19 (.22)
CAsoph	-46.67 (.00)***	63.92 (.00)***	51.39 (.01)***
CAsugg(0)	10.16 (.71)	56.67 (.01)***	56.93 (.00)***
CAsugg(.20)	9.42 (.77)	51.20 (.00)***	47.81 (.02)**
CAsugg(.50)	35.96 (.19)	46.50 (.01)***	39.13 (.09)*
CAsugg(.80)	16.98 (.58)	60.97 (.00)***	56.15 (.00)***
Round	2.78 (.00)***	-1.71 (.00)***	-1.42 (.27)
Dispute History	-6.54 (.01)***	8.86 (.00)***	6.56 (.02)**
Lambda	---	---	-55.01 (.08)*
	N=1500 Adjusted R^2=.12	*N=1500* Adjusted R^2=.19	*N=1038* Adjusted R^2=.05

*, **, *** indicates significance at the .10, .05, or .01 level, respectively, for the two-tailed test.

The covariance matrices for the buyer and seller model are adjusting for data clustering by individual. In the Agreement x-value model, a clustering adjustment is made on the first-stage probit selection equation.

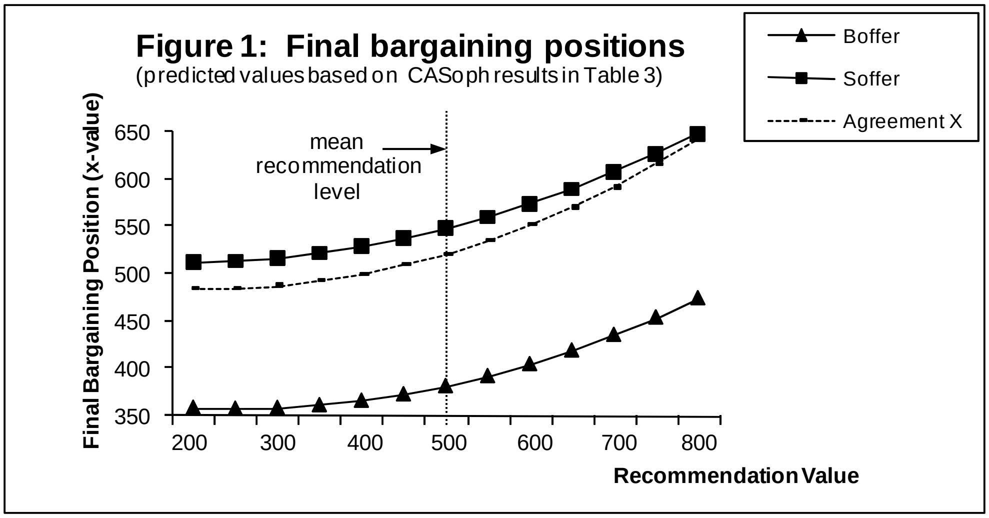


Figure 1: Final bargaining positions
(predicted values based on CASoph results in Table 3)
Boffer
Soffer
Agreement X
mean recommendation level
Final Bargaining Position (x-value)
650
600
550
500
450
400
350
200
300
400
500
600
700
800
Recommendation Value

APPENDIX A

To derive the size of the contract zone Δ, we must first calculate each player's certainty equivalent (the amount they would be willing to accept to avoid bargaining). For Player S (the seller), this is calculated as follows:

Assume that final offers are not affected by the recommendation. After bargaining, the seller expects to receive

$$y_s = (1-\delta)\left(\frac{x_b + x_s}{2}\right) + \delta\left[\gamma R + (1-\gamma) y_{sF}\right] \tag{1a}$$

where y_{sF} reflects the seller's beliefs about the arbitrator, and δ, x_b and x_s are as defined in the text. Since the arbitrator's preferences are normally distributed, the seller's beliefs are also normally distributed, with the mean as given in (1), and variance given by $\delta^2 (1-\gamma)^2 \sigma_s^2$ (σ_s^2 represents the seller's uncertainty about the arbitrator).

To calculate the seller's certainty equivalent, we must find the seller's certainty equivalent, y_{sC}, which is the portion of the pie that gives player S the same utility as she expects to get from the bargaining/arbitration process. That is, we must solve the following equation

$$U_s(y_{sC}) = EU_s$$

where

$$\begin{aligned} EU_s &= \int_{-\infty}^{+\infty} \frac{1-\exp(yc_s)}{1-\exp(c_s)} f(y)dy \\ &= \frac{1}{1-\exp(c_s)} - \frac{1}{1-\exp(c_s)} \int_{-\infty}^{+\infty} \exp(yc_s) f(y)dy \end{aligned}$$

Recall that the moment generating function for a random variable *x* is given by $M(t) = \int_{-\infty}^{+\infty} \exp(tx) f(x)dx$. Letting *y*=*x* and c_s=*t*, we see that we can rewrite expected utility as

$$EU_s = \frac{1-M(c_s)}{1-\exp(c_s)}$$

Finally, for a normally distributed random variable *x*, $M(t) = \exp\left(\mu_x t + \sigma_x^2 t^2 / 2\right)$. Thus, deriving player S's certainty equivalent comes down to solving the equation

$$\exp(c_s y_{sC}) = \exp\left(c_s \left\{ (1-\delta)\left(\frac{x_b + x_s}{2}\right) + \delta[\gamma R + (1-\gamma) y_{sF}] \right\} + \frac{c_s^2 \sigma_s^2 \delta^2 (1-\gamma)^2}{2} \right)$$

