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van Damme, E.E.C.; Güth, W.

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INFORMATION, STRATEGIC BEHAVIOR AND FAIRNESS IN ULTIMATUM BARGAINING

– An Experimental Study –

Werner Güth

Department of Economics

University of Frankfurt*

and

Eric van Damme

CentER for Economic Research

Tilburg University†

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*P.O. Box 11 13 32 (Fach 81), D-6000 Frankfurt/M., Federal Republic of Germany.

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†Postbox 90153, 5000 LE Tilburg, The Netherlands.

Abstract

This paper reports on an experimental study of ultimatum bargaining situations in which an inactive third player is present. The proposer X makes a proposal (x, y, z) on how to divide a cake between X, Y and Z. Information, a message m, about this proposal is sent to the responder Y who has to decide whether to accept or reject the proposal. If Y accepts, each player gets paid according to the proposal, otherwise each player gets zero. There are three possible messages $m = (x, y, z)$, $m = y$, and $m = z$. The information condition is common knowledge. The main regularity observed is that, the extent of strategic behavior decreases with the information content of the message.

1 Introduction

Previous experimental investigations of ultimatum bargaining games have shown that observed outcomes differ markedly and systematically from the subgame perfect equilibrium outcome that is based on the auxiliary assumption that bargainers seek to maximize monetary payoffs. Whereas the latter requires the proposer to demand essentially all of the cake, we tend to observe offers of just less than 50% to the responder; the mode is a demand of exactly 50%, the mean demand is less than 70%, too greedy demands are rejected and less than 1% of the data is in the neighborhood of the game theoretic prediction. (See Guth (1993), Guth and Tietz (1990) and Roth (1992) for recent surveys.) This anomaly has sparked a lively and still ongoing debate about the predictive role of game theory and, more specifically, about the role of fairness considerations in economics.

The debate has shown that issues of fairness are complicated. Are the data best explained by assuming that people have a taste for fairness, that they have altruistic motives? Or should we opt for the alternative explanation that proposers are basically selfish but take into account the possibility that at least some responders might be motivated by distributional considerations, hence, can the proposals be explained as strategic responses to responders' willingness to refuse 'insulting low' offers? In this case, what do we mean by an 'insulting low' offer and how do distributional considerations enter the responder's utility function? Or is it perhaps true that considerations of fairness have no role to play after all? Is it true that with enough experience, and if the conditions are sufficiently favorable, behavior convergence to the game theoretic prediction that is based on monetary considerations alone? In this case, which conditions are favorable for 'gamesmanship'?

This paper reports on an experiment that was designed in order to get a better understanding of these issues. In order to explore more thoroughly whether and how fairness considerations influence ultimatum bargaining behavior, we performed ultimatum bargaining experiments with three players, X, Y and Z instead of the usual two. Player X makes a proposal (x, y, z) of how to divide a certain amount of money M. The rules of the game specify a certain smallest money unit $\varepsilon > 0$; amounts have to be integer multiples of ε and X is required to allocate at least ε to both Y and Z. Player Y then get some information, a message $m = m(x, y, z)$, about the proposal, and, on the basis of this information, he has to decided whether to accept of reject the proposal. If he accepts, each player in the triad gets paid according to the proposal, if he rejects none of the players gets anything. Note that player Z does not have to make any decisions, therefore, we sometimes call him a dummy.

Note that, because of the strictly positive ε specified by the rules of the game, if player Y is motivated only by his own payoffs, the message m is irrelevant for his decision: He should accept not matter what the message is. Hence, if both X and Y are motivated only by their own monetary gains and if X knows this, then the play will be independent of what messages are allowed: Player X will choose $(M - 2\varepsilon, \varepsilon, \varepsilon)$, send the message $m(M - 2\varepsilon, \varepsilon, \varepsilon)$ and Y will accept. (Formally, the ultimatum bargaining game (with complete information) and utility functions $U_X = u_X(x), u_Y = u_Y(y)$ with u_X and u_Y strictly increasing on $\mathbb{R}$ has a unique subgame perfect equilibrium and in this equilibrium player Y always accepts and player X proposes $(M - 2\varepsilon, \varepsilon, \varepsilon)$.) Furthermore, also in the case where players have a strong intrinsic motivation for fairness, the outcome will be independent of the exact content of the message: In this case player X will propose that each bargainer gets a share of $M/3$ irrespective of what the message is. One now sees that varying the information changes the scope for strategic behavior: If the norm of fairness is indeed that each bargainer gets $M/3$, then, if $m(x, y, z) = y$ so that the responder gets to hear only his own share, a selfish proposer can increase his payoff by proposing $(2M/3 - \varepsilon, M/3, \varepsilon)$: For the responder it is as if a fair outcome is proposed so he will accept. Obviously, if Y would be fully informed, $m = (x, y, z)$, this possibility for strategic manipulation would not exist.

In our experiment we did not try to control for the non-monetary elements in the players' utility functions (if any such elements exist, and if control is possible), but we systematically changed the information the Y player received and investigated whether behavior differed systematically across the various conditions. Specifically, we considered three different types of information:

(i) **Full information:** $m = (x, y, z)$

(ii) **Essential information:** $m = y$

(iii) **Irrelevant information:** $m = z$

(We acknowledge that the reader might consider the terminology inappropriate.) Some groups of subjects received the *cycle treatment:* Subjects played 9 rounds (each round against different opponents) with information being full in the rounds 1, 4 and 7, information being essential in rounds 2, 5 and 8, and information being irrelevant in the rounds 3, 6 and 9. Other groups of subjects received the *constant treatment:* Against changing opponents, these subjects either always got full, or essential, or irrelevant information.

Although the subgame perfect equilibria based on the auxiliary assumptions of (i) maximization of monetary rewards and (ii) knowledge of such maximization coincide in the three information conditions, there are strong reasons to expect actual behavior to depend on the information content of the messages that are allowed. The assumption that the proposer knows the utility function of the responder is a strong one and uncertainty concerning the beliefs, motives and rationality of the other players will induce different accommodating proposals in the different information conditions. For example, consider a selfish maximizing proposer X who is not completely sure about the motives of the responder Y. Perhaps Y is a selfish maximizer as well, or perhaps Y cares about person Z, or perhaps he is insulted if offered low payoffs. One might expect such a person to ask less for himself in the full information condition than in the case where Y has essential information. In the latter case, X will try to figure out what the minimal $\bar{y}$ is that Y is still willing to accept and he will propose $(M - \bar{y} - \varepsilon, \bar{y}, \varepsilon)$. This proposal, however, has a good chance of being rejected in the full information condition: Y might be upset by the fact that Z is offered so little and to induce Y to accept, X has to increase z or y (in the latter case he is 'bribing' Y), so that less is left for himself.

