Homo Oeconomicus XVIII(2) (ACCEDO Verlagsgesellschaft, München 2001)

Exploring Response Behavior: An Ultimatum Experiment*

by

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Abstract. In phase 1 of our experiment every participant plays the ultimatum game with each of the other five group members, each taking the role of proposer and responder. For each of the offers one learns how many participants would have accepted it. The pie is 30 times larger in phase 2. It thus pays to explore response behavior in phase 1 by choosing different offers in order to exploit responders in phase 2. Such experimentation is useless, however, if one wants to play fair, e.g. 50:50, or if one believes in the game theoretic solution.

Sixty-one participants out of 77 (only those participants were included in the analysis who correctly answered the control question and whose responder strategy in phase 2 was monotonous) engaged in experimentation by submitting different offers in phase 1, whereas the remaining 16 participants submitted equal offers. Thirteen participants not engaged in experimentation divided equally, whereas the remaining 3 participants offered the smallest positive fraction of the pie.

Keywords: Equity Theory, Experimentation, Game Theory, Ultimatum Game

JEL-Classification: C91, C72

1. Introduction

By experimentation one explores one's decision environment to improve environmental knowledge and future decision behavior. Examples are test markets before the introduction of a new product or cohabitation before the founding of a family. By its very definition, experimentation relies on dynamic decision making: One engages in

* The authors gratefully acknowledge the help of Clemens Knezu, Martin Kocher, Christian Lapp, Armin Lukas, and Andreas Nachbagauer, who helped to run the pilot experiment at the European Forum Alpbach 1999 in Alpbach/Austria, and Sebastian Broskwa, Tarek El-Sehity, Gerlinde Fellner, Susanne Firnthrat and Eva Hofmann, who helped to run the experiment at the University of Vienna, Austria.

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experimentation today in order to improve one's future prospects. Our study of experimentation is based on the ultimatum game where proposers may want to learn which offers will be accepted. This, of course, presupposes that one is considering "unfair" offers, e.g. of less than half the pie. Neither the game theoretic solution nor equity theory would suggest engaging in experimentation except for pure curiosity.

Our experiment consists of two phases: In phase 1 every participant plays the ultimatum game with every other member in his/her group of six participants. Participants must specify five offers which may, but need not, differ in size, and one responder strategy. These offers are randomly assigned to their five partners. In turn their responder strategy is matched with the five offers of one's five partners which were randomly assigned. The random matching is performed after the experiment. At the end of phase 1 participants learn how many participants, including themselves, would have accepted each of the five offers. Thus, by submitting different offers, one learns about the likely success of these offers, whereas by proposing the same offer five times, one learns the likely acceptance of this specific offer only.

Phase 2 differs from phase 1 by the much (i.e., 30 times) larger pie and by the fact that one can submit only one offer (in addition to one's response strategy). This is then randomly matched with the responder strategy of one of the five other participants in one's group, whose earlier responses one has more or less completely observed in phase 1. The first and the second responder strategy of the same participant may differ.

Experimentation by its very definition relies on a holistic approach in the sense that both phases are viewed as successive stages of one big game. On the other hand cognitive decentralization amounts to considering just the ultimatum game and learning how to behave in this game, both as a proposer and a responder.

If responders are only interested in their own monetary payoff (see Bolton and Ockenfels, 2000, and Fehr and Schmidt, 1999, for claims of broader monetary incentives), all positive offers must be accepted.[1] If one assumes that the 0-offer will be accepted with less than 90% probability (all evidence supports this assumption, see Roth, 1995, for a survey), risk-neutral proposers would offer just one point. If the 0-offer is completely rejected, or accepted with lower probability, this risk assumption is not needed, or can be relaxed, respectively. Thus, according to the game theoretic solution there is no need to explore response behavior. In both phases proposers should invariably offer just one point which, like all other positive offers, will surely be accepted.

Let us assume that participants view the situation as a partnership with veto power on both sides suggesting equal sharing (according to equity theory, see Adams, 1965, this can be justified by the personal contribution standard, see Güth, 1988). Since they always play the role of proposer as well as responder, any "consistent behavior" (a responder accepts only offers which are at least as high as his/her own offer) would lead to equal sharing in view of the holistic approach which considers both phases as stages of one big game. Cognitive decentralization, however, would imply an equal share during each of the many bilateral encounters. Neither interpretation suggests a motive for exploring response behavior.

[1] Note that only integer offers could be submitted. Thus, the smallest positive offer is 1.

The basic reason for such "no incentives for experimentation" results is that any accepted and precise hypothesis provides precisely the environmental knowledge that enables experimentation during phase 1. Evidence shows that actually, most decision makers do not rely on such hypotheses.

Since every participant assumes both roles, one can also investigate whether one submits offers which one would not accept. It is especially interesting to explore how participants react to the feedback information of phase 1: Does one, in phase 2, choose the lowest offer that meets a certain probability threshold for acceptance? Or will one simply maximize one's payoff expectation? Such hypotheses presuppose that one views the response behavior in phase 1 as a reliable prediction of what is acceptable in phase 2.

2. *The Experiment*

2.1 *Method*

2.1.1 *Participants*

The participants were 96 students from various disciplines of the University of Vienna. The average financial remuneration was ATS 294 (about $22 when the experiment was conducted in November 1999), the standard deviation was ATS 91 (about $7). Time requirement was about 45 minutes.