It is straightforward to show that

$$y_{sC} = (1-\delta)\left(\frac{x_b + x_s}{2}\right) + \delta\left[\gamma R + (1-\gamma) y_{sF}\right] + \frac{c_s \sigma_s^2}{2} \delta^2 (1-\gamma)^2 \quad (2a)$$

The same steps may be followed for the buyer, and we find that her certainty equivalent, y_{bC}, is given by

$$y_{bC} = (1-\delta)\left(\frac{x_b + x_s}{2}\right) + \delta\left[\gamma R + (1-\gamma) y_{bF}\right] - \frac{c_b \sigma_b^2}{2} \delta^2 (1-\gamma)^2 \quad (3a)$$

Finally, the contract zone is defined as the difference between the most the buyer would pay to avoid arbitration and the least the seller would accept to avoid arbitration. This turns out to be

$$\begin{aligned} \Delta &= y_{bC} - y_{sC} \\ &= \delta(1-\gamma)(y_{bF} - y_{sF}) - \frac{c_b \sigma_b^2 + c_s \sigma_s^2}{2} \delta^2 (1-\gamma)^2 \end{aligned} \quad (4a)$$

as noted in equation (2) the text.

APPENDIX B: Experimental Instructions (NOT MEANT FOR PUBLICATION)

Note: Screen-shots (cut and pasted) of the subjects' on-screen instructions are shown below for the General Instructions for player A (the buyer)—Player B instructions differ by replacing Player A with "Player B", and Player B is instructed to bargain within the possible X-value range of 300 to 800, with higher earnings for larger values of X. Treatment-specific additional instructions—which always followed general instructions at beginning of experiment—are shown for, CAsoph and CAsugg(.20). Appropriate alterations in instructions occur for describing remaining treatments to subjects.

****

GENERAL INSTRUCTIONS—PLAYER A

[page change of on-screen computer instructions noted below]

General Instructions

This is an experiment in decision-making. Please read the following instructions carefully. The amount of money that you earn in this experiment will depend, in part, on your decisions as well as the decisions of the person with whom you will be randomly matched.

You have been randomly assigned as a Player A in this experiment. You and a randomly chosen counterpart will be given a fixed amount of time in a decision-making round to mutually agree upon the size of a variable, X. Your range of possible X values lies from 200 to 700 in increments of one (this may not be the same range as that for your counterpart). The value of X at the end of the round will determine your cash earnings for that round. As a Player A, your cash earnings for any given round are largest for smaller values of X. Similarly, your cash earnings for any given round are smallest for larger values of X. You will be given a payoff sheet that translates the different values of X into earnings in cents. (Player B earns more for larger values of x.) Please study this payoff sheet carefully so that you fully understand how your earnings will vary given the different possible values of X.

If you and your counterpart can mutually agree upon the size of X for that round, then you can look to your payoff sheet to determine how much you will receive for that round. In a few moments we will discuss what will happen should you and your counterpart not be able to come to an agreement by the end of the allotted time.

Your interaction with your counterpart will only be through the computer terminal. You will never know the identity of your counterpart and your counterpart will never know your identity. You are matched with the same counterpart for the entire experiment.