The data obtained in the experiment show that very few subjects are intrinsically motivated by fairness and that if such intrinsic motivation exists, the forces are weak. For example, the proposer offers very little to the dummy and there is no evidence that the responder's behavior is guided by what is allocated to the dummy. Most proposers try to maximize their own monetary rewards but, when making their decision, they take into account the possibility that the responder might care for distribution. Generally speaking, responders in our experiment are very accommodating and compared to other ultimatum bargaining experiments we have very few rejections, the overall rejection rate being 7%. Rejections occur when, based on his information, the responder perceives the ratio y/x to be small and there is an interesting difference between the cycle mode and the constant mode: In the former, rejections are heavily concentrated in the situation where information is irrelevant. Specifically, the data display the following regularities:

R_1: The dummy gets a very small amount, except when the responder gets irrelevant information, i.e. when the message is equal to the payoff allocated to the dummy. The explanation for why the dummy gets (a little more) in this case is that z might serve as a signal for y: If z is low, this might signal that X is greedy, hence, that also y is low and that Y does not lose much by rejecting. On the other hand, a high value of z (around $M/3$) is viewed by Y with suspicion and is not seen as a signal that y will be high. Consequently, Y is inclined to reject messages consisting of high z values as well as X will not offer such proposals.

R_2: The outcome depends strongly on the information condition. In those groups playing the cycle mode, the proposer asks for about half of the cake in the full information condition, he demands slightly more in the case of essential information, and he asks for almost all of the cake in case the responder has irrelevant information. The responder gets (slightly more) than one third of the cake in case he bases his decision on relevant information and he gets essentially nothing in case he does not get a relevant message. Comparing these outcomes to the constant mode, one sees that in the latter, proposers make less greedy demands if they are constantly playing the game with irrelevant information, but that they make more greedy demands if they are constantly playing a situation with relevant information.

R_3: The presence of the dummy influences the fairness norm. Averaging over all situations where the responder bases his decision on relevant information, the proposer is allocated 40% more than the responder. (Transforming this to a two-person ultimatum game would yield approximately 58% for the proposer and 42% for the responder.) [Check! Is this significant?]

R_4: In the groups playing the cycle mode, the disagreements are concentrated in the rounds where the responder does not have relevant information. It seems that, when responders have the choice of when they do not know what they sacrifice, although they certainly expect the sacrifice to be small. Interestingly, there are a few rejections in the groups that constantly face irrelevant information. Although this might partly be explained by the fact that proposers are somewhat less greedy in the constant mode, the overriding force seems to be that, in the constant mode, responders learn to resign themselves to their fate.

The major conclusion that we draw from these regularities is that proposers try to maximize their monetary rewards by manipulating the information of the responder such that the latter cannot decline the offer. We have a much less satisfactory explanation of the responder's behavior at present: The data tell us that only proposals with a (perceived) low y/x ratio are rejected, but we do not know why some of these 'insultingly low' offers are rejected, while others are not.

The remainder of the paper is organized as follows. In Section 2 we introduce our experimental design. Section 3 describes and analyzes the data. Section 4 summarizes our main conclusions and suggests some potentially fruitful future experimental research on ultimatum bargaining in a multiperson environment.

2 Experimental Design

We recruited altogether 216 undergraduate students from the University of Tilburg to participate in the experiment. They had to register personally and most of them were students in economics. The experiment was run on four consecutive evenings, two evenings being devoted to the cycle mode and two devoted to the constant mode. Altogether we had four sessions (groups) that played the cycle mode, and two sessions for each of the constant information conditions, with there being three different information conditions, viz. full, essential and irrelevant.

When entering the meeting room students received their identification code on a letter of welcome (see Appendix A). Although this letter, as well as all other materials were in English, a Dutch translation was read aloud by one of the authors. We then distributed the "Instructions and decision form for the preliminary experiment" (see Appendix B). This pretest served two purposes: (i) To make sure that subjects would earn at least so much money that would make it worthwhile for them to show up (we indicated minimum, average and maximum amounts participants could earn when recruiting them) and (ii) to get some information about the degree to which participants are altruistic. Although the pretest can separate "egoists" from "intermediates" (see Appendix B2), it turns out that in the main experiment, the behavior of these two groups does not differ very much. Therefore, we will not consider the pretest in detail.

After the pretest was finished, the subject group was split into three subgroups which were then assigned to three different classrooms. Since these lecture rooms were rather large it was easy to exclude any communication between participants. Next, it was randomly decided which role (proposer, responder or dummy) each subgroup would play and instructions for the main experiment were distributed. In each of the sessions 1, 2, 3 and 4 devoted to the *cycle mode* 27 subjects participated: 9 persons for each role. They played the ultimatum game for 9 rounds, where a round-robin style matching was used. In each round they bargained for *f* 12,- which at the time of the experiment was about \$6.80. The *f* 12,- were represented as 120 points and the rules of the game specified that the proposer had to allocate at least 5 points to each player. Hence, each player received at least *f* 0,50 (± \$0.28) in each round. All participants received the same instructions (Appendices C.X, C.Y and C.Z, respectively), of which a Dutch translation was read aloud. The instructions inform subjects that they play the full information condition (condition xyz) in the rounds 1, 4 and 7, that they play the essential information condition ('condition y') in the rounds 2, 5 and 8 and that they play the irrelevant information condition ('condition z') in the rounds 3, 6 and 9. Whereas players X and Y also got a decision form which informed them about the number of rounds and the changing information conditions (see Appendices D.X and D.Y), players Z received only a balance sheet to record their payoffs (Appendix D.Z). Players X also received a communication sheet each round (Appendix E) which was used to communicate all the decisions between the players. At the end of each round, players got feedback concerning what happened during this round, i.e. they got to hear the proposal that was actually made in their triad. For each group there was a messenger communicating the information between the players.