2.1.2 *Experimental Design*

The instructions (see Appendix A for an English translation) introduce the basic ultimatum game allowing both players to allocate ten points among themselves. In phase 1 one point was equivalent to ATS 1, whereas this equivalent was ATS 30 in phase 2. Proposers simply have to choose their offer $A \in \{0, 1, ..., 10\}$, whereas responders must decide for each of the eleven possible offers whether they would accept (+) or reject them (-). The decision forms (in English translation) are to be found in Appendix B.

2.1.3 *Procedure*

After a pilot study in Alpbach (Austria) with the participants of a seminar during the European Forum Alpbach, involving three groups of six participants, the main sessions were performed at the University of Vienna. The experiment was conducted in five sessions of three groups and in one session of one group. Participants were orally informed about the group size. Although participants interacted in both phases within the same group of six participants, they could not be sure about their partners since a typical session comprised several such groups. Participants also had to fill out a post experimental questionnaire covering items on perceived fairness, motives for proposer behavior as well as on the understanding of the experiment, and on the participants' effort to make accurate decisions. In addition, they also had to answer two control items covering the rules of ultimatum bargaining (see Appendix C).

2.2 *Results*

In this section it is analyzed whether observed behavior can be explained by the game theoretic solution, or by equity theory, or whether participants engage in exploring response behavior. In addition, descriptive data analysis for proposer and responder behavior as well as the questionnaire data are presented.

Ninety-one of the 96 participants had correctly answered the two control items. The remaining 5 were excluded from the analysis. In addition, there were 14 participants whose responder strategy in phase 2 was non-monotonous. Those participants, for instance, accepted an offer of one point, while rejecting one of six points. Questionnaire data on participants' effort to make accurate decisions as responders yielded significant differences between those participants whose responder strategy was monotonous compared to those whose strategy was non-monotonous in both phases, indicating a lower effort to make accurate decisions on the part of the non-monotonous participants in phase 1 as well as in phase 2 (see Table 1). Items 19 and 21 (see Appendix C) are seven-step items ranging from 1 = I do not agree to 7 = I fully agree. The 14 participants who either did not understand the instructions or were not sufficiently motivated were excluded from the analysis, yielding a sample size of 77 participants.[2, 3]

[2] 11 participants whose responder strategy was only non-monotonous in phase 1 were kept in our analysis.

[3] Note that the inclusion in our analysis of those participants whose responder strategy was non-monotonous in phase 2 did not change overall results.

Table 1. Median and quartile-distance of those participants with a monotonous and a non-monotonous responder strategy with respect to their effort to make accurate decisions.

Responder strategy	phase	MD	Q	U	p
Monotonous	1	6	1	258	< 0.05
Non-monotonous	(item 19)	4	1.5		
Monotonous	2	7	0.5	155.5	< 0.01
Non-monotonous	(item 21)	4	1.25		

Note. MD indicates the median, Q indicates the quartile-distance (computed as: $((Q_{75} - Q_{25})/2)$, U indicates the test value of the Mann-Whitney Test, and p the probability.

2.2.1 *Game Theory, Equity Theory, or Exploration of Response Behavior?*

The focus of the present section is on proposer behavior in phase 1. Four types of proposer motivation and corresponding behavior are relevant. First of all, proposers could be virtually certain that responders would accept any (positive) offer and maximize their payoffs on the basis of this expectation by offering only 0 or 1 in phase 2. This proposer type is henceforth called type-G since it behaves in accordance with game theory. Secondly, proposers might offer five times 5 because of fairness considerations, which means that they behave according to equity theory (type-E). Thirdly, proposers might submit several different offers in phase 1, thereby exploring response behavior in order to more efficiently exploit them in phase 2 (type-X). And, lastly, there may be proposers who employ completely idiosyncratic considerations in the sense of random offers (at least in phase 1). Those participants are referred to as type-I.

The hypothesis that only one proposer type occurs is clearly rejected by the data. Phase-1 proposer behavior falls into four categories that at least prima facie correspond to the four types: 3 participants make offers of 0 or 1 only (type-G), 13 participants make offers of 5 only (type-E), and 61 participants make 2 or more different offers (type-X/I). Further considerations will allow us to distinguish (at least tentatively) between type-X and type-I.

Of the 61 participants with diversified offers 48 place their offers such that they completely cover some range of possible offers (e.g., offering 2, 3, 4). Let us call such a set of offers *connected*. Table 2 displays the frequencies of accepted offers made by type-E, type-G, type-I and type-X participants taking the role of proposer as well as that of responder.