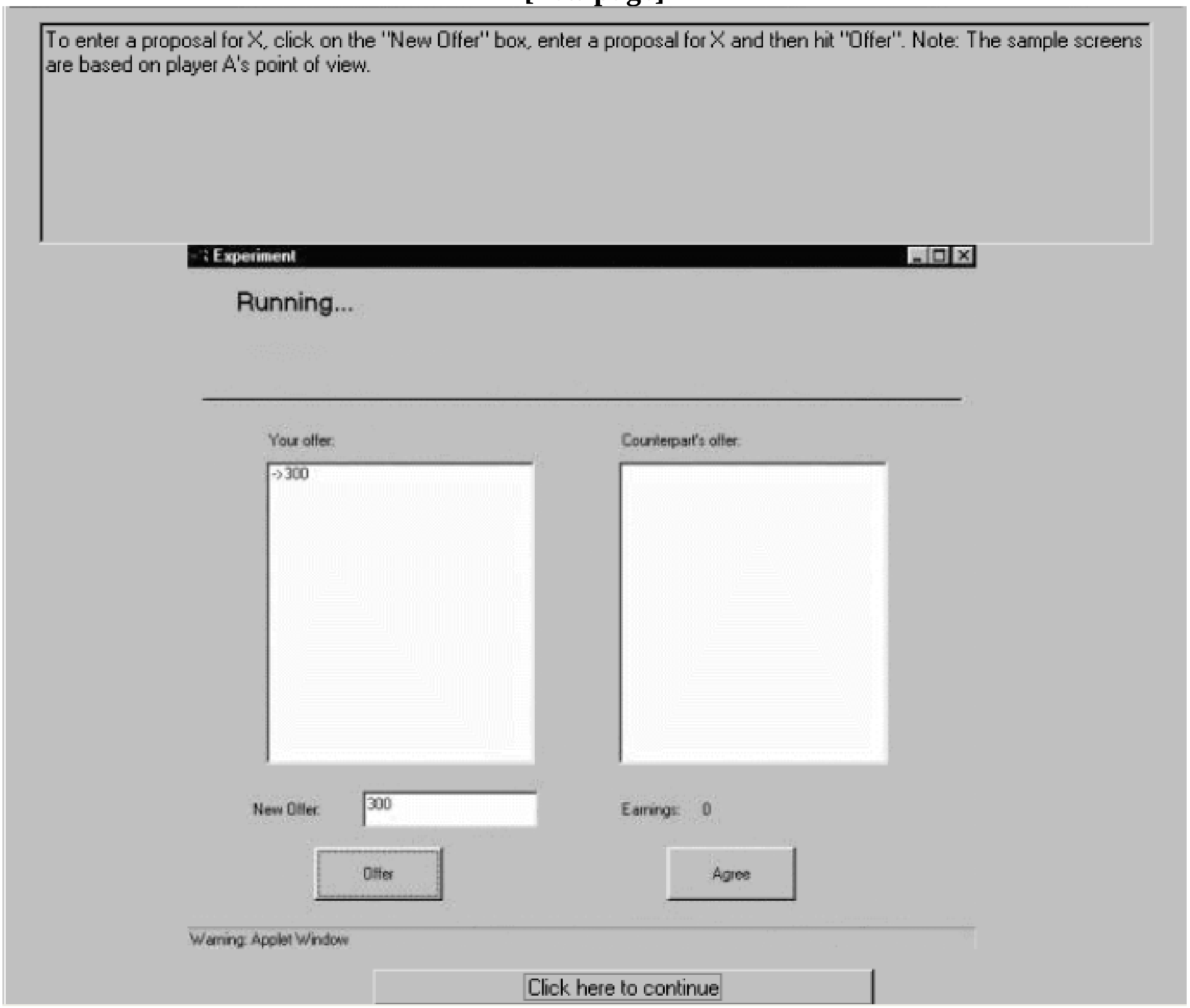
The next screen will show you the environment in which you will interact with your counterpart. If at any point during the instructions you have a question, please raise your hand so the experimenter can help you.

[new page]