If the information condition was xyz, the communication sheet with the proposal (x, y, z) was transformed by the messenger from X to Y, from Y back to X to inform X about Y's response, and then finally to player Z so that he can record the play and compute his payoff. In the two other information conditions y and z players X, when receiving Y's response, were asked to reveal their whole proposal (x, y, z) below the dotted line on the communication sheet which then was transferred to Y and then to Z so that, regardless of the information condition, all three players X, Y, and Z always knew the whole proposal (x, y, z) when the round was over.

In the *constant information mode* (Sessions 11 and 41 for the case where $m = (x, y, z)$, sessions 22 and 52 for the case where $m = y$, and sessions 33 and 63 for the case where $M = z$.) the instructions, decision forms, and balance and communication sheets were adopted to the constant information condition (see the forms F.X1 to F.Z3 in Appendix F). Here the part of the instructions concerning the specific information condition was not read aloud. It was just mentioned that this differs from one group to another and that any questions concerning this condition can only be answered privately. The communication sheet was used in a similar way as for the cycle mode in order to inform the players about the decisions. As for the cycle mode the whole proposal was revealed to all three players X, Y, and Z after each play. Each session devoted to the constant mode involved only 18 persons, hence, only 6 rounds, round-robin style, were played. Each proposer met each responder only once. Another difference is that, in the constant mode, the last three rounds the stakes were doubled: 120 points were *f* 24,- instead of *f* 12,- in the first three rounds. Table 1 summarizes our design

round / session	1	2	3	4	5	6	7	8	9
1, 2, 3, 4	xyz	y	z	xyz	y	z	xyz	y	z
11, 41	xyz	xyz	xyz	xyz	xyz	xyz			
22, 52	y	y	y	y	y	y			
33, 63	z	z	z	z	z	z			

Table 1. Sessions and information conditions. Each of the sessions 1, 2, 3, 4 (the cycle mode) involves 9 players in each of the 3 roles and f 12,- to be divided in each round. Sessions with constant information conditions involve 6 players in each role, and f 12,- (resp. f 24,-) to be divided in each of the first (resp. last) 3 rounds. Altogether we have $4 \times 9 \times 9 = 324$ observations for the cycle mode and $2 \times 6 \times 6 = 72$ observations for each constant mode, a total of 540 observations.

After the last round, all participants were asked to fill out a short postexperimental questionnaire (see Appendices F1 and F2). Afterwards they were paid privately according to their payoffs in the Pretest and the main experiment. In order to keep the Z-players busy they were asked to check the earnings of all players. More specifically, one group of Z-players were asked to calculate the earnings of all players of another group, i.e. no Z-player doublechecked the earnings of individuals with whom he could have ever interacted. This was known to all Z-players whereas the X- and Y-persons were only informed about this procedure after filling out the postexperimental questionnaire. By this we found very few inconsistencies of the declared earnings; mostly due to obvious mistakes. We never found out about a participant who wanted to cheat.

An experimental session lasted about two hours. The earnings of participants varied widely from less than f10 to more than f110. Participants with low earnings were very frustrated and complained about their bad luck, mainly for not being selected as player X.

3 Hypotheses

Since the first experimental studies of ultimatum bargaining (see Güth, Schmittberger, and Schwarze, 1982) it became clear that the game theoretic solution has nearly no predictive power. Although later studies (e.g. Binmore, Shaked, and Sutton, 1985) claimed that experienced participants behave more gamesmenlike than unexperienced decision makers, it is by now a reliable result (see, for instance, Roth et al., 1992, Bolton, 1992) that people do not behave according to the game theoretic solution as long as fairness considerations are not dominated by other motivational forces, see Prasnikar and Roth (19..).

Since our experimental design allows for non-trivial subgroup partitions, e.g. the one with $\{1\}$ on the one hand and $\{2,3\}$ on the other or the one with $\{1,2\}$ on the one hand and $\{3\}$ on the other, we can try to answer questions concerning who cares for whom and why. Will, for instance, player Y reject a proposal in the xyz-information condition when z is very low although y itself appears to be fair? Will player X assign fair amounts to player Y or Z even when these amounts are not known to player Y when he decides whether to accept or to reject? If a subgroup develops a stronger solidarity relationship than the general one between all three players is this more relying on strategic aspects, i.e. is, for instance, player Z excluded, or is it more relying on payoff participation (e.g. players X and Z might care more for each other since they both expect little for themselves)? In our view, this indicates that our experimental design allows us to explore some of the most interesting problems discussed in the ultimatum bargaining literature. In the following we will specify some more definite hypotheses whose predictive relevance can be judged by our experimental observations.

Assume that fairness considerations do not exclude any player. Of course, such a general norm of distributive justice does not mean that a player will not deviate from his obligations if this remains undetected and thereby unpunished. Actually, the previous experimental results of ultimatum bargaining (see the survey of Güth and Tietz, 1991) clearly reveal attempts of the proposer X to exploit responder Y which often resulted in conflict. Due to the variation in the information of responding player Y we can investigate whether the proposer strategically reacts to the information condition in the sense that he gives only minimum amounts to those players whose assigned share is unobservable by the responding player Y.

Hypothesis A: Player Y's (Z's) share y (z) is close to 5 in information condition z, respectively y.

As clearly revealed by the game theoretic and by the observed payoff distributions solution player X is more powerful than player Y. Since player Y can veto any proposal, player Y, in turn, is much more powerful than the dummy player Z which shows that we analyse game situations where players can be ordered according to their strategic power and where the strategic possibilities of any pair of players differ dramatically. Now a general norm of distributive justice will not always be obeyed. For the case at hand this means that player X, when asking for an amount x greater than y, is risking a rejection by player Y. By choosing y large enough, this risk, however, can be kept rather low. Also demands $x > z$ can trigger punishments in case of strong solidarity links between players Y and Z. Choosing z larger does, however, not imply higher costs of punishment. We therefore have to expect payoff proposals which reflect somewhat the power hierarchy of the three players:

Hypothesis B: The amount x is significantly larger than y, which, in turn, is significantly larger than z.

Concerning the question whether a subgroup develops stronger solidarity links one, of course, can test the solidarity feelings of the proposing player X by investigating his proposals for players whose share is not observable by the responding player Y. Actually Hypothesis A claims that player X cares for fairness only if he can be punished for deviating from it.