Table 2. Frequencies of accepted offers among proposers and responders

	Type-E participants (N = 13)				Type-G participants (N = 3)				Type-I participants (N = 13)				Type-X participants (N = 48)			
	Phase 1		Phase 2		Phase 1		Phase 2		Phase 1		Phase 2		Phase 1		Phase 2	
Offer A	Proposer	Responder	Proposer	Responder	Proposer	Responder	Proposer	Responder	Proposer	Responder	Proposer	Responder	Proposer	Responder	Proposer	Responder
0	0 (0)	4 (9)	0 (0)	5 (8)	1 (4)	1 (2)	0 (1)	1 (2)	0 (1)	4 (9)	0 (0)	3 (10)	0 (0)	2 (46)	0 (0)	1 (47)
1	0 (0)	8 (5)	1 (1)	9 (4)	5 (5)	3 (0)	1 (1)	3 (0)	2 (10)	6 (7)	0 (0)	9 (4)	6 (8)	12 (36)	2 (1)	15 (33)
2	0 (0)	9 (4)	0 (0)	9 (4)	0 (0)	3 (0)	0 (0)	3 (0)	3 (3)	9 (4)	1 (0)	10 (3)	11 (8)	14 (34)	2 (1)	19 (29)
3	0 (0)	7 (6)	0 (0)	9 (4)	0 (0)	3 (0)	0 (0)	3 (0)	1 (4)	9 (4)	0 (0)	11 (2)	20 (16)	21 (27)	3 (0)	42 (6)
4	0 (0)	9 (4)	0 (0)	9 (4)	0 (0)	3 (0)	0 (0)	3 (0)	7 (0)	9 (4)	3 (2)	13 (0)	45 (13)	39 (9)	18 (2)	47 (1)
5	58 (7)	12 (1)	8 (1)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	10 (2)	10 (3)	4 (0)	13 (0)	71 (9)	48 (0)	17 (0)	48 (0)
6	0 (0)	12 (1)	1 (0)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	3 (1)	11 (2)	1 (0)	13 (0)	28 (1)	47 (1)	2 (0)	48 (0)
7	0 (0)	12 (1)	0 (0)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	2 (1)	11 (2)	1 (0)	13 (0)	4 (0)	47 (1)	0 (0)	48 (0)
8	0 (0)	12 (1)	0 (1)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	9 (1)	11 (2)	0 (0)	13 (0)	0 (0)	46 (2)	0 (0)	48 (0)
9	0 (0)	12 (1)	0 (0)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	3 (0)	10 (3)	1 (0)	13 (0)	0 (0)	46 (2)	0 (0)	48 (0)
10	0 (0)	12 (1)	0 (0)	13 (0)	0 (0)	3 (0)	0 (0)	3 (0)	2 (0)	9 (4)	0 (0)	13 (0)	0 (0)	46 (2)	0 (0)	48 (0)

Note. In parentheses you will find how many times an offer of A was rejected.

According to aggregate data, higher offers are more frequently accepted and expected payoffs are single-peaked.[4] If one expects a single peak in expected payoffs and has an interval prediction of where it lies, connected offers make sense. This may justify experimentation by making connected offers (in phase 1).

Searching for the offer that maximizes expected payoff suggests strategic thinking. We therefore interpret connected offers in phase 1 as signaling type-X participants. Since the probability of a connected random offer is approximately 0.05, the margin of error is small due to type-I participants. The remaining 13 participants are (tentatively) classified as type-I since their offers might very well have been random. In view of this classification, we can conclude that the most frequent type is X (48 participants), and hence the main cause of aggregate proposer behavior in phase 1 is uncertainty concerning response behavior.

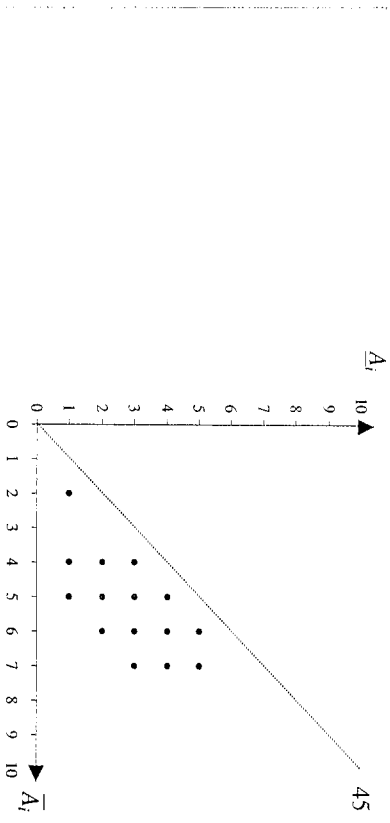

Figure 1. Range of experimentation of type-X participants (N = 48)

Note. Let A_i denote the 5-tuple of offers by participants i, by $\overline{A}_i$ its maximal and by $\underline{A}_i$ its minimal component. The chosen pairs $(\underline{A}_i, \overline{A}_i)$ are graphically indicated in the possible area.

Assuming (sufficient) risk aversion type-E behavior might be viewed as rational since the optimum offer in both phases is 5. Nevertheless, such a conclusion would be premature. Participants played in the same group of six participants in both phases. If

[4] In the relevant range of offers (92.73% of all phase-1 offers ranged from 1 to 6), the relative frequency of acceptance taken over all participants rises monotonously. Calculated on the basis of these relative frequencies and despite slight non-monotonicities for high offers, expected payoffs are single-peaked in both phases with a maximum at an offer of 4. If one was willing to trade off a small reduction of expected payoff against a moderate rise in acceptance frequency (risk aversion), the optimum offer in both phases was 5.

one calculates the acceptance frequencies and corresponding expected payoffs for individual groups, it turns out that experimentation in phase 1 yields valuable information about group characteristics. One would have obtained a higher expected payoff than type-E behavior by offering 1, 2, 3, 4, 5 in phase 1 and repeating the offer with the highest expected payoff in phase 2. Thus, viewed as a payoff-maximizing strategy, type-E behavior more or less correctly presupposes aggregate acceptance frequencies, but under- estimates the variability of response behavior. Given these data, exploring response behavior in phase 1 is reasonable. However, the extent to which one explores responses (i.e., the width of the range covered by phase-1 offers) depends on the subjective certainty concerning the probable location of the best offer. Thirty-one of the 48 type-X participants offered only 2 or 3 different offers, and 25 participants included an offer of 5. Figure 1 displays the range of experimentation of type-X participants.

