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Sources of Prominence in Computer Aided Experimental Spatial Games

by

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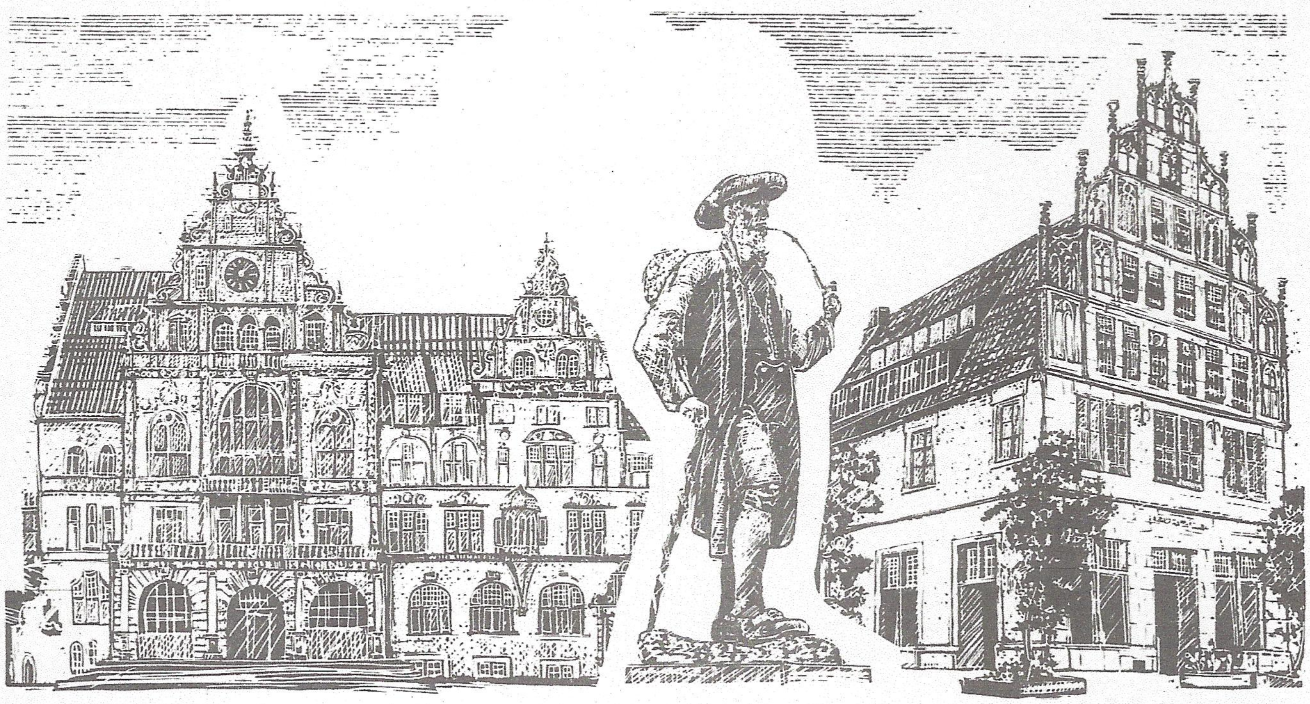

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CONTENTS

A. INTRODUCTION

The paper presents first general results of point selection behavior in location games. It addresses the question to what extend intrinsic structural elements of framing influence the selection behavior. The results may give an impression to which extent "nonrational motives" do guide players' selections. The results seem to show clearly that an adequate theory has to take these phenomena into account. It seems that subjects are approaching rational behavior by learning, starting with fair solution ideas for subcoalitions, and from there learning step by step to take into account the specific power of different players given by the structure of the game.

From this point of view the paper is also a useful information for mathematical modellers, informing about the main nonrational components influencing players behavior.

The relations of the obtained results to rational concepts as the generalization of the stable demands approach to the experimental results will be given in another paper. Before this can be done, it is anyway necessary to reflect about an adequate transformation of the stable demand approach, and to work out the different basic ideas of alternative approaches carefully, to find out which part of subjects behavior is really met by which parts of the models.

On the way to such an analysis this paper seems to be a necessary step, since it enables to extract that parts from the analysis which are influenced by those behavioral patterns which are not intended to be modeled by a purely rational theory. In other words: this analysis explains an essential part of the observed variance, so that a detailed comparison of purely rational theories becomes more promising.

B. SPATIAL DECISION PROBLEMS

The paper addresses a particular kind of majority decision problem. A set N of five players must choose, by simple majority rule, one element z from a set X of decision alternatives, where z denotes the default outcome, the status quo. In principle, the status quo, becomes the decision outcome if it is enacted by a majority, or if no alternative in X is enacted by a majority, so that z becomes the outcome by default. [In the laboratory situation, the payoffs associated with the default outcome are sufficiently unattractive to players that the status quo may be ignored.] The set X of decision alternatives in this situation is represented by a grid of integer-valued points embedded in a two-dimensional Euclidean space. Each player i in N is assigned a payoff function (defined later in this paper) such that his payoff decreases linearly with the Euclidean distance in X of the decision point from that player's bliss point, xi in X. Everyone's payoff function, up to the addition of a positive constant, is common knowledge. Players with different bliss points have a conflict of interests, so compromises must be made if they are to agree on a decision outcome. Thus, each configuration of the five players' bliss points, which we shall call a figure, presents a distinct decision problem. The players' task is to select one decision alternative by simple majority rule through a process that is governed in minute detail by the formal procedure described next.

B.1 THE FORMAL MECHANISM FOR NEGOTIATIONS

We characterize somewhat informally here the formal mechanism governing the negotiation process. A precise specification is given in Appendix A (Albers and Laing, 1988). The mechanism identifies two phases in the negotiation process: (A) the tentative decision (or selection) phase, and (B) the final decision (or verification) phase. If the selection phase produces a tentative agreement (x,S) by any majority coalition S to enact decision alternative x, then that agreement must survive the verification phase if it is to become the final decision outcome. The verification phase is included to permit players to "test the waters" by exploring tentative decisions before they commit themselves to a final decision outcome.

The mechanism incorporates well-defined rules specifying at any stage in the bargaining process such details as (1) who has the floor, (2) what messages are in order, and (3) when a final decision outcome has been reached. Only the player who has the floor may send a message. The player who has the floor occupies just one of two positions: initiator or responder. The set of options that are available to a player in either of these positions depends on whether the negotiations are in the selection or verification phase.

In the selection phase the player with the floor has these options. The initiator, player i, can choose either (1) to pass the initiative to a chance selection of the next initiator or pass the initiative to a designated other player, j in N\i, or (2) to make a proposal (x,S), in which i S both offers an alternative x in X that S can enact, and specifies the order in which players in S\i are queued for responding to the proposal. In the responder position that follows a proposal (x,S) from i, player r in S\i (as responder) can choose either (1) to accept the proposal, or (2) to reject (thus cancelling) the proposal and thereby assume the initiator position. If the proposal (x,S) is accepted by all responders, then the process moves to the verification phase with (x,S) as the tentative decision.

In the verification phase for the tentative decision (x,S), each player will be given the initiative no fewer than a prespecified number of times, a*:=2, before the tentative agreement is enacted as the final decision outcome. In this phase, the options available at each position are modified as follows. The initiator can make a counterproposal or choose to pass, but in the verification phase he can pass only to a chance selection of the next initiator from the set of players who have not yet occupied the initiator position a* times in the verification phase for the current tentative decision. This same chance selection is reached if any responder to a counterproposal in the verification phase rejects the counterproposal. If any member of the coalition S forming the current tentative agreement either initiates or accepts a counterproposal during the verification phase, then the tentative agreement is cancelled and the selection phase is restarted to process the counterproposal. On the other hand, in the verification phase for the tentative decision (x,S), once every player has the initiative a* times and no member of S has cancelled the tentative decision by either making or accepting a counterproposal, then (x,S) is verified as the final decision.

The maximimum number of rounds to be allowed in the negotiation process can be set in the mechanism via the parameter t*, such that if no final decision is enacted by the end of round number t*, then the default outcome z is imposed as the final result. By definition, a new round in the negotiation process begins if (1) a player assumes the initiator position in the selection phase, or if (2) a member of the coalition forming the current tentative agreement either makes or accepts a new proposal in the verification phase. [In the latter case, the software implementation of this mechanism discussed next labels (relabels, if necessary) the new proposal as the first message in the new round.] In our laboratory situation wehad t*:=999, so that the maximum number of rounds permitted by the rules was practically unlimited.