If this is not true, the proposals in the different information conditions reveal whether either player X himself cares for player Z or whether he only thinks that player Y cares for Z's well-being. If player X assigns also a considerable amount z to player Z in information y, he himself cares for Z's well-being. If he only assigns considerable amounts z in situations xyz and z, but not in y, he only cares for Z since he thinks that player Y does.

A direct test of the solidarity relationship between players Y and Z has to investigate the rejected proposals by player Y. Here we must distinguish two situations, namely proposals (x, y, z) with minimal or low values z in information condition z and similar proposals in information condition xyz. In the latter case only rejected proposals with a considerable amount y indicate a strong solidarity of player Y for the dummy player Z. If both amounts y and z are low, the reason for the rejection can also be the low assignment for player Y himself. Observe, however, that very high amounts z in information condition z can indicate that player Y will be exploited. It therefore has to be expected that also such proposals will be rejected by player Y.

Hypothesis C: Proposals (x, y, z) with minimal or low components or large components z in information condition z and proposals (x, y, z) with considerable amounts y but minimal or low components z in information condition xyz are likely to be rejected.

If, contrary to Hypothesis C, solidarity would include only players with significant strategic influence, player Z should always receive minimal or low amounts. Furthermore, proposals with low assignments z in information condition z or low assignments z but considerable amounts y in information xyz should not be rejected. For player X solidarity between players X and Y would mean to let only player Y gain more than 5. We did not believe in such a behavior as revealed by

Hypothesis D: Neither will players X always choose $z = 5$, nor will players Y always accept proposals with minimal observable shares z.

Our experimental design offers some obvious further hypotheses which we do not want to elaborate in full detail and state explicitly. So the pure fact that we allow for extensive learning of game playing indicates that we expect some learning to take place. It has to be expected that this will lead to giving less to players whose assigned payoff is unobservable. On the other hand, conflicts should induce less greedy demands. On the whole we do not expect a monotonic increase of x with experience.

Another design hypothesis concerns the embedding of a specific information condition. Although there may be differences when participants are still not very familiar with the game situation, we do not expect significant differences in the later plays of a certain information condition when it is played in the cycle mode or the constant information mode. Notice, however, a difference between the two modes which, unexpectedly, might prove to be important. Whereas in the constant information mode a player Z always plays the same information condition, participants in the cycle mode expect him to envisage all three information conditions. Now our data indicate that players Z earn substantial rewards in information condition z. So players in the cycle mode could have expected that Z gets something substantial at least sometimes whereas in the constant information mode such an argument does not apply. Here a proposer in information condition y cannot comport his feelings of guilt when exploiting the dummy player by hoping that Z should get more under different circumstances.

Furthermore, *the* decisions in the Pretest and the answers of the postexperimental questionnaire suggest many intuitive hypotheses. We, for instance, expect altruists to be less greedy than egoists but also, as players *Y,* to be more willing to punish greedy proposers.

4 Descriptive data analysis

We first want to look at the major differences in behavior by comparing means and standard deviations, listed in Tables IV. 1 to IV. 6. Notice that every entry in these tables relies on 36 observations, i.e. 36 proposals. Whereas in Tables IV.1 to IV.3 all the 36 proposals are collected from 36 participants, in Tables IV.4 to IV.6 the 36 observations come from 12 participants with three proposals each.

In all 6 tables the average demand x of party X increases with experience. For the same level of experience and the same mode (cycle mode like in Tables IV. 1 to IV.3 or constant mode like in Tables IV.4 to IV.6) it is, furthermore, true that x for condition *xyz* is smaller than for condition *y* which in turn is smaller than for condition *z*. Thus, regardless, how experienced participants are and whether they are confronted with all three information conditions or just one, they consistently view the full information condition *xyz* as the worst one for greedy demands. Whereas information condition *y* is slightly better since one can secretly exploit party *Z*, information condition *z* is far the best one for greedy demands since one cannot only exploit *Y* but also keep *z* modest (too high amounts *z* in information condition involve a considerable risk of conflict).

From the standard deviations one can see that at least for the cycle mode information condition *xyz* seems to be the most puzzling one. In the constant information mode the standard deviations are not so different for the three different information conditions *xyz*, y, and *z*. The standard deviation s_z of assignments *z* to party *Z* are, however, consistently high. This indicates that participants did not agree whether low or high assignments are more appropriate in information condition *z*.

It is interesting to notice that in the constant information mode the average demand x for the first or the second three plays exceeds all average demand levels x in the cycle mode for information conditions *xyz* and y whereas for information condition *z* all levels x in Table IV.3 exceed the ones in Table IV.G. Thus the cycle mode seemed to inspire a stronger reaction to the specific information condition than it can be observed for the different groups playing always the same information condition.

The average assignment y to party *Y* depends dramatically on the information condition. There is no essential difference when comparing y for information condition *xyz* and y: Party *Y* always receives a significant share of around 1/3 if it knows y when deciding. This shows that the higher demands x for condition y, as compared to condition *xyz*, are mainly at the expense,of *z*. If, however, only component *z* is observable, party *Y* gets nearly nothing: The mean assignment y to party *Y* is always smaller than the mean assignment *z* to party *Z* in information condition *z*.

For party *Z* information condition y is obviously the worst situation whereas it can hope for more generous assignments in conditions *xyz* and *z*. Whereas in the constant mode *z* for condition *z* is clearly higher than for condition *xyz,* these average assignments are nearly equal in case of the cycle model.

In the constant information mode there exists no clear dependency of the number of conflicts on the condition. The numers of conflicts in the cycle model reveal, however, a strong dependency: Whereas for condition *xyz,* respectively *y,* we observed only 1, respectively 3, cases of conflict, this number was 18 for condition *z.* This again illustrates that, at least, participants who confronted all three conditions, found information condition *z* the most disturbing one.

The altogether 39 cases of conflict in the altogether 540 plays imply an overall conflict ratio of 7% which is relatively low (see Kagel, 1992, who observed very high conflict ratios). Some proposers X experienced multiple rejections (8 proposers had double rejections, 23 single ones). Similarly, the 39 rejections were caused by 28 responders (3 with three rejections, 5 with two rejections, and 20 who rejected only once).