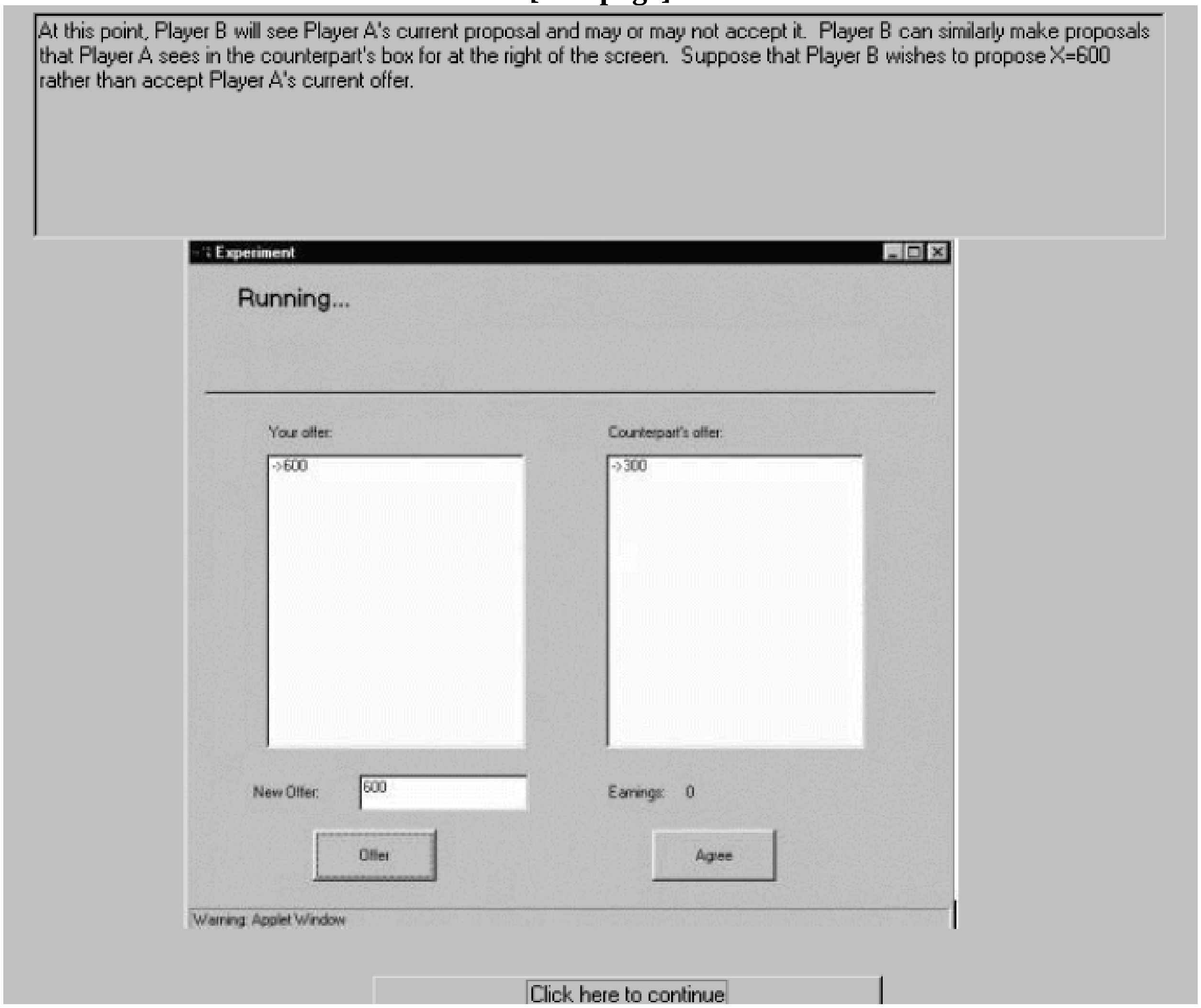
General Instructions

In your interactions with your counterpart, you will submit your proposal for the size of X on this screen

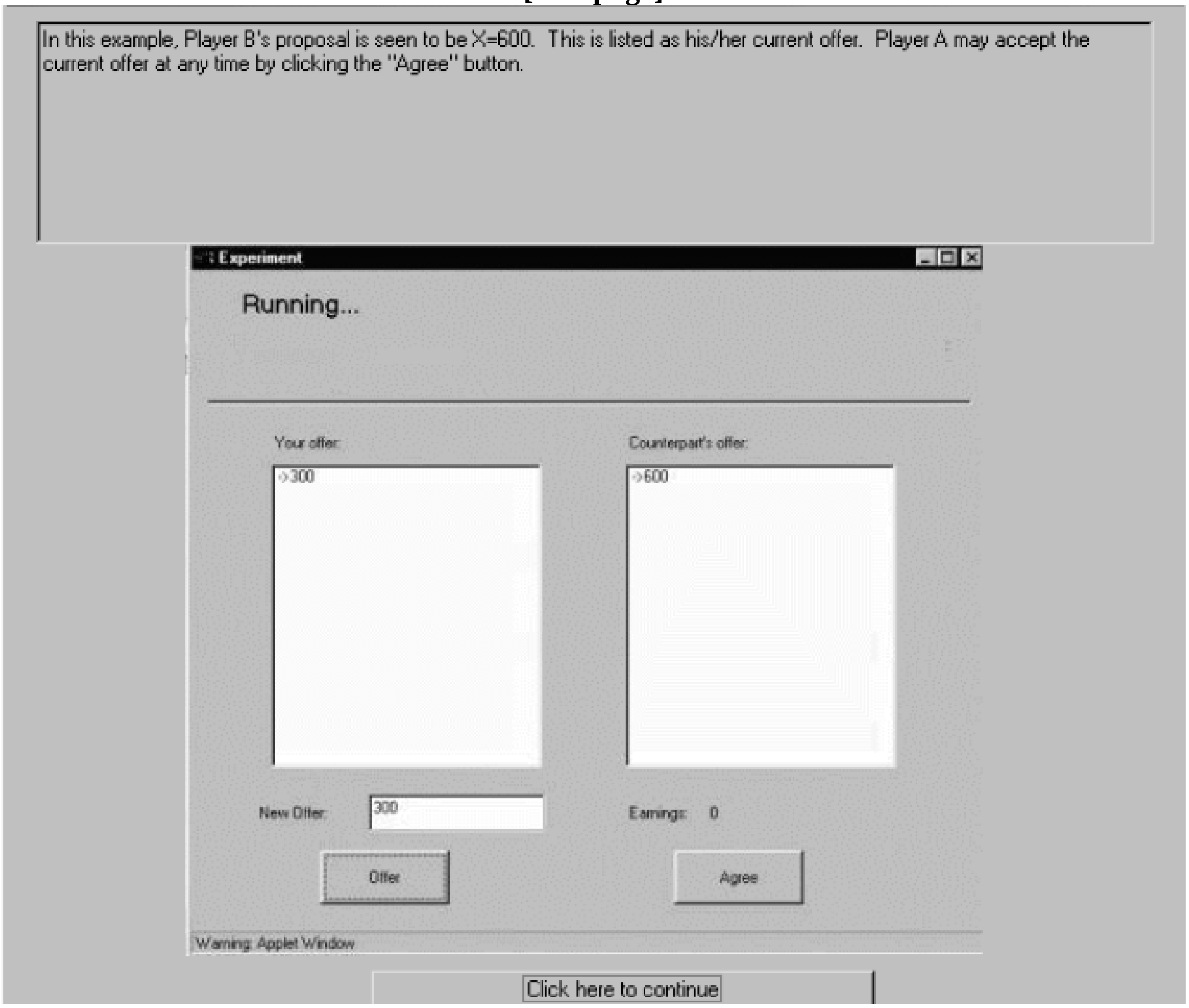
[new page]