2.2.2 *Questionnaire Data and Phase-1 Proposer Behavior*

Generally, answers from the questionnaire seem to be consistent with type-specific motivations. We only mention some selected significant findings.

Table 3. Median and quartile-distance for participants with respect to items 2, 12, 15, 17 and 18

Item	Participants	MD	Q	U	p
2	Type-X	2	1.5	20.5	< 0.05
	Type-G	7	1.5		
12	Type-X	6	1	512	< 0.05
	Types-EGI	5	1		
12	Type-E	4	2.25	262.5	< 0.1
	Types-GIX	6	1		
15	Type-X	6	0.88	329.5	< 0.01
	Types-EGI	7	0.5		
15	Type-E	7	0	181.5	< 0.01
	Types-GIX	6	1		
17	Type-X	1	0.5	487.5	< 0.05
	Types-EGI	2	1.5		
17	Type-E	3.5	1.88	237	< 0.05
	Types-GIX	1	0.5		
18	Type-I	3.5	2.25	223.5	< 0.05
	Types-EGX	6	1		

Table 3 indicates that type-X participants more pronouncedly than type-G participants did not expect proposers to submit only offers equal to 1 (item 2). Type-X participants agreed more than others with the idea that a proposer submits different offers because he/she wants to learn about the acceptance rate of these offers (item 12) and less with the idea that a proposer submits different offers because he/she feels bored (item 15). Moreover, they found it less acceptable that a proposer submits equal offers because he/she has already decided what to offer (item 15). Thus, type-X participants seemed to be more strategically minded.

Table 3 also indicates that type-I participants were the only group that agreed less strongly that they had considered well their offers in phase 1 (item 18). Type-E participants accepted more than others that a proposer submits equal offers because he/she has already decided what to offer (item 15), agreed less that a proposer submits different offers because he/she feels bored (item 17) and rejected more than others that a proposer submits different offers because he/she wants to learn about the acceptance rate of these offers (item 12). Significance levels for items 12, 15 and 17 are even higher if we pool E- and G-types ($U = 306.5$, $p < 0.05$; $U = 210$, $p < 0.01$, $U = 316$, $p < 0.05$). Thus, type-E/G participants appear as more opposed to strategic thinking.

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2.2.3 *Response Behavior*

Our classification of participants into types can also be tested by looking at response behavior in phase 1. Type-G should accept any (or any positive) offer. Type-E should on average have the highest acceptance threshold. Type-I might easily show non-monotonous response behavior. The results indicate that type-G behaves as expected. Type-I shows non-monotonous response behavior significantly more often than other participants ($\chi^2 = 26.38$, $p < 0.01$).[5] This fits in well with the questionnaire result indicating that type-I participants had considered their decisions less well as a responder in phase 1 compared to others (item 19: $MD_I = 5$, $Q_I = 2$; $MD_{EGX} = 6$, $Q_{EGX} = 1$; $U = 286.5$, $p = 0.16$). Type-X showed non-monotonous response behavior significantly less often than other participants ($\chi^2 = 10.94$, $p < 0.01$). Contrary to our expectations, the acceptance threshold (lowest accepted offer) for type-E in phase 1 was lower than

[5] The chi-square values in this paragraph should be considered with reservations because the assumption of expected frequencies higher than five proved to be incorrect.

for other participants ($MD_E = 1$, $Q_E = 2$; $MD_{GIX} = 3$, $Q_{GIX} = 1.5$; $U = 122$, $p = 0.61$). It seems that type-E participants try to account for other types of behavior, e.g. proposers attempting exploitation.

The group with stronger-than-average feelings on fairness issues are those participants whose acceptance threshold in phase 1 was 4 or 5. Table 4 indicates that these participants view offers of 1, 2, 3, and 4 (items 5 to 8) as less fair. Fairness concerns seem to be more important for response than for proposer behavior. For type-X participants the acceptance threshold is significantly higher than for other participants ($MD_X = 4$, $Q_X = 1.25$; $MD_{EGI} = 1$, $Q_{EGI} = 1.25$; $U = 257$, $p < 0.01$).