INSERT FIGURE IV.6 HERE

The overall conflict ratio under the cycle mode is with 6.79% only slightly smaller than the one of 7.87% under the constant information mode. So the main difference in the overall conflict ratio seems to be the one that this is nearly equal for all three information conditions *xyz,y,* and *z* under the constant information mode whereas under the cycle mode nearly all conflicts occur in information condition *z.* Thus one can conclude: In all experimental groups a certain conflict ratio seems to be unavoidable. Either proposers become too greedy or responders want to teach them that there can be conflict or both is true. But if proposers have a choice when to induce conflict and when not, they certainly prefer the situation *z* when they do not know what they sacrifice.

Due to our information feedback all three parties knew the whole play when it was over. Thus responders had a chance to learn that their rewards were in average significantly smaller under information condition *z.* It is nevertheless surprising that this caused an outstanding conflict ratio of 16.67%. After all one does not know what the present proposer has suggested. We will later try to analyse the individual plays ending in conflict to see whether the specific values of z can explain why the proposal has been rejected. If this is not true, one has to explain the choice of conflict either by previous bad experiences *(Y* did not receive much before, specifically in condition *z)* or as voluntary provision of a public good (sometimes there has to be a conflict to keep proposers modest).

The hypothesis that participants prefer to choose conflict when they do not know what they sacrifice could be tested by repeating our experiment without the information feedback, i.e. responders only learn *y* or *z* in information condition *y,* respectively z, even when the play is over. Of course, they learn how much they earned altogether after the experiment. The demand games of Mitzkewitz and Nagel (1993), who explored experimentally ultimatum bargaining with incomplete information (the responder *Y* does not know c(> 0) exactly), are also experimental situations where a responder does not know what he sacrifices when choosing conflict. The conflict ratio, which Mitzkewitz and Nagel (1993) report is ??% whereas for offer games in which responders know what they sacrifice by a rejection the ratio is *11%.*

It seems interesting to look closer at the altogether 23 cases of conflict under information condition z which split up into 18 (out of altogether 108) plays for the cycle mode and 5 (out of altogether 72) plays for the constant information mode. One possible explanation for rejecting a proposal under information condition z is a previous bad experience, e.g. the last assignment *y* in information condition z has been smaller than 15. This would account for 10 of 11 possible cases of the cycle mode, but only for *1* of 5 possible cases of the constant information mode where one should mention that in the latter mode one responder accounts for 3 of the 5 cases of conflicts. Even if one counts only a previous assignment y=5 as a bad experience, 9 of the 11 possible cases of the cycle mode can be explained.

Another explanation for rejecting a proposal under information condition z is that the assignment z signals either a greedy proposer or a low own assignment *y* for the responder *Y.* In Table IV.7 we have listed the z-values for all 23 cases of conflict (in the first row) and in order to compare the two distributions, also in the second row the general distribution of assignments z under information condition z.

z	5	10	15	20	25	30	35	40	≥ 45	$\sum$
cases of conflict	11	1	0	2	1	2	5	1	0	23
all values	70	25	7	26	9	13	9	18	3	180

Table IV.7: Assignments z in information condition z

in cases of conflict and in general

Clearly, the conflict cases are concentrated either at the lower assignments and or at higher assignments (11 of the 23 observations rely on z=5 whereas 11 assign a value z in the range $20 \leq z \leq 40$. The general distribution of assignments z is also highly concentrated since 70 of the 180 observations rely on $z = 5$ whereas 75 lie in the range $20 \leq z \leq 40$. Thus there are exactly 59 accepted proposals with $z = 5$ and in the range $20 \leq z \leq 40$. According to Table IV.7 the best signals seem therefore $z = 10$ or $z = 15$. Signals $z \geq 45$ are also conceivable, but since they are rather costly, they seem to be less recommendable.

5 Evaluation of hypotheses

In the following we will evaluate our initial hypotheses, introduced in Section III, by investigating whether our experimental observations support them or not. If in spite of more rigorous statistical standards every play is viewed as an independent observation, our main conclusions are highly significant. Since not all plays are independent (see our previous explanation of the choices of conflict by previous bad experiences), we refrain, however, from quoting numerical levels of significance based on tests which require independence.

One of the basic problems, posed by the empirical relevance of fairness considerations, is whether proposers are intrinsically interested in fair results or whether they only make fair proposals since they anticipate the rejection of unfair ones. Our results clearly support

Conclusion A: Proposers have no intrinsic interest in fair allocation results. More specifically, they tend to choose $y = 5$ in information condition z and $z = 5$ in information condition y as predicted by Hypothesis A.

Although there are exceptions, the average assignments y in Tables IV.3 and in IV.G justify Conclusion A. The means in Table IV.6 also indicate a strong tendency to choose lower assignments y in information condition z when participants become more experienced and/or exposed to stronger monetary incentives. For Table IV.3 this tendency is weaker but, due to a lower starting value of $y = 11.67$ as compared to $y = 17.50$ for the constant mode, the final levels of y in Tables IV.3 and IV.6 are very close.

In a similar fashion the prediction of low assignments z for condition y is supported by Tables IV.2 and IV.5. Here the levels z of the last rounds are very close to their minimal level of 5. There is, furthermore, a clear tendency to become less generous when proposers are more experienced and/or more motivated by monetary incentives.

Conclusion A has important implications. It clearly proves that fairness is a social norm which can only be well obeyed when its compliance can be monitored (see the observability requirement in the theory of distributive justice as discussed by Guth, 1992). The assignment y can only be monitored by responders in conditions xyz and y but not in information condition z when responders do not receive in average an amount which one could call fair.

Proposers also care mostly for the dummy Z since they believe that responders try to protect them. This is revealed by the higher average assignments z in Tables IV.1, IV.3, IV.4, and IV.6 as compared with the ones in Tables IV.2 and IV.5. Proposers think, however, that responders are much more sensitive to own low assignments y than to low assignments z. Whenever both components, y and z, are observable, i.e. in condition xyz, the average assignment y was close to 40 whereas the average assignment z was near to 10 (if one restricts attention to the later rounds).

The fact that z. in information condition z is consistently larger than z in condition y should not be viewed as strong support that responders are seriously trying to protect

Z's well-being. Since both, high and low assignments *z* in condition *z* were rejected (see Table IV.7), responders considered the assignments more as signals of their own share, e.g. in the sense that a very low value *z* signals a greedy proposer and that a high value *z* signals somebody who only pretends to be generally generous.