To enter a proposal for X, click on the "New Offer" box, enter a proposal for X and then hit "Offer". Note: The sample screens are based on player A's point of view.
Experiment
Running...
Your offer:
->300
Counterpart's offer:
New Offer:
300
Earnings: 0
Offer
Agree
Warning: Applet Window
Click here to continue

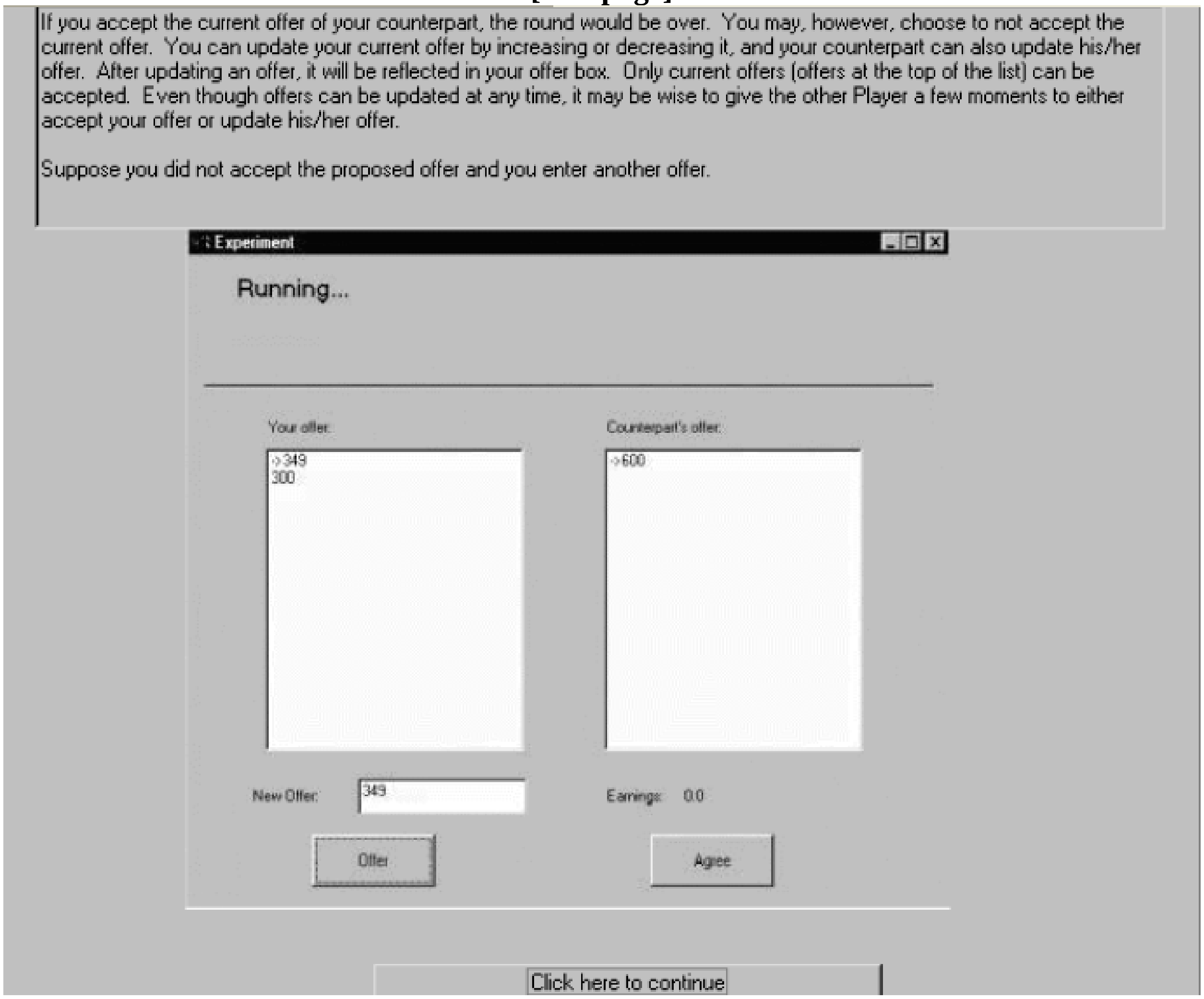
[new page]


At this point, Player B will see Player A's current proposal and may or may not accept it. Player B can similarly make proposals that Player A sees in the counterpart's box for at the right of the screen. Suppose that Player B wishes to propose X=600 rather than accept Player A's current offer.
Experiment
Running...
Your offer:
->600
Counterpart's offer:
->300
New Offer:
600
Earnings: 0
Offer
Agree
Warning: Applet Window
Click here to continue