Table 4. Median and quartile-distance for participants with a threshold of 4 or 5 compared to others

Item	Participants	MD	Q	U	p
5	Threshold of 4 or 5	2	1.5	500.5	< 0.05
	Others	2	2		
6	Threshold of 4 or 5	2	1.5	489	< 0.05
	Others	3	2		
7	Threshold of 4 or 5	4	1	501	< 0.05
	Others	4	1.5		
8	Threshold of 4 or 5	4	0.75	540.5	< 0.1
	Others	5	1.13		

Regarding response behavior in phase 2 the same behavior is only confirmed for type-G but not for type-E. Again, the acceptance threshold for type-E in phase 2 is lower than for other participants ($MD_E = 1$, $Q_E = 2.5$; $MD_{GIX} = 2.5$, $Q_{GIX} = 1.5$), although not significantly ($U = 332$, $p = 0.24$). Type-X again had a higher acceptance threshold than others ($MD_X = 3$, $Q_X = 1.5$; $MD_{EGI} = 1$, $Q_{EGI} = 1.25$; $U = 398$, $p < 0.01$).

One might respond strategically in phase 1 (i.e., reject relatively high offers) in order to trigger better offers in phase 2. Thus, the acceptance threshold should fall from phase 1 to phase 2. A falling acceptance threshold can also be interpreted as swallowing one's pride in the face of a much bigger pie. Overall, the acceptance threshold for all participants whose responder behavior was monotonous in both phases decreases significantly from phase 1 to phase 2 ($MD_I = 3$, $Q_I = 1.5$; $MD_{II} = 2$, $Q_{II} = 1.5$; Wilcoxon Signed Ranks Test, $z = -4.52$, $p < 0.01$). However, this statistically significant difference is caused by type-X participants only ($MD_{X,I} = 4$, $Q_{X,I} = 1.25$; $MD_{X,II} = 3$, $Q_{X,II} = 1.5$; Wilcoxon Signed Ranks Test, $z = -4.22$, $p < 0.01$).

2.2.4 *Phase-2 Proposer Behavior*

Let us call the difference between the offer and the acceptance threshold the offer markup. A positive offer markup means that the participant's offers are higher than his/her own acceptance threshold. For type-X, the offer markup in both phases was lower than for other participants (phase 1: $MD_X = 0.8$, $Q_X = 0.9$; $MD_{EGI} = 2.6$, $Q_{EGI} = 2$; $U = 427.5$, $p = 0.45$; phase 2: $MD_X = 1$, $Q_X = 1.25$; $MD_{EGI} = 3$, $Q_{EGI} = 2.5$, $U = 355$, $p < 0.1$), although not significantly in phase 1 nor in phase 2. On average the offer markup increases from phase 1 to phase 2 by 44.28% for type-X participants, whereas the offer markup of the remaining participants only increases by 18.77%. Table 5 indicates that these changes in type-X's offer markup result from the fact that their offers (in phase 1: lowest) rose from phase 1 to phase 2, whereas their acceptance threshold decreased from phase 1 to phase 2. Table 5 also displays the change in offer markup and acceptance threshold for all participants. Concerning the G- and E-types one should expect the same proposer behavior in phases 1 and 2, which is confirmed as indicated in Table 6.

Table 5. Differences in offer markup and acceptance threshold between the two phases

		Offer markup				Acceptance threshold			
Phase	Participants	MD	Q	z	p	MD	Q	z	p
1	Type-X	3	1	-4.43	< 0.01	4	2.5	-4.22	< 0.01
2		4	0.5			3	3		
1	All	3	1.75	-4.72	< 0.01	3	1.5	-4.52	< 0.01
2		4	0.5			2	1.5		

Note. z refers to the test value of the Wilcoxon Signed Ranks Test.

Table 6. Proposer behavior of type-E and type-G participants in phases 1 and 2

Phase	Participants	MD	Q	z	p
1	Type-E	5	0	-0.74	0.46
2		5	0		
1	Type-G	1	0.5	0	1
2		1	0.5		

The phase-2 offers by type-X participants should depend on the feedback concerning response behavior in phase 1. The same might hold for type-I participants.

Forty-two of the 48 type-X participants choose a phase-2 offer that they had actually tried out in phase 1 (conservative phase-2 offer). This difference is significant ($\chi^2 = 12.84$, $p < 0.01$, condition of expected frequencies higher than 5 fulfilled). The phase-2 offer by type-I participants, on the other hand, was conservative significantly less often than that made by of other participants ($\chi^2 = 24.01$, $p < 0.01$, condition of expected frequencies higher than five fulfilled). Figure 2a displays the offer distribution of type-X participants in phases 1 and 2, whereas Figure 2b displays the offer distribution of type-I participants in both phases.

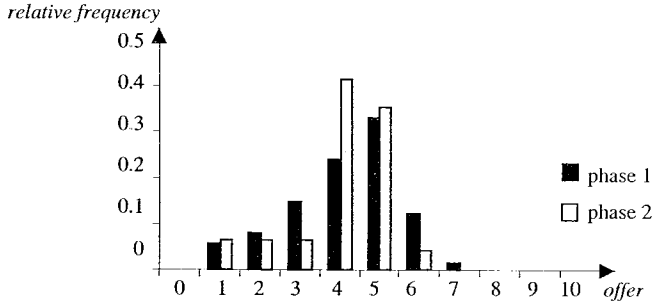

Figure 2a. Offer distribution for type-X participants in phases 1 and 2 ($N = 48$)