The differences in assignments for *X, Y,* and *Z* which Hypothesis D predicts based on the obvious disparities in the strategic possibilities of the three parties are not always validated. Whereas Hypothesis B is always supported by the average results for conditions *xyz* and y, no average assignment y ever exceeds *z* in information condition *z*. How the positive differences $z — y$ for condition *z* change when participants become more experienced and/or motivated by financial incentives is less obvious. Whereas this difference clearly increases in Table IV.6, this tendency is not observable in Table IV.3. We summarize our results by

Conclusion D: The power relationship is only reflected by payoff proposals when responders can observe their own share. More specifically, Hypothesis B is only supported in conditions *xyz* and y whereas it obviously is falsified for information condition *z.*

To investigate Hypothesis C we want to compare Table IV.7 with the corresponding Table IV.8 for information condition *xyz* and y, respectively, where we have concentrated on the 36 plays in the 7th round of the cycle mode as well as the 36 plays in the last 3 round of the constant mode.

z / y	$z \leq 10$	$z \geq 20$	Σ
$y \leq 35$	19(3)	3(0)	22(3)
$y = 40$	10(0)	6(0)	16(0)
$y = 45$	6(0)	2(0)	8(0)
$y = 50$	9(0)	3(0)	12(0)
$y \geq 55$	17(0)	0(0)	14(0)
Σ	58(3)	14(0)	72(3)

Table IV.8: The rejected and general assignments (y, z) in information condition xyz together for the 7th round of the cycle mode and the last 3 games of the constant mode xyz (the numbers in brackets are the rejected proposals)

According to Table IV.8 only the greedy proposals (x, y, z) with $y \leq 35$ and $z \leq 10$, i.e. with $x \geq 75$, are endangered by rejection when participants are more experienced. The results of Table IV.8 thus blankly disqualify Hypothesis C since none of the 41 proposals with $y \geq 40$ and $z \leq 10$ have been rejected. Thus at least experienced responders care only for their own share but not at all the one of party Z. Together with the results contained in Table IV.7 this implies

Conclusion C: Whenever y is known to the responder, only proposals with low assignments y in the sense of $y \leq 35$ are rejected by experienced responders. When such responders only learn about z, they tend to reject more likely proposals with extremely low and high assignments. More specifically, Hypothesis C is clearly rejected as far as it concerns information condition xyz.

Hypothesis D, which is a rather weak prediction, is obviously validated by the results for information condition z. In our view it is, however, surprising how badly party Z is treated in information conditions xyz and y. Thus the support for Hypothesis D seems to be less grounded in a real concern for Z either by proposers and/or by responders but in the signaling role of assignments *z* in condition *z* and attempts to reciprocate (the fact that a responder does not meet the same proposer again does not rule out reciprocity, considerations between groups). We thus feel justified to state

Conclusion D: There is no strong concern for party *Z* although it is compartively well treated in information condition *z*. Although Hypothesis D is supported, this cannot be interpreted as a real concern of proposers and/or responders for party *Z*.

6 Conclusions for a behavioral theory of ultimatum bargaining

In general our results provide more definite answers than we originally expected. The experimental data clearly refute the idea that proposers are intrinsically motived by fairness. More specifically, this rejects the idea of altruism (e.g. in the form of additional arguments of utilities, see Ochs and Roth, 19.., Bolton, 19.., Palfrey and McKelvey, 19..). Responders mainly do not ask for nearly all the cake since they anticipate that such proposals are more likely rejected what, also according to our data, is a well justified behavioral expectation. There is no direct concern of proposers for responders.

This does not mean that gamesmenship defeats fairness as it has been sometimes concluded (see, for instance, Harrison and McCabe, 19..). After all, gamesmenship does not provide any justification why responders refuse proposals with significant amounts y in our conditions *xyz* and y. What can be concluded is, however, that fairness has to be a social norm whose compliance can be monitored. This is clearly illustrated by comparing the results of condition *z* with those of the other information conditions: Responders only can hope for a fair share when they learn about it.

There is also at most a weak concern of, responders for party *Z* in the sense that responders are not willing to choose conflict if party *Z* has been treated badly. This is clearly revealed by Table V.8 which shows that experienced responders never choose conflict purely for party Z's sake. This attitude of responders is either quickly learned or anticipated by responders who correspondingly dare to assign little to party *Z* even when this can be observed by responders.

What we have learned about the possible solidarity relationships can be summarized as follows: There is no concern of proposers for responders, as illustrated by condition z, nor for dummies as illustrated by condition y. Responders in turn do not care very much for dummies as demonstrated by the results for condition xyz. This, of course, implies that there can be no overall solidarity in the sense that each of the three parties cares for both other parties.

Since fairness nevertheless matters, it must be in the form of a social norm which only yields reliable behavioral predictions if its compliance can be monitored, most importantly by those who can punish. That pure observability of norm deviations alone does not guarantee compliance can be concluded since due to our information feedback all proposals became finally known and since this did not prevent extremely greedy proposals.

Thus the equal split $(x, y, z) = (40, 40, 40)$ among all three parties can serve only as a preliminary behavioral intention of unexperienced proposers who never encountered such a situation before. More experienced proposers or proposers who rejected the simple idea of general equality, e.g. since it contradicts the obvious power relationships, consider how much they can demand for themselves without risking conflict.

Our results clearly indicate that different considerations are employed in the three different information conditions x, y, z, and z when deriving what a proposer can safely demand for himself. Whenever y is observable by the responder one seems to predict the prohibitive amount $\underline{y}$ in the sense that assignments $y \geq \underline{y}$ will not be rejected. As in previous ultimatum experiments (see the survey of Güth and Tietz, 19..) the average prediction $\underline{y}$ of proposers seem to be that $\underline{y}$ is nearly 1/3 of the total cake. If y is observable, experienced proposers do not seem to bother a lot how much to assign to the dummy party Z.

In information condition z proposers apparently have to entertain more complicated considerations. They have to predict how responders conclude from z what the proposer might have left them. Apparently responders who dare to choose conflict rely on two major interpretations: $z = 5$ indicates greed and therefore a low assignment y. On the other hand significant levels z with $20 < z < 40$ are interpreted as falsely pretending overall generosity.