B.2 COLLECTIVE DECISION PROCESS SOFTWARE

This mechanism provides a logic for the software system (Laing and Lau,1988) that was used in the laboratory situation to govern the bargaining process. In this system, players communicate in accordance with the bargaining mechanism via a network (NETBIOS calls) of 80286-based personal computers, each equipped with a hard disk, Enhanced Color Graphics, Microsoft Windows, and a mouse. This software implements simple collective decision games in which the set of n=5 players must select an outcome from a 1400 x 1200 (horizontal x vertical) coordinate system of spatially represented decision alternatives in accordance with the mechanism and m/n majority rule (m > n/2), such that any coalition with at least m members can enact any alternative in X that it chooses, once a member of the coalition gains access to the floor. (In our laboratory situation, m:=3.) This system controls the network in accordance with the bargaining mechanism. All messages are sent via the network. At each player's station the system presents a graphical display of the decision problem and the location of every player's bliss point, plots and records the default option, each proposal, and the tentative decision, maintains a current log of the messages sent in the bargaining on this problem, and identifies both the round and the name of the player who currently has the floor. It also provides a variety of graphical aids that the player may use. Thus the player can plot or "unplot": points; everyone's circle through a selected point; or straight lines connecting the bliss points of any or every pair of players. The screen display can be zoomed from the "big picture" (Zoom 0) for a magnified view of the subset of decision alternatives centered on any selected point in the grid, and two levels of magnification (Zoom 1 or 2) are available. Also, a window displays the coordinates of the current location of the mouse-controlled cursor in the grid and the distance of this point from the player's bliss point. The player can choose to display also in this window the distances of the cursor point from the other four players' bliss points. We shall present additional details about these features of the laboratory situation when they are needed in the subsequent discussions. For a more complete description, see the laboratory instructions in Appendix B.

B.3 THE LABORATORY STUDY

In the spring of 1988 at the University of Bielefeld, Federal Republic of Germany, we conducted an extensive series of laboratory studies of 17 five-person groups of upperdivision university students negotiating within this computer environment in accordance with the process mechanism and simple majority rule. This high-tech environment appeals to participants, the decision problems are intrinsically quite interesting, and high stakes are involved. Each player's payoff function for any of these decision problems is a (decreasing) linear function of the distance of the group's decision point from that player's "best" point (blisspoint). In accordance with this payoff function, a change of 10 distance units (about .13 cm if the screenview is not zoomed) from his best point anywhere in the 1200 x 1400 grid of decision alternatives implies a payoff increment of 2 DM (then about $1.15). Specifically, we assume that the preferences of each player i in N may be represented by the payoff function ui:X->R, such that for any alternative x in X, ui(x) = a * .2 di(x), where the a is an arbitrary positive constant and di(x) is the Euclidean distance in grid units of x from the blisspoint of player i. This payoff function, up to addition of a positive constant, of every player in the five-person group was common knowledge and all communications, conducted via the network and in accordance with the mechanism, were public. The default outcome was unattractive, having been set at a distance of 2000 grid units from each players blisspoint. The possible length of the game on any decision problem was virtually unlimited (t*:=999), and each game was played, in fact, until an outcome was reached. This design induces intensely focused negotiations and highly motivated play.

Moreover, we designed the study to observe sophisticated play of experienced subjects. We recruited 30 students from an upperdivision microeconomics class at the university who had volunteered to participate in at least two full-day laboratory sessions. Half of these students also participated in a third session, and 10 of these in a fourth. The assignments were made to ensure that no one in the present group had ever participated previously with more than one player in the group. Thus, altogether, we observed 17 laboratory sessions that, from the beginning of the first decision to the end of the last, averaged 6 hours and 42 minutes per session. In addition, instructing the subjects about the rules and giving them time to practice operating their computers within the software environment required roughly one and three-quarter hours for the first-time groups. On average, the first decision by the first-time groups took 3 and 1/4 hours; therefore, to some extent, the players were already experienced when they began decision 2. Clearly, the subjects who participated in a third or fourth session were highly experienced, having logged as much as 30 hours or more in the lab by the time they had finished. In the following we will also denote the first sessions as "experience 1", the second sessions as "experience 2", etc. .

Within a given session, the group played a sequence of distinct spatial games each governed by the mechanism and simple-majority rule. Within any such game, each player sat in a separate room and was identified by a color name that changed across games. Therefore each of the decision problems can be modeled as a distinct game. Altogether, we recorded data about the processes and outcomes of 103 decisions and 7 distinct spatial games.

The motivation of the subjects was high. They perceived the game as interesting and were engaged in the bargaining process. In fact they could earn substantial amounts of money. The actual total payoffs of the players ranged between DM 55 (around $ 27) (of a player who participated only in the first pair of sessions) and DM 544 (around $ 270).

The motivation was marginally. The players received 0.20 DM (around 10 cents) for every point of distance for which the finally selected point was better for them than the mean distance reached by the other players in the same position, where the mean was taken only over those games , where the player did not participate in any position. The 0.20 DM per point mean that by entering a coalition a player could easily increase his payoff by 50 DM (around $25) and more , and that he lost about the same amount when he dropped out of the coalition.

No subject could really loose money, the minimal amount a subject was promised to receive was 40 DM (around $20) for two sessions with 13 hours. In the first pair of sessions it happened two times (out of 30) that in the aggregated payoff a subject dropped below this benchmark, in the second pair of sessions it happened 4 times (out of 15). No player dropped below this bench mark in both pairs of sessions. The players were asked to contact the experimentator in case they had the feeling to have made so substantial losses, that they did not feel motivated for the following games. No player did so. (In fact it is difficult to estimate one's own success compared to that of the others, not knowing anything about the results of the other groups.)

In addition to the profits from the game the subjects received DM 10 (around $5) for every hour that a session did take longer than 6 1/2 hours.

C. GENERAL RESULTS

C.1 NUMBERS OF PROPOSALS AND TENTATIVE DECISIONS

Table C1 gives the numbers of proposals (P), tentative decisions (including the tentative decision itself) (P1), and the number of rounds for all games hich have been played (R).

Pure mathematical theories of rational player's behavior in the bargaining framework given here will probably predict that the player who is selected to start the game will give one proposal, that the other players in the coalition will accept this proposal and that this tentative decision becomes the final result. We must confess that we did not yet solve the game in the given structure with an quilibrium model, but such a model would in any way imply some criteria of rational behavior in bargaining chains, as for instance the asssumption of stationarity.

For a subject of our games - as for a mathematician - such a criterion of rational behavior is not known in advance. The task of the subjects may be seen in the problem, to discover such a criterion during the sessions, which can be applied in a way that it creates success. It is a priori not at all clear which criterion is selected. This is just the question of the mathematician to the experimentor, to give hints for reasonable criteria, and to give information about the criteria subjects apply to evaluate certain situations as stable.

From this point of view it does not surprise that in the first sessions the subjects performed only a low number of games (although the time of presence was sometimes twice as long as in later sessions). Even for experts it seems suprising that within the first sessions, which took between 7 1/4 and 12 hours only 3 (in 5 cases) or 4 (in 1 case), games have been played with a mean time of more than 2 hours per game ! (The experienced players in sessions 4 did on the average play for about 1 hour per game).

The mean time to create a proposal in these first sessions was about roughly 3 1/2 minutes. The mean in in sessions 2 was about 4 1/2 minutes and in sessions 3 and 4 it was nearly 5 1/2 minutes. This suggests that with growing experience players selected the points less spontaneously and with more care. That we obtained this result although the manual abilities of using the tools have been learned in the first session and the imaginative skill of the players had been trained in all preceding sessions, suggests that the players did put essentially higher efforts into considerations of possible future moves in the game.

The high numbers of proposals (10 of the 19 games of the first session have more than 30 proposals) have been frequently created in long sequences of redistributional bargaining within three-person coalitions (or even between two players). This behavior reminds on two person bargaining, where players start with relatively extreme claims and then reduce their demands step by step. Chains of redistributional bargaining have been essentially shorter and happened essentially less frequently in later games.

It is mainly this behavior which creates the high number of proposals before the first tentative decision is made. (We observed a mean of 15.8 proposals per game in session 1, but only 5.3 per game in session 2 and 3.6 per game in sessions 3 and 4. On the other hand the number of tentative decisions per game did increase with experience 2 so that the number of proposals per tentative decision was essentiallly reduced. This indicates that experienced players bargain more carefully and with less bilateral or multilateral "pulling". The behavior seems to be more and more governed by the intention to obtain a result which has a good chance to become final. This explanation is supported by the dramatic reduction of the number of proposals per game.

There are essential differences between the games. To make this visual we added values P, T, P1 and R of table 1 to create a variable "intensity of bargaining", informing, how difficult bargaining was (see table C2).