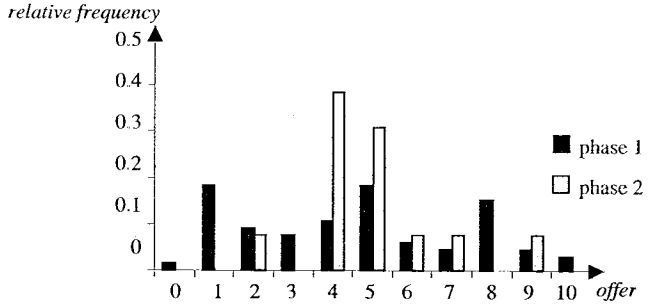

Figure 2b. Offer distribution for type-I participants in phases 1 and 2 ($N = 48$)

The phase-2 offer made by exactly half of the 48 type-X participants maximized the expected payoff as computed on the basis of the acceptance frequencies learned in phase 1. A pattern explaining the deviations from payoff maximization emerges if one looks at the acceptance frequencies for the offer that maximizes expected payoff. There is a tendency to offer less in phase 2 if the payoff-maximizing offer has been accepted by all 6 participants in the group, to stick to the offer if it has been accepted by 5 out of 6 participants, and to offer more if it has been accepted by less than 5 out of 6 participants (see Table 7a).

Table 7a. Acceptance frequencies and deviations from the payoff-maximizing offer in phase 2 for type-X participants (N = 48)

	Accepted frequency			Σ
	< 5	= 5	> 5	
Lower offer	2	2	8	12
Expected payoff maximizing offer	0	17	7	24
Higher offer	4	3	5	12
Σ	6	22	20	48

Table 7b. Acceptance frequencies and deviations from the payoff-maximizing offer in phase 2 for monotonous and conservative type-X participants ($N = 40$)

	Accepted frequency			Σ
	< 5	= 5	> 5	
Lower offer	2	1	6	9
Expected payoff maximizing offer	0	17	7	24
Higher offer	2	2	3	7
Σ	4	20	16	40

Table 7c. Acceptance frequencies and deviations from the payoff-maximizing offer in phase 2 for monotonous and conservative type-X/I participants ($N = 45$)

	Accepted frequency			Σ
	< 5	= 5	> 5	
Lower offer	2	1	6	9
Expected-payoff maximizing offer	0	18	10	28
Higher offer	2	3	3	8
Σ	4	22	19	45

The pattern deviates significantly from randomness ($\chi^2 = 16.67$, $p < 0.01$, condition of expected frequencies higher than five not fulfilled). Only 12 out of 48 type-X participants clearly contradict this pattern: They deviated although they received 5 acceptances (5 participants), or deviated in the wrong direction (offering more after 6 acceptances (5 participants) or less after less than 5 acceptances (2 participants)).

Thus, type-X reacts systematically to the feedback concerning response behavior in phase 1. Whereas 75% of type-X participants conform to the pattern described above, it explains only 65.6% of type-X/I participants. If we consider only those participants (type-X: 40 participants, type-X/I: 45 participants) who fulfill two further conditions, namely, monotonicity (monotonous response behavior in phase 1) and conservatism (repeating a previously tested offer in phase 2), 80% of both, type-X and type-X/I participants conform to the pattern (see Tables 7b and 7c).

2.2.5 *Questionnaire data and structural equations model (AMOS)*

Participants were also asked to fill out a post-experimental questionnaire covering items on perceived fairness, motives for proposer behavior as well as on the understanding of the experiment, and on the participants' effort to make accurate decisions.

Participants confirmed that their decisions as responders had been considered well, both in phase 1 (item 19) and in phase 2 (item 21), as had their decisions as proposers in phase 1 (item 18) and in phase 2 (item 20). Table 8 also indicates that there was agreement that the instructions were clear and easy to understand (item 22). Overall, participants were satisfied with the financial remuneration they received (item 25). All items are seven-step items ranging from 1 = I do not agree to 7 = I fully agree.

Table 8. Participants' response to items 18, 19, 20, 21, 22 and 25

Item	MD	Q
18	6	1.13
19	6	1
20	7	0.5
21	7	0.5
22	6	1.5
25	7	0

Reasons for exploration were studied by analyzing responses to the questionnaire. A confirmatory factor analysis ($\chi^2 = 53.28$, $df = 41$, $p = 0.10$, RMR[6] $= 0.18$, $AGFI$[7] $= 0.82$) was performed supporting the questionnaire factors fairness considerations (constructed of items 4, 5, 6, 7 and 8, reliability coefficient according to Cronbach's $\alpha = 0.91$), game theoretic solution (items 1 and 2, Cronbach's $\alpha = 0.57$) and accuracy, referring to how well participants' decisions as proposers and responders had been considered (items 18, 19, 20 and 21, Cronbach's $\alpha = 0.74$). Indices of these three factors were computed ranging from 1 to 7 (low values imply perceived unfairness, a strategy other than the one implied by game theory, and not to have made well-considered decisions as proposers and responders, whereas high values imply the reverse).

[6] The Root Mean Square Residual Index (RMR) displays the residual variance that cannot be explained by the model.

[7] The Adjusted Goodness of Fit Index (AGFI) displays the total variance that can be explained by the model with regard to the degrees of freedom.