It is rather surprising that behavior is quite different for the cycle mode and the constant information mode. This is clearly illustrated by the wider variance of mean assignments as well as by the high concentration of conflicts in information condition z for the cycle mode. In our view, this can be explained by a more thorough understanding which the cycle mode triggers. Participants in the cycle mode experience all three information conditions and therefore have to investigate their discrepancies. Our results shows that this yields clearer differences in behavior than the different conditions yield when participants always remain in the same information condition. One could conclude from this more generally that decision makers who are confronted with a multiplicity of different decision problems will usually be more willing to exploit the strategic aspects of a given situation as compared to others who mainly envisage the same situation. This could explain why firms like to hire managers who have many different job experiences.

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Smith

Weg and Smith

Code

Dear Participant,

Thank you for showing up!

You are going to participate in an experimental study of decision making for which the funding has been provided by the Dutch Science Foundation (NWO) via Bcozoek (Stichting tot Bevordering van het Onderzoek in de Economische Wetenschappen). The decision problems that you will encounter are simple and during the experiment you may earn a considerable amount of money. All the money that you earn will be yours to keep and your earnings will be paid to you in cash at the end of the experiment. You will be paid privately, so that the other participants will not get to see how much you earned. We hope you will find the experiment both instructive and rewarding.

Please note your personal identification code that is in the upper right corner of this form. During the experiment please fill in this number at the appropriate places on all your decision forms. In order to be paid out at the end of the experiment, you have to return this form to the experimenter, together with all decision forms with the code filled in.

The experiment will last for about 1,5 hours. You are asked not to talk to any other participant during this time period. WE ASK YOU TO REMAIN SILENT AS OF NOW.

The experiment consists of two parts, a preliminary experiment and the main experiment. The preliminary experiment takes place in this room. For the main experiment you will be split into three groups, your personal code determines to which group you belong and in which room you must be. More detailed information will he given later. You will have the chance to ask questions to the experimenter after these instructions have been read aloud. If you then want to ask a question, please raise your hand; the experimenter will then come to you and answer your question in private. You can only ask clarifying questions about procedures, questions about which decisions to make will not be answered.

If there are no more questions, we will distribute the instructions for the preliminary experiment.

Appendix B

Code	

Instructions and decision form for the preliminary experiment

Please fill in your personal identification code in the upper right corner.

Instructions

You will be randomly matched with another participant in the experiment, who is getting exactly the same instructions as you get and who has to make the same decisions. Each of you has to make a decision in two decision situations. In situation 1, the decision is between ■ and ▲ and the payoffs that each of you gets are given by the following table

your decision	■	▲
your payoff	ƒ 7,-	ƒ 6,-
other's payoff	ƒ 1,-	ƒ 6,-

In situation 2 you have to choose between ● and ◆ and the payoffs are as follows

your decision	●	◆
your payoff	ƒ 5,-	ƒ 3,-
other's payoff	ƒ 5,-	ƒ 10,-

It will be determined by tossing a coin whether it is your choice or the choice of the other player that actually matters. If you are selected, only your choices matter to determine the payoffs in the pair, if your partner is selected, only his choices matter. For example, suppose you choose ■ and ◆, and your partner chooses ▲ and ●. Then, if you are selected, the payoffs are ƒ 10,- for you and ƒ 11,- for the other. If chance selects your partner, then the payoffs are ƒ 11,- for each of you.

If you have any questions, please raise your hand. If not please make your decision.

Your decision

In situation 1 when I have the choice between ■ and ▲, I choose:

In situation 2 when I have the choice between ● and ◆, I choose:

Please wait for further instructions concerning the main experiment.

Appendix B2

The results of the Pretest are visualised in Table II.1. When it was rather costly to give the other $f\,5$, this was rarely done (only 17 cases out of 216), whereas 123 of 216 participants gave up $f\,1$ in order to give $f\,5$ to the other.

Situation 1	2	○	◇	Σ
□		88	5	93
△		111	12	123
Σ		199	17	216

Table II.1

In the following we will refer to the 88 cases with (□,○) as 'egoists', the 12 cases with (△,◇) as 'altruists', and the 111 cases with (△,○) as 'intermediates'. The 5 participants with (□,◇) give $f\,5$ to the other only when it is expensive. Of course, their counterintuitive behavior might be explained by a preference for imparity. In the same way, the choices of the 111 intermediates may be induced by parity considerations.

Appendix CX1

INSTRUCTIONS (For persons with an X-code)

You will be involved in an experiment. The experiment will last for 9 rounds. In each round you (person X) will be randomly matched with two other persons (to be called Y and Z). In different rounds you will be matched with different persons and you will not be matched with the same persons twice. In each round, you will have to make a decision on how to divide 120 points (the equivalent of ƒ 12,-) among the three persons involved. Hence, 10 points is ƒ 1,-. You have to write the division (x, y, z) that you propose in column (3) of your decision form. Please write the numbers in the correct order, first the number x of points that you ask for yourself, then the number y of points that you allocate to Y and, finally, the number z of points that you allocate to Z. Make sure that the three numbers add up to 120. **It is required that x, y and z are all divisible by 5 and that each of these numbers is at least 5** i.e. you only can choose from the numbers 5, 10, 15, 20, 25, ..., . When making your decision, take into account column (2) of your decision form labelled "Info Cond" (Information condition). This column determines what information (message) about your proposal is communicated to your partner Y, hence, what you have to write on the communication sheet as well as in column (4) of your decision form.

(i) If (xyz) is written in column (2), you are asked to communicate your entire proposal hence, you have to write the complete entry from column (3) of your decision form onto the message box of the communication sheet;

(ii) If y is written in column (2), you are asked to only communicate the points that you allocate to Y. Hence, only the second number y from those in column (3) should be written in the message box of the communication sheet;

(iii) If z is written in column (2), you are asked to only communicate the points that you allocate to Z, hence, only the last number z from those in column (3) should be written in the message box of the communication sheet.