TABLE C2: mean "intensity of bargaining" for different games

	A	F	H	M	W	mean A-W	B	S
exp 1	129.6	51.4	87.6	56.4	77.9	80.6	-	-
2	27.7	32.2	23.5	41.0	49.4	34.8	20.3	-
3+4	20.1	17.5	15.5	28.4	21.7	20.5	13.3	9.5

The results suggest that the subjects needed different times to learn a general behavior in different games , so that for instance game H seems to be perceived as "quite difficult to solve", in the first session, but seemed to be perceived as comparatively easy to solve later. On the other hand, game M had a

TABLE C1: proposals and tentative decisions in different rounds

groups of exp	A				F				H				M				W				B				S				ALL			
	P	T	P1	R	P	T	P1	R	P	T	P1	R	P	T	P1	R	P	T	P1	R	P	T	P1	R	P	T	P1	R	P	T	P1	R
A 01-03	35	5	20	32	20	5	2	19	43	5	9	28	44	8	13	38	19	6	2	13												
	82	3	79	81					14	4	2	2	25	1	25	25	51	1	51	51												
B 01-03	32	5	8	32	13	2	12	13	62	20	22	51	3	1	3	3	8	1	8	8												
	36	6	5	37	22	1	22	22	28	7	2	24	14	4	2	10	33	6	7	32												
exp 1	46.3	4.8	28.0	45.3	18.3	2.7	12	18	36.8	9.0	8.8	26.3	21.5	3.5	10.8	19.0	27.8	3.5	17.0	26,0									30.7	4.8	15.5	27.4
A 11-13	8	4	1	7	8	3	6	8	12	5	6	12	26	7	6	15	5	3	1	4	10	3	6	9								
	11	1	11	11	5	2	4	5	5	2	4	5	36	13	8	28	8	1	8	8												
	3	1	3	3	25	7	16	21	5	1	5	5	4	2	3	4	45	1	9	40												
B 11-13	12	3	7	10	22	8	3	18	4	1	4	4	9	3	3	6	13	3	9	13	3	2	2	3								
	18	5	1	14	8	3	2	7	5	1	5	5	27	9	5	19	15	8	1	14	4	3	2	4								
	9	1	9	9	1	1	1	1	6	1	6	6	11	4	1	5	31	9	6	25	4	2	3	4								
									15	4	7	12																				
exp 2	10.2	2.5	5.3	9	11,5	4	5.3	10.0	7.4	2.1	5.3	7.0	18.8	6.3	4.3	12.8	19.5	4.2	5.7	17.3	5.3	2.5	3.3	5.0	9	2	2	5	12.4	3.6	5.0	10.4
C 01-03	4	2	1	2	6	3	3	6	5	2	4	5	8	2	4	2	2	1	2	2	3	1	3	3	5	2	1	4				
	15	1	14	15	8	1	8	8	2	1	2	2	14	6	3	12	23	4	5	14	11	5	1	5	12	5	2	6				
	2	1	2	2	4	1	4	4	12	3	8	10	18	5	6	14	3	2	1	3	4	1	4	4	1	1	1	1				
					2	1	2	2	4	2	2	4	13	5	7	11	4	1	4	4	2	2	1	2	4	3	1	3				
C 11-13	4	4	1	4	3	1	3	3	4	3	2	4	4	4	1	4	18	5	5	17	8	3	2	4	1	1	1	1				
	2	1	2	2	15	5	1	11	2	1	2	2	17	5	4	13	3	2	1	2	1	1	1	1	1	1	1	1				
	17	4	6	12					7	4	3	6	4	1	4	4					4	1	4	4	2	1	2	2				
																					3	3	1	3	4	2	3	4				
exp 3+4	7.3	2.2	4.3	6.2	6.3	2.0	3.5	5.7	5.1	2.3	3.3	4.7	11.1	4.0	4.1	8.6	8.8	2.5	3.0	7.0	4.5	2.1	2.1	3.3	4.3	2.0	1.6	3.0	6.7	2.4	3.0	5.3

P = no. of rounds T = no. of tentative decisions P1 = no. of proposals to reach the first tentative decision (including the tentative decision itself) R = no. of rounds played comparatively low level in the beginning, but - relatively to the others - did raise to the first rank of intensity of bargaining under high experience. The bear and the simple star - although not played in the first (or the first two) rounds - did not create a high intensity of bargaining.

(The "bear" got his name from the high difficulty to compute the MC KELVEY-ORDESHOOK-Solution for this figure. More than 500 000 Dollars of computer time have been invested to find such a solution. However this seems to be no problem for the subjects: they neglect the time mathematical structure and solve the game similar to a 3-personn game with players 245.)

C.2 FORMED COALITIONS

There have been nearly exclusively 3-person coalitions proposed. These coalitions have been selected from the set 124, 125, 123, 234, 345, 145, 245 and 135. Tables C3 and C4 show the absolute and relative frequencies of these coalitions in proposals (P), tentative decisions(T), and final results (F) under the four degrees of experience. Data of coalitions which are symmetric with respect to the figure have been aggregated.

An different phenomenon is, that different coalitions were selected in different figures. We ordered the figures according to their similarity: F, A, H, M, W.

In fact, by turning the fox in a way that player 3 goes on top of the figure, and by pulling the two insiders, 2 and 4, outward so that their positions tuch the border, figure A can be obtained.. By pulling these positions even more outside and a little bit upward, one gets the house. Moving player 3 (in the top) downward, so that the roof becomes flat, and pulling players 1 and 5 into the direction of the axis of symmetry, the figure switches to M (standing upward down). Figure W is obtained from this by stretching the figure horizontally.

During this procedure of stepwise changes the set of reasonable coalitions does also change stepwise (see tables C3 and C4). In figure F coalitions 123/345 and 124/145 are most reasonable. For figure A the importance of 234 and 125/145 increases, while 124/245 go down in frequency. This direction of change is continued in game H, where coalitions 124/245 disappear and 234 becomes the most important coalition. In figures M and W the "corner coalitions", 123/345 become increasingly important and accordingly the freqency of coalition 234 goes down.

Coalition 135 was nearly exclusively selected in games M and W, but even there it did never become a final result. "Other" coalitions did only occur as proposals, except from 3 cases of tentative agreements of which one became the final result.

These observations do clearly support the idea that only extreme coalitions are formed. The formation of coalitions 124/245 in game F (which contradicts the idea) can be explained in the following way: as the radii show, on which compromises are made, the game was mainly perceived as a three-person game of players 2,3,4 where the compromises in the different coalitions were supported by 1 or 5, namely 23 by 5, 34 by 5, and 24 by 1 or 5, which gives the resulting coalitions 123, 345, 124, and 245. - Similar arguments explain the formation of coalitions 512/514 in figure A. - However it should be noted, that for both figures these coalitions did not become final results under experience 3 and 4.

The formation of coalitions 512/514, 123/345 and 234 is straightforward, and does not need additional comments. To mention is only the high importance which 123/345 becomes in games H, M and W. The avoidance behavior to coalition 234 in these games is described in detail in section G.2 . Remains to report that coalition 135 and the "other" coalitions are not predicted as solution coalitions for any of these games while the five coalitions 123, 234, 345, 451, 512 are predicted by the by the stable demand approach.

TABLE C3: absolute frequencies of proposals (P), tentative agreements (T) and final results (F) under experience 1,2,3,4 in different figures

game		F				A				H				M				W			
	exper	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
124	P	22	15	9	6	37	3	3	3	2	.	.	.	.	.	.	.	.	.	.	.
245	T	3	8	1	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
	F	1	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
125	P	.	1	.	3	15	18	9	8	45	27	15	9	12	39	22	18	15	29	15	7
145	T	.	.	.	.	6	.	.	2	11	6	4	3	.	11	7	4	3	9	.	2
	F	.	.	.	.	2	.	.	.	1	4	1	2	.	1	2	2	1	1	.	1
123	P	24	50	23	14	65	47	16	17	40	26	12	10	46	51	26	7	101	88	30	15
345	T	4	13	4	6	10	12	3	5	9	5	3	5	9	14	7	3	12	18	8	4
	F	2	2	3	2	2	6	2	2	1	.	2	1	2	2	1	.	3	4	4	1
234	P	17	23	3	2	79	13	4	5	68	27	11	6	19	38	16	12	.	14	2	5
	T	1	3	1	.	2	2	1	2	16	4	1	.	3	10	3	3	.	3	.	1
	F	.	.	1	.	.	.	1	1	2	3	1	.	2	2	1	1	.	1	.	.
135	P	.	.	.	.	.	.	.	.	1	.	.	.	16	5	3	.	11	9	1	2
	T	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	.	.	1	.	.
	F	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
oth	P	3	2	1	1	3	4	1	.	4	.	1	.	3	2	1	.	2	.	.	.
	T	.	.	.	.	.	1	.	.	.	.	.	.	.	2	.	.	.	.	.	.
	F	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
all	P	66	91	36	26	199	85	33	33	160	80	39	25	96	135	68	37	129	140	48	29
	T	8	24	6	6	19	15	5	9	36	15	8	8	14	39	18	10	15	31	8	7
	F	3	6	4	2	4	6	3	3	4	7	4	3	4	6	4	3	4	6	4	2

C.3 SELECTED POINTS

A general impression of the points the players selected in their proposal is given by figures 1 to 6 showing all proposals. These figures show that in their decisions subjects were clearly guided by connection lines, axis of symmetry, and midpoints of connection lines or triangles spanned by the blisspoints of sets of players. A detailed analysis of this "figural prominence" will be given in sections F an G.