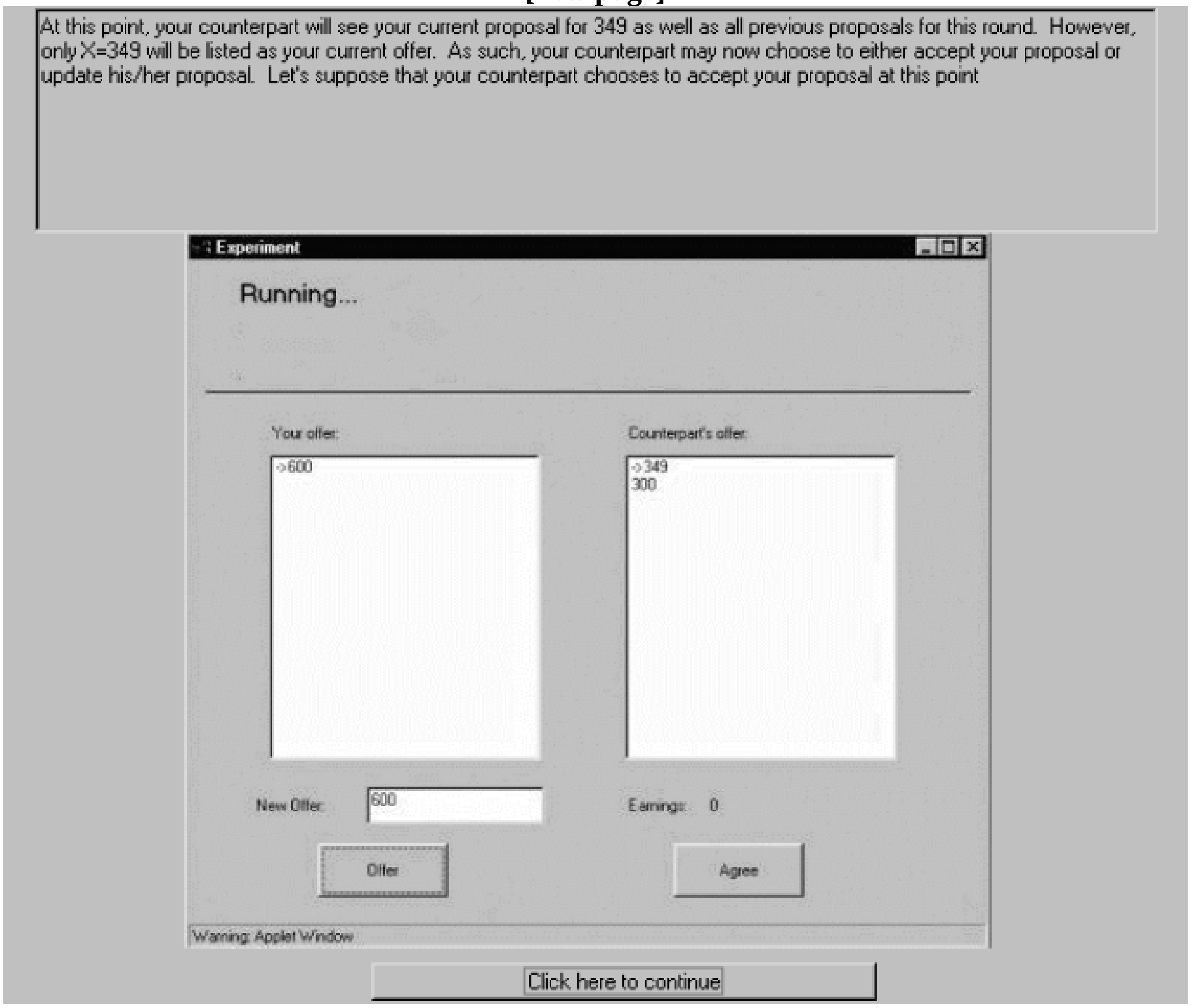
[new page]


In this example, Player B's proposal is seen to be X=600. This is listed as his/her current offer. Player A may accept the current offer at any time by clicking the "Agree" button.
Experiment
Running...
Your offer:
->300
Counterpart's offer:
->600
New Offer:
300
Earnings: 0
Offer
Agree
Warning: Applet Window
Click here to continue

[new page]


If you accept the current offer of your counterpart, the round would be over. You may, however, choose to not accept the current offer. You can update your current offer by increasing or decreasing it, and your counterpart can also update his/her offer. After updating an offer, it will be reflected in your offer box. Only current offers (offers at the top of the list) can be accepted. Even though offers can be updated at any time, it may be wise to give the other Player a few moments to either accept your offer or update his/her offer.
Suppose you did not accept the proposed offer and you enter another offer.
Experiment
Running...
Your offer:
->349
300
Counterpart's offer:
->600
New Offer:
349
Earnings:
0.0
Offer
Agree
Click here to continue

[new page]


At this point, your counterpart will see your current proposal for 349 as well as all previous proposals for this round. However, only X=349 will be listed as your current offer. As such, your counterpart may now choose to either accept your proposal or update his/her proposal. Let's suppose that your counterpart chooses to accept your proposal at this point
Experiment
Running...
Your offer:
->600
Counterpart's offer:
->349
300
New Offer:
600
Earnings: 0
Offer
Agree
Warning: Applet Window
Click here to continue

