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Heike Hennig-Schmidt

Bargaining in a Video Experiment

Determinants of
Boundedly Rational Behavior



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To my family:
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Chapter 1

Introduction

In this study we will analyze an experiment which is designed to observe experimental subjects in decision situations. The design of our experiment was motivated by the fact that experiments clearly show that subjects do not behave according to the assumptions of neoclassical microeconomics. As Tversky and Kahneman (1986) put it “...the deviations [...] are too widespread to be ignored, too systematic to be dismissed as random error and too fundamental to be accommodated by relaxing the normative system” (p. 68).

Subjects do not behave according to full rationality, i.e. making decisions according to Bayesianism and the game theoretic notion of Nash equilibrium. They behave according to bounded rationality, the goal-oriented systematic behavior human beings show when taking actual decisions. It is an empirical question to discover the determinants of boundedly rational behavior.

Human beings are bounded concerning the access and processing of information as well as their computational capacities. The complexity of optimization goes beyond their cognitive capabilities. This fact was pointed out by Herbert Simon already in the 1950s. He introduced the concept of bounded rationality in human subjects, and stressed the necessity to take into account the empirical behavior of individuals instead of deriving it from abstract principles. He demanded that the global rationality of economic men should be replaced by boundedly rational behavior (Simon, 1955).

In addition to cognitive limitations, also motivational and emotional bounds of rationality may be a feature of bounded rationality: It is not the lack of cognitive capability but the failure of behavioral trust into abstract induction arguments that is likely to guide human behavior (Selten, 1978a, 1993).

Research has provided clear evidence that subjects do behave according to rules that are not guided by full rationality. Yet many experiments show that the typical behavior of experimental subjects is not irrational even if it is nonoptimizing. It is rational in the sense that it is grounded on reasonable

systematic principles which are quite different from those normative decision and game theory assumes (Selten, 1990, 1997).

Since we still have only limited knowledge of boundedly rational economic behavior, the aim of this exploratory study is to look for behavioral regularities in the context of our bargaining experiment, and to learn about subjects' reasoning and motivations. As will be shown later, we found such regularities that facilitate handling the subjects' difficult task of problem solving during a decision process. How do we get the data in order to achieve our aim?

When conducting experiments in a computer laboratory we do get a great number of data in a quick and very efficient way. However, the disadvantage of this method is that only formal decisions can be observed. We get the results of the individuals' decision processes, but we obtain no or only few verbalizations of the players' decisions that allow an interpretation of their motives. Since we are interested in the way how subjects actually behave and in the motives for their behavior, people have to be observed in decision situations and, moreover, they have to be induced to verbalize their thought processes. There are several methods to address the problem:

1. At the beginning, at the end or during the experiment subjects are asked to report on the motives for their decisions by *questionnaires* or other means¹.
2. Interviewing people in field studies could reveal the intentions of decision makers without using questionnaires in order not to impose structure on an interview which might not capture the important aspects of the problem (Bewley, 1997).
3. Strategies can be made observable by the *strategy method* (Selten, 1967). Subjects have to write computer programs for a given problem. For every possible situation they have to program a corresponding solution (see for example Selten, Mitzkewitz, and Uhlich 1997, Keser 1992).
4. The method of *thinking-aloud* asks subjects to vocalize their thoughts, thought processes, motives and reasons when solving a problem. Yet there is evidence that deliberately verbalizing motives or reasons for one's thinking leads to different outcomes than spontaneous remarks (c.f. Ericsson and Simon 1984, pp. 78).

¹Nagel (1998) reports on two experiments the participants of which have been readers of newspapers. They have been asked to comment on their choices. The evaluation of these extensive statements will certainly further the understanding of subjects' reasoning.

5. Subjects are observed during experiments by recording their spontaneous remarks during their decision process either on audio (Klemisch-Ahlert, 1996) or on videotapes (Ostmann, 1990). Two or three subjects act together in a group and have to perform a common task. The discussions between the group members are transcribed into text protocols, and these protocols are investigated.