On the other hand the points selected in the "star" (figure ..) do clearly show that the selection behavior has been influenced by other motives as well. In this perfectly symmetric game all solution concepts predict midpoints between any two players as solution points. However clearly asymmetric points have been selected and became tentative decisions in several cases. This indicates the high influence of bargaining history on point selection.

The paper here, however, focusses on that part of selection behavior, which is independent from special bargaining histories. The analysis of bargaining chains will be given in a separate paper.

TABLE C4: relative frequencies of proposals (P) tentative agreements (T) and final results (F) under experience 1,2,3,4 in different figures

game		F				A				H				M				W			
exper		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
124	PI	33	16	25	23	19	4	9	9	1	.	.	.	.	.	.	.	.	.	.	.
245	TI	38	33	17	.	5	.	20	.	.	.	.	.	.	.	.	.	.	.	.	.
	FI	33	67	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
125	PI	.	1	.	12	8	21	27	24	28	34	38	36	13	29	32	49	12	21	31	24
145	TI	.	.	.	.	32	.	.	22	31	40	50	38	.	28	39	40	20	29	.	29
	FI	.	.	.	.	50	.	.	.	25	57	25	67	.	17	50	67	25	17	.	50
123	PI	36	55	64	54	33	55	48	52	25	32	31	40	48	38	38	19	78	63	63	52
345	TI	50	54	67	100	53	80	60	56	25	33	38	63	64	36	39	30	80	58	100	57
	FI	67	33	75	100	50	100	67	67	25	.	50	33	50	33	25	.	75	67	100	50
234	PI	26	25	8	8	40	15	12	15	42	34	28	24	20	28	24	32	.	10	4	17
	TI	13	13	17	.	11	13	20	22	44	27	13	.	21	26	17	30	.	10	.	14
	FI	.	.	25	.	.	.	33	33	50	43	25	.	50	33	25	33	.	17	.	.
135	PI	.	.	.	.	.	.	.	.	1	.	.	.	17	4	4	.	9	6	2	7
	TI	.	.	.	.	.	.	.	.	.	.	.	.	14	5	6	.	.	3	.	.
	FI	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
oth	PI	5	2	3	4	2	5	3	.	2	.	3	.	3	1	1	.	2	.	.	.
	TI	.	.	.	.	.	7	.	.	.	.	.	.	.	5	.	.	.	.	.	.
	FI	.	.	.	.	.	.	.	.	.	.	.	.	.	17	.	.	.	.	.	.
all	PI	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	TI	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	FI	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

D. EXACTNESS OF BARGAINING

D.1 THE GRID

The field from which points could be selected was restricted to an integer array of 1400 (horizontal) x 1200 (vertical) pixels. However, the total grid could not be shown on the screen at once, since only a field of 320 (horizontal) x 430 (vertical) pixels was available on the screen. Three conditions of zoom were available:

ZOOM 0: This condition showed the total space of alternatives, however, since the resolution of the screen wos not fine enough to hold the total field of points, only every third y-value, and 4 of 15 x-values were selected. So the difference of the y-values of two pixels which were vertical neighbours was 3, the distance of horizontal neighbours was 4 (in three of four cases) or 3 (in one of four cases).

ZOOM 1: Under this condition a part with a vertical height of 600 pixels (instead of the total 1200 pixels) was selected from the space of alternatives and showed on the screen. 8 of 15 x-values could be presented and 2 of 3 y-values. The difference of two y-values was alternatingly 1 or 2, the difference of two horizontal neighbours was two (in 7 of 8 cases) or 1 (in 1 of 8 cases).

ZOOM 2: here the selected part of the space of alternatives had a height of 400 (instead of the total 1200 pixels). Exactly all y-values and all x-values could be presented on the screen.

Which points appeared on the screen under zoom 1 and zoom 2 did depend on the center of zooming, so that by selection of an adequate center of zoom every point could be hit exactly.

D.2 SELECTION OF ZOOM

Points of new proposals could only be created by picking them from the screen. So that proposals which were created under the zoom could only pick up points of the restricted screen described above (zoom 0).

It could be observed that subjects either used the zoom 0 or otherwise mostly the zoom 2 condition, the advantage of the zoom 1 and 2 condition was that points could be selected more precisely, the disadvantage, however, was that the subjects could not see the whole screen and the relations of the selected points to the rest figures, although the connection lines between blisspoints of the players, the circles round given points which could be drawn, and the possibility to show the distances to the blisspoints of other players could help the subjects to identify the position on the screen.

However it seems that the conditions under zoom 1 and 2 conditions have only been seldomly selected, probably mainly to select points with high accuracy when this was intended for special reasons:

The fact that only very special points could be selected under the zoom 0 condition enables ex post to identify the points, which needed zoom 1 or zoom 2 to be created. (Ex ante it is only a proportion of 1/3 times 4/5, i.e. 8.9 percent of the space of alternatives could be selected under zoom 0, while 91.1 percent of the space of alternatives could only be selected via zoom 1 or 2.)

TABLE D1: percentages (# of cases/# total) where proposals, tentative results, and final results could not be selected under zoom 0.

experience	1	2	3	4
all proposals	21.4(139/650)	10.4(59/569)	13.2(41/311)	4.4(9/204)
tentative results	10.9(10/ 92)	13.4(18/134)	10.4(7/ 67)	5.7(3/ 53)
final results	21.1(4/ 19)	14.3(5/ 35)	17.9(5/ 28)	9.5(2/ 21)

Table D1 shows that in roughly about 10 percent of the cases the zoom 1 or zoom 2 condition has necessarily been used to create the proposal.
It can be argued that in another 8.9 percent of those cases where zoom 1 or 2 has not necessarily been used, the zoom condition has in fact been used to create one of those pixels which can be selected under zoom zero as well. So the correct proportion of points which have been selected under zoom 1 or zoom 2 is essentially higher than the values in table D1. The

TABLE D2: percentages of proposals, tentative results, and final results which have been selected under zoom 1 or 2 (estimate)

experience	1	2	3	4	mean
all proposals	38.2%	19.7%	30.9%	8.6%	24.4%
tentative results	20.6%	25.0%	19.7%	10.1%	18.9%
final results	37.7%	26.6%	32.6%	18.1%	28.8%

estimates for these values aregiven in table D2. It shows that in between 10 and 40 percent of the cases points were selected under zoom 1 or 2. (This proportion does significantly go down with growing experience (experience 4). - Note in this context that not all subjects participated in experience 3 and 4, and that the subjects who did so did select zoom 1 and 2 more frequently.)

Table D3 informs about the "rate of success" of proposals (i.e. the proportion of proposals that became tentative results), and of tentative results (i.e. the proportion of tentative results that became final results). For tentative decisions the rate of success was significantly higher for those proposals which had to be selected under zoom 1 or 2 (52% versus 31% in the mean). However, the success of ordinary proposals (to become a tentative decision) does not depend on the zoom.

In addition it may be remarked that we did not observe that there was any relation between a high proportion of using zoom and success in form of overall payoff in the games.

TABLE D3: rate of success

experience	1	2	3	4	mean
rate of success of a proposal to become a tentative decision:					
general	14%	24%	22%	26%	22%
under zoom 1 or 2	7%	31%	17%	33%	22%
rate of success of a tentative decision to become a final result:					
general	21%	22%	42%	40%	31%
under zoom 1 or 2	40%	28%	71%	67%	52%

Table D4 shows that the players used zoom in quite different proportions. The trend can be seen easily that the proportion of proposals selected under zoom is reduced with increasing experience. (The data just lack to hit the 5% level of significance, because the phenomenon is not just a drop in proportion, but first an increase and a drop afterwords, where the subjects reach their respective maxima in different sessions, compare table D4a and the following considerations.) Generally it could be observed that the 15 players who participated in at least 3 sessions (experience 1-3) showed the following patterns: 1)

- 7 reached a high proportion of zoom 1 or 2 already in the first session and afterwords reduced this proportion,
- 2 first increased the proportion of zoom 1 or 2 up to session 2 or 3 and reduced it thereafter,
- 1 increased the proportion of zoom up to session 3 and did not participate in session 4,
- 4 kept a constant (always low) level of zoom,
- 1 started with high proportion of zoom, reduced it, and turned back to high zoom in session 3 (84%, 65%, 83%).