The communication sheet will be transferred to the person Y with whom you are matched. This person has to decide, **on the basis of the information that he has**, whether he accepts the division as proposed by you. If he agrees, he writes YES on the communication sheet, if he does not agree he writes NO. If Y writes YES, all three persons in the match will get paid according to your proposal, if Y writes NO, then each person in the match gets nothing in this round. After Y has made his decision, the communication sheet will be transferred back to you, so that you can see what your payoff in this round is, which you can enter in column (5) of your decision form. Regardless of the information condition person Y always will be informed about the entire vector (x, y, z) after his decision. Thus person Y will be able to

Appendix CX2

his payoff for each round on the basis of the information that he has. At the end of each round, the experimenter will fill in the bottom half of the communication sheet and transfer it first to person X and then to person Z so that also this person can compute his payoffs. This then ends the current round, and if this round was not yet the last one, you can then make your decision for the next round in which you are matched with other partners.

INSTRUCTIONS (For persons with a Y-code)

You will be involved in an experiment. The experiment will last for 9 rounds. In each round, you (person *Y*) will be randomly matched with two other persons (to be called *X* and *Z*). In different rounds you will be matched with different persons, you will not be matched with the same persons twice. In each round, person *X* makes a decision on how to divide 120 points (the equivalent of f 12,-) among the three people involved. Hence, 10 points is f 1,-. The rules of the experiment specify that player *X* can only choose divisions (x,y,z) of the 120 points in which each of the numbers x,y and *z* is divisible by 5 and each is at least equal to 5, hence only the values 5, 10, 15, 20, 25, can be chosen for the numbers x,y and z. Of course, the numbers add up to 120. On a communication sheet, you will get a message that provides some information on the division that *X* proposes. As you can see on your decision form (column (2)), there will be three information conditions:

(i) Information Condition *xyz:* In this case you will get to hear the entire proposal made by person *X*. On the communication form the three numbers (x,y,z) are written. The order is such that the first number is what *X* asks for himself, the second is what he allocates to you and the third number is what is allocated to person *Z*.

(ii) Information Condition y: In this case you will get to hear only the number of points y that player *X* has allocated to you.

(iii) Information Condition *z:* In this case you will get to hear only the number of points z that player *X* has allocated to the person *Z* in the triple.

On the basis of the information that is given on the communication sheet, you have to say whether you accept the proposal or not. If you accept it (write YES on the communication sheet), each person in the triple will get paid according to the proposed division, if you reject it (write NO) each person in the match gets nothing in this round. Before making a decision please first insert the message from the communication sheet into column (3) of your decision form. Please write your decision both in column (4) of the decision form as well as on the communication sheet. Also write your personal code on this communication sheet. After you have filled in the communication sheet, it will be transferred back to *X* so that he can compute his payoff for his round. Thereafter, the bottom half of the communication sheet will be filled out and in the information conditions y and z, the sheet will be transferred back to you so that you can see what the actual proposal was in this round. Finally, the sheet will be transferred to *Z* so that also person *Z* is informed and can compute his payoffs. This ends the current round and if this was not yet the last round, it starts a new round in which you are matched with other partners. At the end of the experiment please compute your total payoff.

Appendix CZ

Z-code

INSTRUCTIONS (For persons with a Z-code)

You will be involved in an experiment. The experiment will last for 9 rounds. In each round, you (person Z) will be randomly matched with two other persons (to be called *X* and *Y*). In different rounds you will be matched with different persons and you will not be matched with the same persons twice. In each round, person *X* makes a decision on how to divide 120 points (the equivalent of f 12,-) among the three people involved. Hence, 10 points is f1,-. The rules of the experiment specify that player *X* can only choose divisions (x,y,z) of the 120 points in which each of the numbers *x,y* and z is divisible by 5 and each is at least equal to 5, hence only the values 5, 10, 15, 20, 25, can be chosen for the numbers *x,y* and *z*. Of course, the numbers add up to 120. Person *Y* gets information (a message) about the division that *X* proposes and on the basis, of this information person *Y* has to decide whether he accepts or rejects the proposal. If *Y* accepts (writes YES on the communication sheet), each person in the triple gets paid according to the proposed division, if *Y* rejects (writes NO), each player in the match gets nothing in this round. There are three information conditions:

(i) Information Condition *xyz:* In this case *Y* will get to hear the entire proposal made by person *X.*

(ii) Information Condition *y:* In this case *Y* will get to hear only the number of points *y* that player *X* has allocated to person *Y.*

(iii) Information Condition *z:* In this case *Y* will get to hear only the number of points *z* that player *X* has allocated to you.

You can read in column (2) of your balance sheet which information condition is relevant in each round. As soon as all decisions in a round have been made, the experimenter will write the proposal that was made in that round on the communication sheet and transfer this sheet to you so that you can see what happened, can compute your payoffs and fill in the columns (3), (4) and (5) of your decision form.

As you do not have to make any decisions and since we do not want to keep you idle during the experiment, we would like to ask your cooperation in the running of the experiment and to help keep control of the earnings of all subjects. Somebody else will control your own balance sheet, so do not try to cheat. Any attempt to do so will be punished by excluding you from the experiment.

Specifically, we will provide you'(as a group) with copies of the decision forms of all persons in the experiment and, after each round, with all the communication sheets from that round. We want you to fill out all these decision forms and compute, at the end of the experiment, the total earnings of each participant. This procedure will enable us to check the earnings of the other participants and to pay each person exactly the amount that he has earned.

Code

DECISION FORM PERSON *X*

(1) Round	(2) Info Cond.	(3) Proposal (x,y, *z*)	(4) Message	(5) Response YES/NO	(6) Payoff in Points
1	*xyz*				
2	*y*	-			
3	*z*				
4	*xyz*				
5	*y*				
6	*z*				
7	*xyz*				
.8	*y*				
9	*z*				
				Total	

Note: 10 points are f 1,-.

Appendix DY

Code	

DECISION FORM PERSON Y

(1) Round	(2) Info Cond.	(3) Message	(4) Response YES/NO	(5) Payoff in Points
1	xyz			
2	y			
3	z			
4	xyz			
5	y			
6	z			
7	xyz			
8	y			
9	z			
			Total	

Note: 10 points are *f* 1,-!

Appendix E

X-Code	
Y-Code	
Z-Code	

Communication sheet:

Round	
Info Cond.	

Message	Response YES/NO

- -

Please do not write on this part. (It will be filled out by the experimenters, who, at the end of ea round will transfer this form to the Z-person so as to enable this person to compute his payoff for t round.)

Proposal	