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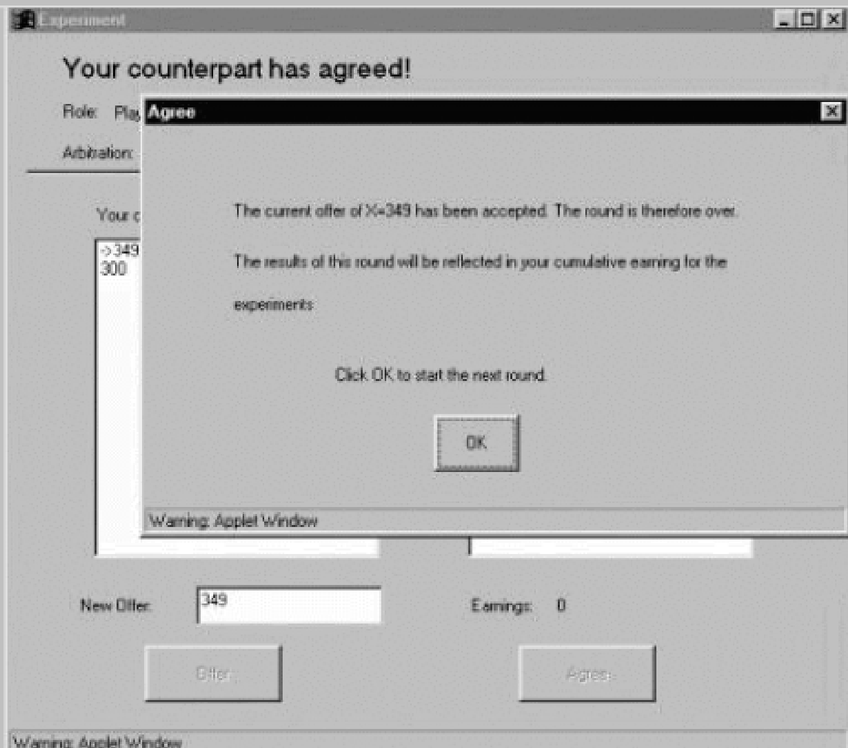
Your counterpart has accepted your offer, and so X=349 for that round. Once the round is over, either another round of similar interactions will occur, or instructions will follow to indicate the differences in the subsequent round(s). You will be asked to indicate when you are ready to continue with the experiment.



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The computer will keep track of your cumulative experimental earnings and post them on your main computer screen. You will also have a timer on the screen to let you know how much time is left in a particular round. Please take a moment to locate these information items on your screen once bargaining begins.

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The next several screens will inform you as to what will happen should you not come to an agreement within the time limit.

Treatment Specific Instructions for CAsoph

For the next several rounds, there will be particular procedure used to deal with the possibility that you and your counterpart may not reach an agreement by the end of the round.

Should you reach the end of the round without having mutually agreed upon a value of X, you will then be prompted for a final offer. If you and your counterpart's final offers come to agreement, then that is the value of X for the round (if they overlap, then X will be the average of the final offers for that round). If there is still no agreement, then the computer will generate a value of X for you.Specifically, the value of X for that round will be determined based on a combination of how close your final offers are and an X value drawn by the computer. The closer your final offers are to agreement, the highe the weight the computer will place on the mid-point between your final offers (and, hence, the lower the weight it will place on its own choice of an X value).For example, suppose that there are two scenarios, one with final offers of 10,000 for Player A and 11,000 for Player B (the mid-point is 10,500) and another where final offers are 10,000 and 14,000 (mid-poir is 12,000). In each scenario the computer would weight both the midpoint of your final offers and its own choice of X in determining the final value of X for that round, but in the first scenario it will place a higher weighting on the mid-point valu of X since the final offers are closer together. Basically, a higher weighting on the mid-point value of X means that the fina X outcome for the round will be closer to that mid-point value. If your final offers are farther apart, then computer will more heavily weight its own choice of an X value.

When the computer draws its own choice of an X value, some values of X are more likely to be drawn then others, but there is a random element to the computer's choice of X. To give you some information about this random number generation procedure, these are the last 100 value of X randomly generated by the computer (the order in which they are shown is irrelevant) using the exact same procedure as will apply in your case. This should be used to give you an idea o more likely and less likely values of X.

500	418	507	559	530	537	628	475	500	610
505	582	458	522	448	602	434	507	498	428
538	482	572	487	499	521	453	541	463	514
589	407	550	573	461	541	582	447	493	539
489	509	350	437	457	555	438	510	523	567
405	436	516	606	561	556	475	506	536	547
454	446	563	489	465	488	677	442	450	454
443	415	553	439	457	424	604	529	486	568
463	371	462	519	534	560	535	455	474	597
510	520	515	362	399	515	415	446	520	430

Again, if you and your counterpart have not reached agreement by the end of the round, you will be prompted for a final offer. If final offers still do not agree, then the computer will determine the value of X for you for that round by drawing its own value of X (based on the same random number generation procedure as drew the table of 100 numbers above) and weighting its own value of X with the mid-point of your final offers. A higher weighting will be placed on your final offers the closer they are to agreement.