These results suggest that normally a player has a single peaked pattern in his proportion of using zoom. In our data only the last subject of our list violates this rule. His zoom selection behavior is anyway, and especially in round 3, far away from the other subjects' behavior (see table D4).

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1) in the analysis we considered two proportions a/b and c/d of using zoom as "equal", if (a/b >= c/d) and (a/b <= c/(d+1). I.e. we "permitted statistical deviations up to 1.

Of the 15 players who did only participate in two sessions: 2 started with a high proportion of using zoom and reduced it thereafter, 2 increased their proportion of zoom, and 11 kept their proportion of using zoom constant (5 of the latter subgroup never used zoom, and 3 did use zoom only once in the two sessions). This result may indicate that there was less learning in this group, and it may be that this is connected with perceiving the game less interesting and feeling less incentives to participate in additional sessions than the other subjects who had to be really highly motivated to continue the experiment for a total of 30 hours of participation.

TABLE D4: no. of players using zoom
(the respective second terms refer to those players who participated in all four sessions)

	proportion of zoom 1 or 2 in proposals										
	0	<=10	<=20	<=30	<=40	<=50	<=60	<=70	<=80	<=90	<=100
exper. 1	8/2	4/2	5/1	3/1	1/1	3/2	1/-	2/1	-/-	2/-	1/-
2	13/4	2/1	3/1	2/1	5/2	-/-	3/1	2/-	-/-	-/-	-/-
3	4/3	2/2	3/2	1/1	2/1	1/-	1/1	-/-	-/-	1/-	-/-
4	5/5	4/4	-/-	-/-	1/1	-/-	-/-	-/-	-/-	-/-	-/-

TABLE D4a: no. of players using more or less zoom than in the respective preceding session

experience	1 to 2	2 to 3	3 to 4
used less zoom	9	1	2
used more zoom	3	2	-

D.3 SOURCES OF INEXACTNESS

Information about the exactness of bargaining can be deduced from the exactness with which certain points on the screen, lines on the screen or symetries in outcomes, which the players obviously tried to hit were factually met by the selected points.

There can be different reasons not to meet a given point exactly:

INEXACTNES OF THE SYSTEM (UNDER LOW ZOOM): Under the low zoom condition lines, shown on the screen are not identical with the true connection lines, since the screen can only present a line by using the nearest corresponding points of the grid. Therefore deviations are obtained even when the subjects did hit the pixels showing the line on the screen exactly, just by the incorrectness of the presentation on the screen. (It must be said that the players were not informed about this inaccuracy so that they may have thought to hit a line exactly while factually they did only hit the corresponding pixels on the screen presenting the line, so that - under the zoom zero condition a deviation was possible by the incorrectness of the grid.)

FAILURES IN FINDING POINTS WITH EQUAL DISTANCES TO THE BLISSPOINTS OF TWO OR MORE OTHERS: Sometimes it was not possible to obtain an intended equality of distances to other players in a small neighbourhood of a given point of the screen exactly under zoom 0. However, in this case the players did usually control the equality of distances in the window showing the distances and could switch to another zoom condition, when necessary. A fallacy that they thought to have taken an equal distance point accurately, while the inexactness of the screen created uncontrolled deviations from their intentions is not possible for this type of points.

INEXACTNESS BY TREMBLING OR OTHER INACCURACIES OF THE PLAYERS: In addition to the inaccuracies created by the system under the zoom zero condition, the players themselves could not be expected to hit a point always, although they may have wanted. It really needs quite a bit of manual skill to hit a given point (which is reachable on the screen) exactly by use of the mouse. This can easily take 20 to 40 seconds for experienced and skillful persons, but the necessary exactness is so fine that some people with low technical abilities weree not able to hit the qiven point. They have to try repeatedly and check after every trial if they did hit the point or not, as a person who wants to the center (bullseye) of the darts by repeated trials.

INTENDED DEVIATIONS: The motivation of the players was high enough that they sometimes tried to make a point look as being on a line or as being in a symmetric position, however giving themselves a little bit more. (The fact that the system created inaccuracy under zoom 0 could be used to make other players think that the inaccuracy was created by the system rather than being intented.) Incentives to take advantage from inaccurate proposals were in fact not low, since already a small deviation of 5 points (i.e. clearly within the range of deviations which could be produced by "trembling") gave an advantage of 1 DM (1/2 Dollar). Moreover, this may have been an additional reason, why experienced players selected the zoom zero condition that frequently.)

D.3.1 ACCURACY OF HITTING LINES

TABLE D5: distances from lines for points which could only be proposed under high zoom conditions (zoom 1 or 2) *)

distance	-16 to -7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10 to 16
exper.1	-	1				1	14	45	6	2	1		2	1	1	1		-
2	-				2	1	1	25	2	1								-
3	-						3	16	2	1	2							-
4	-						1	5	2									-
total	-	1			2	2	19	91	12	4	3		2	1	1	1		-

*) This Table contains lines connecting the "two outsiders" of three person coalitions (i.e. those two players whose connection line seperates the blisspoint of the third player within the coalition from the blisspoints of the two players outside the coalition.)

Table D5 shows how accurately the subjects did hit connection lines (connecting the blisspoints of two players). Two remarks should be added to the data:

(1) The results have been obtained under zoom 1 and zoom 2, where zoom 1 does permit to hit a given point only on 1/2 x 1/8 = 6.3 percent of the cases. (where a deviation of 2 in the y-coordinate occures in 50 percent the cases and (deviations of two in the y-coordinate and two in the x-coordinate) occur in 50% x 7/8 = 43.8%).

(2) 8 of the 14 cases of distance -1 under experience 1 are obtained in one game (A0302A0) where players using zoom 2 offered points near the horizontal connection line (2 and 4) which met the y-value given by the value another player had given as a reference level by a point which was selected under zoom 0.

The obtained results suggest that the subjects (who did not select zoom 0) normally selected zoom 2 to create points, since otherwise they would not reach the hit rate of table D5. (It should be taken to account that even when the screen gives correct integer x- and y-values, the distance to the correct line can still be sqrt(sqr(0.5)+sqr(0.5))=0.707.)

The data of experience 2,3,4 suggest, that the subjects had no difficulties to hit a line they wanted to hit in a distance not greater than 3.

The aggregated data (cosidering the 8 cases of game A0302A0 as exact hits) give a hit rate of 99/133=74% exact hits, and higher deviations in only 11/133=8% of the cases. So roughly three quarters of the intentions to hit a line were exact hits and 90% succeeded in a distance not greater than 1. This is a very high degree of exactness, but it should be taken into account that we are considering those players who selected zoom 1 or zoom 2, i.e. those players who probably intended to make quite a precise selection of the proposed point. The selection of the 5 points in distance 5-8 from the line under experience 1 seem to be intended deviations. (They were deviations in the direction of the third player of the 3-person coalition.) Those intended small deviations did not occur under the experience conditions 2,3,4.

TABLE D6: distances from lines for points which could be proposed under the low zoom condition:

exp:	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 :	.	.	1	.	1	3	.	.	1	6	7	11	10	20	21	16	13	6	4	4	1	1	2	1	1	3	1	1	.
2 :	.	.	.	.	2	1	.	4	2	5	7	15	17	24	40	28	32	6	12	5	5	3	1	2	.	1	2	1	2
3 :	.	.	.	.	1	1	2	.	3	3	7	3	15	24	23	19	25	9	12	4	3	2	.	1	1	.	.	.	.
4 :	.	.	.	.	.	.	2	.	1	1	5	6	7	22	19	22	9	3	3	3	2	1	.	2	.	.	.	2	.
tot:	.	.	1	.	4	5	4	4	7	15	26	35	49	90	103	85	79	24	31	16	11	7	3	6	2	4	3	4	2

Table D6 shows that the no zoom condition (zoom 0) gives an essential increase of variance in the deviations from the intended line (compared with the data of table D5). Deviations of -3 to +3 have been caused by the truncations of the presentation on the screen. Mishits of the given presentation of the line on the scren by one pixel can cause a deviation of 5 to 7 from the ideal value 0. This explains nearly all deviations in the high experience condition (experience 4). Generally the data suggests that even under the no zoom condition and although the system created a substantial noise under this condition, the subjects could without problems hit the lines within a distance of +-10 points. -Intended deviations are mainly to the right, i.e. into the direction of the third player.