In our experiment we decided to follow the latter approach. The methodology of videotaping does provide a unique opportunity to observe the spontaneous behavior of subjects during their decision processes, and therefore extremely well meets the methodological requirement that hypotheses and conclusions in economics should be based on entities that are observable and thereby are falsifiable.²

Controversies about how to explain deviations from normative predictions on behavior in equilibrium provoked a lot of papers hypothesizing on the motivations that might have led people to the observed behavior³. Most of the authors quoted by Roth (1995a) address the deviations from game theoretic predictions by including noneconomic concerns into utility functions. Other authors strictly reject this approach since their results from ultimatum bargaining indicate that subjects are not maximizing (Güth, 1994, 1995, Güth and Tietz, 1990). This statement complies with the findings from our experiment; the videotapes clearly show that subjects do not maximize. Since we have a means of observing directly what people are doing and how they are arguing in a certain experimental setup we should use it to learn which motives might lead subjects to certain actions. If we find behavioral regularities being valid in different setups we possibly can make better predictions and design better descriptive theories.

We will see that the regularities we found are not at all new findings. What is new is that in our experiment they are directly observable in contrast to the most common practice in designing experiments where one can at best hypothesize on the existence of behavioral regularities underlying the obtained results. In this context it is worthwhile to quote Herbert Simon (1962, p. 12) who wrote that if the words could be recorded that accompany the thoughts being induced by problem solving a great deal could be learned about the process. He notes that decision making in groups is "... a means of externalizing the phenomena and making them accessible to observation."⁴

²C.f. Hildenbrand (1994a,b, 1998)

³See for instance Roth (1995a) for an overview on experiments in ultimatum bargaining.

⁴See also Camerer and Thaler (1995) and Camerer (1997b) who writes that ignoring almost all data but choices in experimental economics "...wastes a valuable opportunity to learn something more from a group of subjects who are often eager to

Looking closely at actual behavior shows that there is a lot more to be discovered than an even intensely contemplating theorist may imagine. People are different, and the behavior of others could be guided by motives that may not be worthwhile thinking about or may even not be conceivable for another person. We found for instance that non of the noneconomist students and less than 50% of the economists knew the concept of "Split the Difference" which, however, is a commonly used solution concept in game theory .

From a game-theoretic point of view the game played in our experiment is classified as a game with complete information. However, there are uncertainties in many respects. The guaranteed payoff is the only information on opponents that groups receive. The number of possible decision alternatives, i.e. the possible divisions of the coalition value, is very large. Moreover, groups don't have any knowledge of their opponents. They have no information on most of the variables game theory assumes as common knowledge, and they don't know all the determinants which may affect decisions and which are possibly different from those game theory takes for granted, e.g. whether opponent's decisions are purely payoff-oriented.

There is a whole range of factors that may affect bargaining behavior , and, as we saw from the experiment, in fact do have influence. Therefore, players have to find guidelines for their behavior that makes the decision problem manageable and criteria that allow them to select the alternative that is to be taken as final decision.

explain their thinking processes and inferences. Whether their thoughts are useful or not is difficult to answer, but it is surely less difficult if we collect such data!" (p. 325).

Chapter 2

Description of the Experiment

2.1 Experimental Design

In our experiment a two-person characteristic function game was played. Each of the 'players' comprises a group of three, in some cases two, persons. The groups receive a guaranteed payoff, if they do not form a coalition, but break off the negotiation. These values, being $v(1), v(2)$, where $v(1) > v(2)$, are also called alternative, outside option, threat point or status quo. The coalition value, $v(12)$, can be distributed between the two groups, where $v(12) > v(1) + v(2)$ and $v(1) + v(2) = v(12)/2$.

The experimental setup was arranged as follows: The two groups negotiate on the allocation of the coalition value by alternately making offers to the opponent group. The negotiation ends if one of the groups accepts the proposal of the other group or if one of the groups breaks off negotiation. The subjects in each group are instructed to argue which of the decisions allowed by the rules of the game is to be taken and why this should be done. At the end of this discussion they have to take a joint decision.