The relationships between (i) fairness considerations, (ii) game theoretic solution, (iii) the subjective accuracy of participants' decisions, and (iv) their concluding offers in phase 1 and (v) in phase 2, considering the whole sample of 77 participants, were studied simultaneously within a structural equations model (AMOS). Whereas the first three factors (i to iii) refer to questionnaire data, the last two (iv and v) refer to actual behavior, namely participants' offers in phase 1 (average offers) and their concluding offers in phase 2.

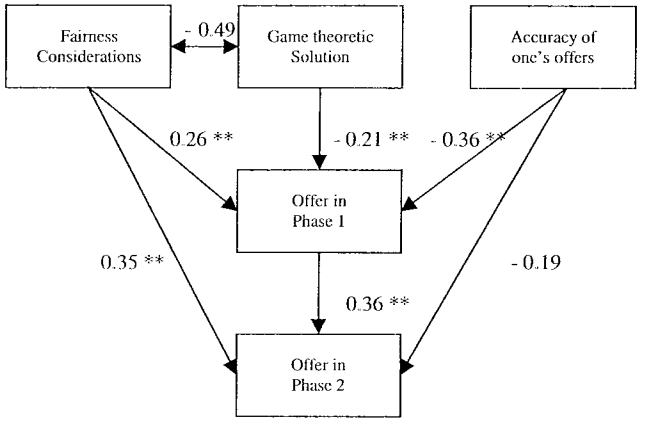

Figure 3. Linear structural model (N = 77, beta weights)

Note. Beta-weights marked with ** are significant at $p \leq 0.01$ (two-tailed)

It could be shown that participants who believed in fairness considerations submitted high offers in phase 1 as well as in phase 2, whereas those who believed in the game theoretic solution submitted lower offers in phase 1. Also, subjective accuracy of participants' decisions as proposers and responders were significant. As the accuracy of decisions increased, the offers submitted in phase 1, and also in phase 2, decreased.

Finally, offers in phase 1 were correlated with the corresponding offers in phase 2, whereas fairness considerations were found to be negatively correlated with the game theoretic solution. Figure 3 represents the results of the best fitting model ($\chi^2 = 1.49$, $df = 3$, $p = 0.68$, $RMR = 0.09$, $AGFI = 0.91$).

3. *Discussion*

More sophisticated game theoretic solution concepts like (subgame) perfect or sequential equilibria (see van Damme, 1991, for a survey) postulate a decentralization property in the sense that smaller (sub)games can be solved independently of their being embedded in a larger game context. For the situation at hand, this means that decisions in phase 2 are solely determined by the structure of the game played in phase 2.

Experimentation, however, implies that behavior in phase 1 is mainly focused on preparing and improving the decisions in phase 2, i.e., one assumes a holistic view of the whole experiment. Whereas neither game theory nor equity theory suggest a holistic view, our results reveal that only fairness- or equity-minded participants see no purpose in experimentation. Strategically minded participants, however, assume rather a global perspective and thus reject the decentralization hypothesis of the sophisticated game theoretic concepts mentioned above.

From a modeling perspective the holistic or global perspective offers quite a challenge since it could imply a more or less complex path dependence. When does a game start and when does it end? Apparently, human decision makers sometimes neglect the past, while sometimes they do not; but how this is organized is definitely not in the way suggested by game theory.

More specific results of our study are that neither game theory nor equity theory (although to a lesser degree) are fully supported. Only 3 participants (type-G) employed a strategy guided by the game-theoretic solution, whereas the behavior of 13 (type-E) participants followed fairness considerations. The majority of those participants, namely 48 participants, who were engaged in experimentation were found to be deliberating on a more rational and global level (type-X), whereas those participants who submitted equal offers were found usually to be norm-guided, most of them submitting 50:50-splits. The remaining 13 participants referred to as type-I participants employed completely idiosyncratic considerations in the sense that they submitted random offers.

It could be confirmed that strategic participants (type-X) rejected relatively high offers in phase 1 in order to trigger better offers in phase 2. Their acceptance threshold decreased significantly from phase 1 to phase 2, whereas their offers increased significantly from phase 1 to phase 2. As expected, type-X participants based their offer in phase 2 on the likely acceptance of their offers in phase 1. Forty-two of the 48 type-X participants chose a phase-2 offer that they had actually tried out in phase 1. Concerning the G- and E-types one should expect the same proposer behavior in phases 1 and 2, which could also be confirmed by the data.

Results of a linear structural equations model revealed that participants who believed in fairness considerations submitted higher offers in phase 1 as well as in phase 2, in contrast to those participants who believed in the game theoretic solution. Moreover, it could be shown that as subjective accuracy of participants' decisions as proposers and responders increased, the offers submitted in phase 1 and phase 2 decreased. Finally, fairness considerations were found to be negatively correlated with the strategy implied by the game theoretic solution.

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Appendix A

Instructions

The experiment describes a situation in which *10 points* may be divided between two partners called *proposer* and *responder*. The offer the proposer submits to the responder is called *A*. The rules are the following:

The proposer chooses A, that is, how many points out of 10 points he/she wants to submit to the responder. The proposer thus wants to keep the residual (10 – A) for him/herself. Only offers of A in integers from 0 to 10 are allowed.

The responder has to decide for each possible offer A whether to accept or reject it.