D.3.2 ACCURACY IN HITTING MIDPOINTS

In several cases subjects proposed points which gave two or more players equal distances to their blisspoints. This may have been done for reasons of fairness (equality), and -in addition- for reasons of symmetry of the figure with respect to the positions of the players.

An impression of the exactness players could reach when they tried to give two players equal distances to blisspoints can be obtained by the differences of distances to blisspoints for all proposals and pairs of players, and then restrict the considerations to that part of the distribution which is near equality, i.e. near zero. Table D7 shows the result under the high zoom conditions (zoom 1 and 2), table D8 shows the results for zoom 0. Both tables are splitted in two parts where the upper part shows the success of hitting for the optional selection of players. The data refer to those points, where the equality of distances for two players was intended, but they also include the best hits of those data, where subjects intended points with equal distances to blisspoints for three and more players.

TABLE D7: difference of distances to blisspoints of two players, when equality was intended (for zoom 1 or 2)

a: differences for the pair with best correspondance

		0	1	2	3	4	5	6	7	8	9	10
experience	1	59	12	4	3	5	3	1	1		1	
	2	25	10	1	2					1		
	3	18	3	2	2			1		1		
	4	3		1								
total		105	25	8	7	5	3	2	1	2	1	

b: differences in distances from blisspoints for the other pairs

		0	1	2	3	4	5	6	7	8	9	10
experience	1	60	21	17	4	1	2			1	1	
	2	21	38	15	3			4				
	3	18	3	2	2			2				
	4	2	4	1								
total		98	69	36	9	1	2	6		1	1	

Table D7 shows that in experience 2,3,4 under the high zoom conditions (as we showed before, high zoom means in most of the cases that the zoom 2 condition was selected) the players had no problem to reach differences of payoff of at most 3 points. (In this context it should be mentioned that in several cases it was not possible to hit a point of two given points exactly on the integer grid given by the screen, for instance when the distance of the players' positions was 501, then the nearest distributions to equal split were 250 for one and 251 for the other.) In the first session (experience 1) the data show a little higher deviations, of which is not clear, whether they have been intended or not. Over all players admiered a hit rate of 130 out of 159, i.e. 82% with a deviation of at most 1, if they intended to reach the equality of two dis-

TABLE D8: difference of distances to blisspoints of two players, when equality was intended (for zoom 0)

a: differences for the pair with best correspondance

		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
experience	1	70	43	36	20	14	14	13	8	2	4X	7	8	4	1	6	6
	2	33	35	45	21	18	13	12	9	8	6	3X	3	12	8	3	8
	3	14	25	20	12	11	3	4X	1	8	4	1	1	2	3	.	1
	4	16	8	8	4	3	.	.X	2	9	2	2	1	1	2	1	.
total		133	111	109	57	46	30	29	20	27	16	13X13		19	14	10	15

b: differences for the other pairs of players:

		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
experience	1	64	28	37	18	9	11	10	9X11		13	15	.	5	2	3	4
	2	44	14	19	10	17	13	5	5	4X	5	5	1	1	5	10	1
	3	5	10	21	2	5X	2	5	4	1	1	2	1	5	5	.	1
	4	16	9	9	2	5X	4	3	.	.	1	1	.	.	.	1	.
total		129	61	86	32	36	30	23	18	16X20		23	2	11	12	14	6

dances, and a hit rate of 167 out of 224 i.e. 75% when they intended to hit an additional equality.

Table D8 gives the same date as table D7 for the no zoom (zoom 0) condition. Under this condition it is not quite as easy as under zoom 1 and 2 conditions to define the extension of the distribution. Here the general noise level is substantially higher. It seems that the moving average minimum of three subsequent values describes the extension quite well. (The mean values of the corresponding triples are marked in the tables.) It can be seen, that under no zoom the "trembling" of the players was higher, but that deviations below could normally be reached, in experiance 3 and 4 the results suggest to assume that the players could usually obtain results below 6.

The clear drop of frequencies between a deviation of 2 and 3 indicates the inexactness of the system, so that over all a hit rate of 353 of 591, i.e. 60% was reached for the first coincidence within the inexactness bounderies of the system, and a hit rate of 276 of 431 = 64% for additional intended equalities (again within the bounderies of exactness given by the system).

. PROMINENCE

Location games as presented here have different sources of prominence:

- Visual or figural prominence, which causes subjects to select points on connection lines of blisspoints of players, or crosspoints of such lines.
- prominence by fairness concepts, which causes players within coalitions to select gravicenter or circumcenters as fair solution points for the group. This principle causes two-person subgroups to decide for equal share among themselves.
- prominence of values of distances, which causes players to select certain prominent values as outcomes (as for instance at least 500) or to deviate from prominent points or lines for at most 10, 20 or 50 points, etc.
- prominence in colors, which causes players to prefer certain coalition because of the special attractivity of the combination of the colors.

E FIGURAL PROMINENCE

E.1 GENERAL IDEAS OF FIGURAL PROMINENCE

Since the selection of new points had to be done on the screen, and the perception of new proposals or tentative decisions was also done via the screen, the x and y coordinates by which the points are characterized in the log could only serve to identify the point on the screen, when reading it, the players were surely not able to draw any information from the abstract coordinates, except the case they identified a preceding proposal. This makes it reasonable to assume that the general selection pattern for points was essentially influenced by the visual structure of the game, which comes out clearly when the connection lines between players are drawn (as far as we remember most players did draw all connection lines at the end of experience 1, although there was one player who did not draw connection lines until experience 4). However the perception does not necessarily need those lines to be drawn, since men are able to "percieve" connection lines visually even when they are not drawn. More precisely: men are able to decide quite exactly if a given point hits a connection line or if it is on a specific side of it, even when the line is not drawn. (It is just this fact which did cause that an exceptional player decided not to draw lines: his imaginative abilities did not need to be supported by the concrete drawings of the lines.)

The mayority rule reglemented to at least 3 players in a coalition (and - as mentioned above - there were usually 3 players selected in a proposal.) This means that a player who wants to create a proposal has to select a 3-person coalition and a point which has a chance to be accepted by the players of the coalition. - Here we address the question which visual attitudes or imaginative patterns oriented at visually percieved structural elements do in fluence the players decisions.

(Of course visual attributes of points can correspond with rational selection criteria, and it is reasonable that those attitudes will be intensified by learning, which do help to select points which afterwards have a good chance to be accepted.)

The following patterns of visual prominence could be observed:

(1) select a point in the convex closure of the blisspoints of the players in the coalition

For the normal 3-person coalition this means that the point has to be selected from the triangle spanned by the blisspoints of the corresponding players. This problem has the rational background that it selects Pareto-optimal points.

(2) select an "extreme coalition", i.e. a minimal winning (here 3-person-) coalition with the following property:

there are two players (here called critical players) such that their connection line devides the convex closure of the set of the blisspoints of all players into two parts, one of which is the convex closure of the blisspoints of the members of the coalition.

For the games A,H,M,W 116 of the 1336 proposals (= 9 %) were extreme coalitions, 11 of the 257 tentative decisions (= 4%), and only 1 of the 67 final results (= 1%). This clear reduction of proportion is significant on the 1.3 % level (proposals versus tentative decisions, FISHER's exact). It illustrates the low chances of proposals with coalitions, which are not extreme, to become final results.

Among the other coalitions only 135 became important (as the "central coalition" of games M and W), and the coalitions 124 and 245 in game A (which seems to have been intended as a way to enact the 4-person coalition 1245 without of taking the risk that the fourth player did not agree). In games M and W coalition 135 was selected in 7% of the proposals, 4% of the tentative agreements, and became a final result only once (= 3%). In game A the coalitions 124 and 245 were selected in 13% of the proposals, 4% of the tentative agreements, and never became final results.

E.2 SELECTION PATTERN IN EXTREME COALITIONS (WITH RESPECT TO THE LINE CONNECTING THE TWO EXTREME PLAYERS)

For extreme (3-person) coalitions it makes sense to raise the question, which points should be preferably selected as proposals:

(A) points in the interior of the coalition, i.e on that side of the connection line of the critical two players, which favors the third player of the coalition.

(B) points on the connection line of the critical players

(C) points on the other side of the connection line of the critical players.