The following decisions can be taken if a group is in decision mode:

1. *Making a proposal* on the allocation of the coalition value,
2. *Shift*, i.e. passing the initiative to the other group without making a proposal,
3. *Accepting* the last proposal of the other group,
4. *Breaking off* negotiation.

We gave no rules how the decision was to be taken within the groups. There was no time constraint. The groups did not bargain directly with each other. Only their decisions were transmitted by the experimenter. Each participant received a money payoff proportional to the final payoff of his or

her group. Thus we excluded within-group bargaining on the distribution of the amount finally paid. The point-to-cash rate was 1 to 0.10 Deutsche Mark in each session.

Payoffs were calculated such that individuals could gain about 12 Deutsche Mark per hour, an amount students used to earn if they had a job in or outside the university. All but one group either received an offer ≥ 12 DM within the first hour of negotiation or could have achieved a fictitious payoff per hour $\gg 12$ DM had they accepted an early offer.⁵

Both groups received identical information on the alternatives of both groups and all other characteristics of the game. They knew that the other group got the same information⁶.

The design of our experiment follows as closely as possible a computer experiment by Uhlich (1988, 1990), and Kuon and Uhlich (1993) which was conducted in the Bonn Laboratory of Experimental Economics. Our experiment, however, was restricted to those two of the games with a positive threat point carried out by Kuon and Uhlich where the two alternatives added up to half of the coalition value. The design concerning the decision alternatives was exactly like in the Kuon/Uhlich-experiment, the essential difference being that subjects did not have to decide on their own, but were grouped with other subjects and had to make a joint decision. Moreover, they were videotaped during the entire experiment.

We had three treatments⁷: two different values for $v(1)$ and $v(2)$, and two levels of experience (cf. Table 2.1).

Groups with a larger alternative $v(1)$ we call S-groups, and those with a smaller alternative $v(2)$ we call W-groups (group 1 or group 2 respectively). The numbers we refer to are the amounts that are attributed to S-groups. Proposed amounts are to be interpreted either as demands of S-groups for themselves or as offers of W-groups to S-groups. To get the figures for W-groups the corresponding amounts have to be deducted from 320, the coalition

⁵Subjects participating in our experiment saw the money they were going to earn as part of their monthly budget. They calculated which goods of their daily expenses they could buy or were not able to buy if they gain or lose certain amounts of money, e.g. a meal in the students' cafeteria (4.1.21; 5.1.9, 5.1.26; 6.1.4; 12.1.18), beverages at the Christmas fair or in the students' cafeteria (8.2.3; 9.2.3, 9.2.35; 10.1.94, 19.1.32; 18.2.17; 19.2.11, 19.2.12, 19.2.31), a ticket for a movie or a concert (5.2.12; 10.1.42), buying Christmas presents (6.1.14; 7.1.24), a meal in a restaurant (10.1.73; 12.1.14; 15.1.4, 15.1.23; 18.2.5), cigarettes (4.1.42).

⁶The introduction to the experimental subjects is to be found in Appendix A.

⁷We use the terminology following Davis and Holt (1992, p. 21): *session*: a sequence of periods involving the same group of subjects on the same day; *treatment*: a unique environment or configuration of treatment variables, i.e., of experience and incentives; *experiment*: the collection of sessions in one or more related cells.

Table 2.1: Coalition values, alternatives, relation between alternatives and number of sessions in different treatments

$v(12)$	$v(1)$	$v(2)$	$v(1)/v(2)$	Number of sessions
Inexperienced (I-)Groups / I-sessions				
320	96	64	3:2	6
320	128	32	4:1	6
Experienced (E-)Groups / E-sessions				
320	128	32	4:1	8

value $v(12)$ that is to be distributed between the two groups in case of agreement. It will be stressed if occasionally we refer to amounts of W-groups.

Inexperienced groups (I-groups) consist of subjects who had not participated in our experiment before or in the computer experiment by Uhlich, and Kuon and Uhlich. Experienced groups (E-groups) are those who had already participated in our experiment. Sessions with inexperienced participants we call I-sessions, those with experienced subjects we call E-sessions.