If the offer is accepted, the proposer obtains 10-A points; the responder obtains A points. If the offer is rejected, both obtain zero points.
This basic situation has to be played by all participants taking *both roles.*
In *phase 1* one point equals ATS 1.
As a *responder* (see page 1) you have to decide which of the eleven possible offers (A = 0, 1,..., 10) you want to accept or reject, respectively. As a *proposer* (see page 2 (Appendix B)) you have to submit five offers (A to E) to the other participants.

In phase 1 you will have to make eleven decisions between acceptance and rejection as a responder, and you will have to submit five offers to your group members.

After phase 1 is over, each participant will be informed about the acceptance of your offers by the other group members. At the end of the experiment your offers will be *randomly assigned* to other participants who will then decide about the acceptance of these offers and thereby about your financial payoff.

In *phase 2* one point equals ATS 30. The only other difference compared with phase 1 is that you will only have to submit one offer to one other participant which will be chosen randomly. As a proposer you only submit one offer A to one other participant. As a responder you have to decide which offers out of the eleven possible offers you accept and which you reject, respectively.

Please do not communicate!

Appendix B

Page 1

Phase I *Code No.: .....*

Your decisions as a responder:

You have to decide between acceptance (+) and rejection (-) for each of the eleven possible offers A = 0, 1,..., 10

Offer A	0	1	2	3	4	5	6	7	8	9	10
Your decision (+, -)											

One point equals ATS 1

Page 2

Phase I *Code No.: .....*

Your decision as a proposer:

You play the role of a proposer five times. Thus, you have to submit five offers. Each offer can be any point out of A = 0, 1,..., 10. If the offer is accepted, you will obtain the residual (10 – A). The offers are independent of one another, equal, or different, whatever you choose. Your offers (A to E) will be submitted to other participants later at random.

	Your offer A = 0, 1,..., 10
Offer A	
Offer B	
Offer C	
Offer D	
Offer E	

Your offer of A was accepted by T participants:
(Will be filled out by the experimenter):

A. Your offer of ..... was accepted by ..... participants.

B. Your offer of ..... was accepted by ..... participants.

C. Your offer of ..... was accepted by ..... participants.

D. Your offer of ..... was accepted by ..... participants.

E. Your offer of ..... was accepted by ..... participants.

One point equals ATS 1

Page 3

Phase II *Code No.: .....*

Your decisions as a responder:

You have to decide between acceptance (+) and rejection (-) for each of the eleven possible offers A = 0, 1,..., 10

Offer A	0	1	2	3	4	5	6	7	8	9	10
Your decision (+, -)											

One point equals ATS 30

Page 4

Phase II *Code No.: .....*

Your decision as a proposer:

You have to choose an offer, which can be any point out of A = 0, 1,..., 10, you want to submit to a participant randomly chosen by the experimenter.

Your offer A = 0, 1,..., 10	

One point equals ATS 30

Appendix C

Code No.: .....

Questionnaire

Please answer the following questions:

1. Did you expect that proposers will only submit offers of 1?
   not expected ☐ ☐ ☐ ☐ ☐ ☐ ☐ expected
2. Did you expect that all participants will accept any offer higher than 0?
   not expected ☐ ☐ ☐ ☐ ☐ ☐ ☐ expected
3. How fair is it if a proposer just submits offers of 1?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
4. How fair is an offer of 0?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
5. How fair is an offer of 1?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
6. How fair is an offer of 2?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
7. How fair is an offer of 3?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
8. How fair is an offer of 4?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
9. How fair is an offer of 5?
   unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
10. How fair is it if a responder rejects an offer of 1?
    unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair
11. How fair is it if a responder rejects an offer of 5?
    unfair ☐ ☐ ☐ ☐ ☐ ☐ ☐ fair

Questions 12 to 17 refer to phase 1 of the experiment:

12. A proposer submits different offers, because he/she wants to learn about the acceptance rate of these offers.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

13. A proposer submits different offers because he/she is not yet sure about which offer to submit.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

14. A proposer submits equal offers because he/she is not interested in the acceptance rate of these offers.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

15. A proposer submits equal offers because he/she has already decided what to offer.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

16. A proposer submits different offers because he/she wants to explore responder behavior.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

17. A proposer submits different offers because he/she feels bored.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

Finally, please answer the following questions about the experiment itself:

18. I have considered my offers in phase 1 well.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

19. I have considered well my decisions as a responder in phase 1.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

20. I have considered my offer in phase 2 well.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

21. I have considered well my decisions as a responder in phase 2.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

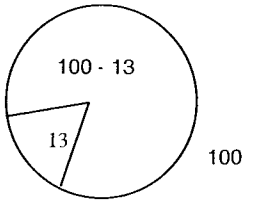
22. Instructions were clear and easy to understand.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

23. The probability that an offer will be accepted is equally high in both phases.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

24. In phase 2 everything is different.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

25. I am satisfied with the financial remuneration I received.
I do not agree ☐ ☐ ☐ ☐ ☐ ☐ ☐ I fully agree

Please answer the following two control questions:



1. The proposer submits an offer of 13 out of 100 to the responder. The responder *accepts* this offer.

Thus, the *responder* obtains .....

and the *proposer* obtains .....

2. The proposer submits an offer of 13 out of 100 to the responder. The responder *rejects* this offer.

Thus, the *responder* obtains .....

and the *proposer* obtains .....

Thank you for your participation!