TABLE E1: distances of the proposed points from the line connecting the critical players, under low zoom (first table), and high zoom (second table) 1) 2)

zoom 0 <- outside the coalition

exp:	->>	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0
1:	49	1	6	3	2	1	2	3	1	3	1	.	3	.	5	3	3	3	5	18	90
2:	37	.	.	3	1	1	2	.	3	3	.	3	2	3	4	2	3	3	3	25	152
3:	8	.	.	1	2	.	.	2	.	1	.	.	.	.	.	.	1	.	4	15	111
4:	8	.	1	.	.	.	.	2	3	3	1	.	.	6	.	1	1	1	.	11	85
tot:	102	1	7	7	5	2	4	7	7	9	2	3	5	9	9	6	8	7	12	69	438

inside the coalition ->

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	<<+	: tot
15	6	3	24	7	19	6	5	10	5	15	9	5	4	5	4	2	2	5	144	: 497
28	6	8	3	2	11	1	2	8	7	5	14	8	5	5	6	8	3	9	113	: 501
26	2	3	1	10	5	2	4	5	4	2	1	4	2	3	3	6	6	.	31	: 265
10	2	4	.	4	3	5	2	3	2	1	2	6	2	3	1	1	.	2	17	: 193
79	16	18	28	23	38	14	13	26	18	23	26	23	13	16	14	17	11	16	305	:1456

zoom 1,2 <- outside the coalition

exp:	->>	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	0
1:	6	1	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	68
2:	1	1	.	.	.	.	1	.	.	1	.	.	.	1	.	.	.	.	.	.	32
3:	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	24
4:	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	8
tot:	9	2	.	1	1	.	1	.	.	1	.	.	.	1	.	1	.	.	.	1	132

inside the coalition ->

5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	<<+	: tot
5	1	.	2	1	5	2	2	2	2	1	.	.	.	.	.	.	1	.	35	:
.	1	2	2	2	2	.	.	2	1	.	.	.	.	.	.	1	.	1	5	:
.	.	.	1	.	.	1	3	1	.	.	.	.	.	.	.	.	.	.	7	:
.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	:
5	2	2	5	3	7	3	5	5	3	1	.	.	1	.	.	1	1	1	47	:

1) The idea of critical players has been generalized in the way, that also those two players are considered as critical on the connection line of which seperates the third player of the coalition from the players outside the coalition.
2) To correct the inexactness of the system (+-3 points under zoom zero) the values presented under 0,5,10,.. include values up to 3,8,13.. .

The corresponding selection of points may be influenced by emotional patterns:

Interior points (type (A)) may be motivated by intra group fairness criteria within the coalition, as for instance to select a point in the direction to the gravicenter of the coalition. (Usually by low increases of their distances the critical players can reach points which are considerably better for the third player than the points on their connection line.) - On the other hand points fulfilling condition (A) are not favourable for the players outside the coalition. This gives an additional reason to select such points: namely negative emotions against one or both players outside the coalition.

Points on the line (type (B)) are Pareto-optimal for the critical players. In many cases the stability of a proposed point against offers from outside is highest when the points hit this line. This is so in all cases, where the critical players are the most probable candidates to deviate from the coalition. - This idea is supported by the fact that the points corresponding to the demand equilibria are on the connection lines of the critical players for most extreme coalitions. (However, there are cases, as for instance coalition (2,3,4) in figure A, where interior points have higher stability, for this coalition the selection of a point on the connection line (2,4) would cause a JOINT deviation of (2,3) or (3,4), where 3 becomes the critical player of the new coalition.)

Points outside the coalition (type (C)) can be selected under the motivation to increase the stability, by giving the other players outside the coalition better distances. This deviation from the Pareto-set of the coalition is mainly in disfavour of the noncritical player. Therefore another motivation to select a point of this type can be envying the noncritical player if his outcome would be considerably high otherwise.

The data of table E1 can be condensed in the following way:

TABLE E2: motivation of subjects in point selection in critical coalitions

motivation		zoom 0 outside (A)	zoom 0 on (B)	zoom 0 inside (C)	zoom 1,2 outside (A)	zoom 1,2 on (B)	zoom 1,2 inside (C)
experience	1	19%	25%	56%	7%	50%	43%
	2	14%	41%	45%	9%	57%	34%
	3	7%	57%	35%	8%	60%	33%
	4	14%	55%	31%	(0%)	(88%)	(11%)

The data show that motivation (C) (favor the outsiders or disfavor the collegue) was clearly the weakest of the three, but, surprisingly, not negligable (around 10-20%), motivation (B) (maximal stability) started at low experience with a share of 25% but became more and more important with increasing experience (up to 50-60%). Motivation (C) was dominating for unexperienced players (56%), but clearly lost importance with growing experience (31%). It is not surprising that in the high zoom condition (zoom 1,2) the probability that subjects selected a point on a line was higher, since there were probably cases, in which they selected the high zoom condition especially to hit the line.

In addition to these main results table E1 gives the impression that results outside the line more likely appear to be evenly distributed rather than to be wings of a distribution with maximum at distance zero from the line.

Generally it should be remarked that the general proportions of results supporting criteria (A),(B) or (C) are given by the coalition and the shape of the figure. There are certain coalitions, for which rational solution concepts predict points inside the convex closure of the blisspoints of the corresponding players, and other coalitions for which this is not the case. Subjects' learning seems to approach the predictions of these concepts (see for instance sections G.3.2 and I). So the main value of the observations above is that they give incentives and directions of possible deviations.

The phenomenon that subjects tried to violate players outside their coalition versus motivations (B) and (C) can be studied seperately for those extreme coalitions, for which the convex closure of the blisspoints is given by a straight line on the border of the Pareto-Set of the set of all players. (These are 123 and 345 in figure A, and 234 in figures M and W).

TABLE E3: distances from the line for extreme coalitions with collinear blisspoints

direction :	to other players						outside the figure				
distance :	>98	>53	>23	>8	>3	0	>3	>8	>23	>53	>98
(1,2,3) in A :	10	5	2	2	3	42	2	.	1	1	4
(3,4,5) in A :	8	2	.	3	5	48	.	2	2	1	2
(2,3,4) in M :	14	4	3	5	9	47	3	.	.	.	.
(2,3,4) in W :	2	.	.	.	5	13	.	.	.	.	1
total :	34	11	5	10	22	150	5	2	3	2	7

The surprising result is that in 19 of 252 cases (i.e. 8%) subjects tried to violate others, and that in 82 of 242 cases (i.e. 34%) they placed their proposals in substatial distance to the line in the direction of the bliss points of the others. Our impression from observations in the laboratory was that the main motivaton for the 34% of points in favor of the other players was - at least in game M and W - to keep the proposal in distance from the blisspoint of the third player in order to keep his profit on a similar level as their own. That the players did so in order to increase the stability of the coalition is difficult to believe, since the resulting point is anyway an essential amount away from points the others would accept. However, it may have been meant as a signal of excusion to the others, improving the chances of the players in the coalition for the case that the coalition did not hold.

E.3 INTERSECTION POINTS OF LINES

Based on the general prominence of lines, intersection points of such lines can be created as prominent points. These points will be considered in the next paragraph jointly with equidistance points.

F. PROMINENCE BY CONCEPTS OF FAIRNESS

F.1 FAIR SOLUTION POINTS OF SUBCOALITIONS

It is a well known phenomenon that the first ideas of players when structuring a new location game they never played before is given by fair solution poins of subcoalitions.

Fair solution points of three-person coalitions under unanimity rule may be expected in the range between the circumcenter and the gravicenter. Experimental results under unanimity rule indicate that 3-person groups tend to select quite clearly that of these two alternatives, (circumcenter or gravicenter) which is prefered by a majority of the group (ALBERS, in preparation).

F.2 ASPIRATION ADJUSTMENT WITH GROWING EXPERIENCE

With increasing experience the players will modify these fair solution ideas of the subcoalitions in a direction which reflects the power of the players.

Theoretical concepts which reflect this idea are the equal share analysis (SELTEN, 1972) see also the more detailed equal division bounds concept

(SELTEN 1983, see also 1985), its generalization to location games (ALBERS, BRUNWINKEL,1987), the aspiration adjustment model for location games (ALBERS 1988, see also ALBERS, ALBERS 1983). Similar ideas for characteristic function games are also contained in the equal excess model (KOMORITA 1979) and the equal division kernel (CROTT, ALBERS 1981). Similar from its basic idea is the model of LAING, FORMAN (1983) in which players successively revise their ideas about reasonable solution points in subcoalitions starting with a given fairness concept which does not necessarily reflect the power situation of the game.