According to the different treatments we distinguish the following types of groups (see Table 2.2):

Table 2.2: Types of groups according to different treatments

Game Type	Experience of Groups			
	Inexperienced (I)		Experienced (E)	
	$v(1)$ S-Groups (S)	$v(2)$ W-Groups (W)	$v(1)$ S-Groups (S)	$v(2)$ W-Groups (W)
$v(1)/v(2) = 3:2$	96	64		
Low (L)	ISL	IWL		
$v(1)/v(2) = 4:1$	128	32	128	32
High (H)	ISH	IWH	ES(H)	EW(H)

If an I-group agreed to play in an E-session, all subjects were asked to participate again to ensure that the composition of the groups did not change. This requirement could not always be met. In addition to two I-groups that consisted of two persons, in another 8 E-groups only two persons participated.⁸ E-groups were matched such that the opponent group changed, they did not play against a group which they had met already in I-sessions.

It was our goal to arrange the groups in such a way that in E-sessions all S-groups became W-groups and vice versa. This was not possible in three cases: two strong groups remained strong, one weak group remained weak again.

Sessions are divided into proposal rounds, abbreviatingly called rounds in the following, a *proposal round* being the time between two decisions plus the decision of the previous round. We decided to use this definition since mostly extensive discussions started as a reaction to the foregoing proposal of the opponent group. The structure of the discussions becomes more transparent by assigning rounds to the decisions they refer to.

We introduce an abbreviating notation to indicate groups and rounds in particular sessions. 10.1.86, e.g., has the following meaning: the first one or two digits refer to the session number. The sessions are numbered chronologically as they have been conducted. The third digit indicates whether we examine group 1 or group 2, i.e. an S- or a W-group. The next (maximally three) digits indicate the round number. Thus we indicated session no. 10, group no. 1, round no. 86 in the transcripts of this group (Hennig-Schmidt 1996a).

2.2 Organizational Features

When registering for the experiment subjects were informed that they would be videotaped. They signed that they agreed to be videotaped, and that the tapes could be used for scientific purposes. They were told when and where to show up, first mover groups arrived 15 minutes earlier than second mover groups. Groups were assigned randomly to be S- or W-groups. When showing up subjects were gathered in rooms apart from each other. They were seated in front of a videocamera such that all verbal and nonverbal expressions could be recorded. The videocamera was switched on when the session started. Beside each camera there was a student helper in order to ensure that subjects did not stop the recording. Subjects were provided with

⁸In 3 of these 8 groups only one of the original group members was willing to participate. In order to be able to run the session we asked one of the student helpers to join the group having served in one of the I-sessions as a controller and thus could also be seen as experienced.

one copy of the introduction and several copies of the bargaining protocol (see Appendix A). In addition they had to fill in a questionnaire after each decision. The questionnaire asked whether subjects agreed with the group's decision. In case of deviation they were requested to write down their preferred decision and the reasons. Moreover, they were asked to evaluate the atmosphere within the group ranging from 1 (excellent) to 9 (very bad). This questionnaire was meant to give those subjects who might not have been able or willing to articulate themselves before the camera the possibility to write down their thoughts. Yet, this fear proved to be unfounded since all subjects very lively took part in often most controversial discussions. However, in case of deviation they readily used the additional chance to state their different view.

At the beginning of each session the experimenter (the author) gave an introduction to the subjects according to Appendix A. Afterwards subjects were asked to read the introduction carefully and ask questions which were answered. Having finished the introduction the experimenter left the room to instruct the other group in exactly the same way. This was the starting time for proposal round 1. After a decision had been taken, i.e. subjects had agreed on an allocation to be proposed to the opponent group, they had to write it down into the bargaining protocol. Each participant had to sign that he/she assents to this proposal. Then the experimenter was called by the student helper and was informed about the decision. She left the room and transferred the decision to the other group. After acceptance or break off the other group was informed and subjects were paid. Videotaping stopped after the group has left the room.