If you have any questions, please raise your hand before starting the round. If you do not have any questions, then please click below to start.

Treatment Specific Instructions for CAsugg(.20)

Mid-way through the round, if you and your counterpart have not yet agreed on a value of X, then a computerized "suggester" will make a suggestion for you. You do not have to agree upon the suggestion, but the suggestion will play a role in the computer's determination of the value of X for that round should you and your counterpart fail to agree for the remainder of the round (i.e., you will resume bargaining after the suggestion). Should you reach the end of the round without having mutually agreed upon a value of X, you will then be prompted for a final offer. If you and your counterpart's final offers come to agreement, then that is the value of X for the round (if they overlap, then X will be the average of the final offers for that round). If there is still no agreement, then the computer will generate a value of X for you.

Specifically, the value of X for that round will be determined based on a combination of how close your final offers are, what the computer suggestion was, and an X value drawn by the computer at the end of the round. The closer your final offers are to agreement, the higher the weight the computer will place on the mid-point between your final offers (and, hence, the lower the weight it will place on a weighted-average of its own choice of an X value and the computer suggestion for X). For example, suppose that there are two scenarios, one with final offers of 10,000 for Player A and 11,000 for Player B (the mid-point is 10,500) and another where final offers are 10,000 and 14,000 (mid-point is 12,000). In each scenario the computer would weight both the midpoint of your final offers and its own weighted-average choice of X (weighted between the end-of-round computer choice and the suggestion) in determining the final value of X for that round, but in the first scenario it will place a higher weighting on the mid-point value of X since the final offers are closer together. Basically, a higher weighting on the mid-point value of X means that the final X outcome for the round will be closer to that mid-point value. If your final offers are farther apart, then the computer will more heavily weight the weighted-average value between its own choice of an X value and the computer suggestion.

The term "weighted-average" just means that the percentage placed on both the computer suggestion and the computer's new draw of an X value need not be 50% each. For purposes of your experiment, the weighted average will be a 20.0% weight on the computer suggestion from earlier in the round and a 80.0% weight on the end-of-the round computer draw of X. A higher than 50% weighting implies that the result of the weighting will be closer to the value weighted more than 50% (e.g. a 25% weighting on 10,000 and a 75% weighting on 1000 yields the weighted-average of 3250).

These percentages describe how the computer will combine its own draw of X and the computer suggestion in determining its weighted-average of X. It is still always the case that the computer will weight the mid-point of your final offers more heavily than its weighted-average when the final offers are close, and it will weight the mid-point value of X less heavily-and, hence, weight the computer's weighted-average more heavily-when the final offers are farther apart.

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When the computer offers a suggestion midway through the round, some values of X are more likely to be suggested than others, but there is a random element to the computer's suggestion of X. To give you some information about this random number generation procedure, below are the last 100 values of X randomly generated by the computer as "suggestions" (the order in which they are shown is irrelevant) using the exact same procedure that would apply in your case. This can be used to give you an idea of more likely and less likely suggestions of X.

472	436	396	528	529	447	588	494	563	422
519	443	507	580	540	589	442	468	517	480
491	474	564	485	554	485	504	510	487	430
539	516	584	553	412	566	393	441	458	342
418	521	589	569	489	463	574	537	581	504
564	416	434	392	617	555	437	507	421	468
500	443	551	517	489	493	577	483	572	477
579	489	651	505	476	510	486	593	568	577
502	555	471	445	485	473	469	420	582	442
572	506	549	453	392	550	619	568	380	391

Similarly, when the computer draws its own choice of an X value, some values of X are more likely to be drawn then others, but there is a random element to the computer's choice of X. To give you some information about this random number generation procedure, below are the last 100 values of X randomly generated by the computer (the order in which they are shown is irrelevant) using the exact same procedure that would apply in your case. This should be used to give you an idea of more likely and less likely values of X.

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697	403	492	405	419	482	495	519	563	460
502	440	512	449	478	486	491	441	399	412
416	603	381	450	558	461	576	497	536	444
453	628	564	434	577	595	425	436	587	447
579	490	437	560	562	513	529	428	512	433
477	482	505	576	560	477	449	527	484	505
459	513	499	486	424	503	459	408	467	515
463	525	448	528	588	366	539	524	553	514
441	493	466	481	502	433	520	412	464	466
501	471	620	448	502	553	578	624	428	584

Again, midway through the round, you will be offered a "suggested" value of X if you have not yet agreed (based on the same random number generation procedure as drew the first table of 100 numbers above). You are not required to agree on this value of X, but it does play a role in the end-of-round determination of X. If you and your counterpart have not reached agreement by the end of the round, you will be prompted for a final offer. If final offers still do not agree, then the computer will determine the value of X for you for that round by drawing its own value of X (based on the same random number generation procedure as drew the second table of 100 numbers above) and weighting the mid-point of your final offers along with the computer's own weighted average of the computer suggestion and its end-of-round draw of X. A higher weighting will be placed on your final offers the closer they are to agreement.

If you have any questions, please raise your hand before starting the round. If you do not have any questions, then please click below to start.