The process of aspiration adjustment can in reality need substantial time. For one game played in the Bielefeld laboratories HUESTER (1983) reports on a game which has been played for 5 times with changing partners of about one hour for each session. A coalition including player 5, whose blisspoint was 4 to 5 times as far away from the joint midpoint of the figure than the bliss-points of the other players, has not been formed earlier than in the games of the last round. So it took more then 4 hours of bargaining before the subjects had adjusted their aspirations of adequate outcomes of this player to make acceptable offers.

The data of the preceding paragraph give a similar impression for the development of patterns (A),(B) and (C) of point selection behaviour over time and the general speed of learning new point selection behaviour.

Since gravicenters could not be constructed by the players, the points selected under this idea will not focus precisely at the correct gravicenter, but will be rather widely distributed around the theoretical points. This makes a reliable identification difficult seperating points selected according to this idea from those selected under other selection criteria. We therefore restrict our considerations to the circumcenter which may be regarded to be motivated by the equality norm. (Note that the monetary payoffs of the players were not given by the distances from their blisspoints but by the distances of the own achieved result from the average result of other players in the same position. Therefore equal distances to the blisspoints did not necessarily mean equal payoffs of the respective players - except the case that the players were in symmetric positions. Neverless players did use the equidistance criteria to construct points, which meant - at least for players in asymmetric positions - that they misused the fairness concept of equality to construct points with a certain intrinsic prominence.

According to different theories the prediction is the following:

> In their proposals for 3-person coalitions subjects will in the beginning be highly influenced by within-group fairness considerations (where we will restrict our considerations to equal distance points). With growing experience they will switch to a point selection behavior which reflects the power structure of the game more adequately.

G. EXPERIMENTAL RESULTS CONCERNING FIGURAL PROMINENCE

G.1 CRITERIA OF FAIRNESS VERSUS FIGURAL PROMINENCE

The data of table G1 show that generally the percentage of prominent points is around 20%, with a significant decrease of proportions from experience 1 to experience 4 (14% to 13% in all proposals, 26% to 5% in tentative agreements and 26% to 8% in final results - the first two changes are significant on the 0.02 level by Fishers exact). Especially the reduced share of prominent points in tentative and final results from 1/4 to clearly below 10% shows the dramatic inadequacy of the prominent points to serve as solution points, but it also shows the structural and by itself convincing power which makes inexperienced subjects keep to a prominent point.

TABLE G1: Prominent points (midpoints equidistance points and intersection points of lines) for different games and different degrees of experience

M = midpoints (of blisspoints of two players)
E = equidistance points (to blisspoits of three or more players) 1)
I = intersection points (of lines connecting blisspoints of players which do not intersect in the blisspoint of a player)
(The symbol "&" denotes "intersection" of sets)

game exper.	proposals M	E	I	M&I	E&I	tot prom	% prom	tentative coalitions M	E	I	tot prom	tot tent	% prom	final results M	E	I	tot prom	tot fina	% prom
A 1	60*	15	3	6	3	76	(38)	2	2	.	3	19	16	.	.	.	.	4	.
2	9	8	3	3	3	14	(16)	1	.	.	1	15	7	.	.	.	.	6	.
3	5	3	.	2	.	6	(18)	1	1	.	1	5	20	.	.	.	.	3	.
4	1	1	1	.	1	2	(6)	.	.	.	.	9	.	.	.	.	.	3	.
tot	75	27	7	11	7	98	(28)	4	3	.	5	48	10	.	.	.	.	16	.
F 1	11	4	.	3	.	12	(18)	2	1	.	3	8	38	1	.	.	1	4	33
2	13	6	4	4	.	19	(21)	3	2	1	5	24	21	2	.	1	3	6	50
3	3	.	1	.	.	4	(11)	.	.	.	.	6	.	.	.	.	.	3	.
4	1	1	1	.	.	3	(12)	.	.	1	1	6	17	.	.	1	1	3	50
tot	28	11	6	7	.	38	(17)	5	3	2	9	44	20	3	.	2	5	16	33
H 1	15	9	17	.	8	33	(21)	2	.	5	7	36	19	.	.	.	.	3	.
2	14	5	16	.	5	30	(38)	2	.	2	4	15	27	1	.	1	2	6	29
3	2	2	6	.	.	10	(26)	.	.	1	1	8	13	.	.	.	.	4	.
4	4	2	3	.	2	7	(28)	.	.	1	1	8	13	.	.	.	.	2	.
tot	35	18	42	.	15	80	(26)	4	.	9	13	67	19	1	.	1	2	15	11
M 1	7	10	3	.	.	20	(21)	2	.	1	3	14	21	2	.	.	2	4	50
2	13	2	7	.	.	22	(16)	7	2	2	11	39	28	1	.	1	2	7	33
3	8	2	1	.	.	11	(16)	1	.	.	1	18	6	1	.	.	1	4	25
4	2	1	2	.	.	5	(14)	.	.	.	.	10	.	.	.	.	.	3	.
tot	30	15	13	.	.	58	(20)	10	2	3	15	81	19	4	.	1	5	18	29
W 1	10	9	12	2	7	22	(17)	3	1	4	8	15	53	1	.	1	2	4	50
2	21	15	18	9	12	33	(24)	5	3	7	13	31	42	3	1	1	3	6	50
3	6	7	6	3	3	13	(27)	.	.	.	.	8	.	.	.	.	.	4	.
4	3	2	3	1	2	5	(17)	.	.	.	.	7	.	.	.	.	.	2	.
tot	40	33	39	15	24	73	(21)	8	4	11	21	61	34	4	1	2	5	16	31
sum 1	103	47	35	11	18	156	(24)	11	4	10	24	92	26	4	.	1	5	19	26
2	70	36	48	15	20	119	(22)	28	7	12	34	124	27	7	1**	4	10	31	32
3	24	14	14	5	3	44	(16)	2	1	1	2	45	7	1	.	.	1	19	5
4	11	7	10	1	5	22	(13)	.	.	2	3	40	5	.	.	1	1	13	8
tot	208	104	107	32	46	341	(21)	41	12	25	63	301	21	12	1	6	17	82	21
%	61	30	31	9	13	(100)	--	65	19	40	(100)			71	6	35	(100)		

1) Except from blisspoints 2,4 in game A, which are equidistant for 13 (35) and are also (by figure) equidistant to 4 (2).

*) 41 of these cases occured in game A0302A0, while the values in other games with the same figure in the same round are 5,6,8. In this game an excessive bargaining just around one point (the midpoint of 2 and 4) took place, which has never been observed in other games.

**) is in E&M.

G.2 AVOIDING THE BLISSPOINT OF PLAYER 3 IN GAMES H, M, and W

A remarkable phenomenon is that even in those games where the midpoint of 2 and 4 in a coalition 234 is a solution point of the theoretical rational concepts (this is the case for figure H,M and W) this point neverless became the final result in only 1 of a total of 32 cases. The idea behind this phenomenon is slightly different, depending on the game:

In games H and M players observe coalition 234 as their first reference point. It is the coalition with the smallest circumcenter which is the first reference point by the theories of ALBERS, ALBERS (1982) as well as by that of KOMORITA (1979) or LAING, FORMAN (1982).

However this strong reference point with high ex ante probability forces the remaining players to adjust and make substantial offers to avoid the reference coalition by "corrupting" one of the players 2 and 4 with an amount which prevents the player from switching to 234.

Of course, a "corruption", i.e. a reaction on the equal share distribution 2 and 4 in 234 by undercutting, can only be legitimated when 234 is a "strong" alternative, which becomes the result otherwise. But how else can the strength of the alternative 234 be measured but by its factual importance. A high factual importance of 234 is reached, when the coalition is about to become final. So the alternative itself creates the legitimation of players 1 and 5 to undercut and thereby corrupt 2 or 4 into another coalition. (A similar phenomenon could be observed in the 3-person characteristic function game with quotas (80,80,40), where coalition 80,80 of the two "strong" players could not be formed under communication via terminal (see the dissertataion of HAVENITH, Bielefeld, in preparation).) We are aware that this idea is not yet precise; it seems that it cannot be formulated as a rational concept and needs to be based on (or formulated as) a general principle of boundedly rational behavior.

In game W the players are first looking for solutions in coalitions 123, 135, 345, of which after some experience 135 drops out since the points proposed in coalition 123 and 345 are nearer to 1 and 5 than to 2 and 4.

From that follows that players 1, 3, 5 - when considering a pair of reasonable solution points for coalitions 123 and 345 (which will be symmetric with respect to the symmetry axis of the game) and drawing circles round the bliss points of 1, 3, and 5 through these two points - will not find a point for coalition 135 which fulfills the corresponding demands, for all of them. This explains why 135 can - at a high stage of experience - no longer be formed. So only two coalitions, 123 and 345, remain which compete for player 3. Usually the proposed points of these coalitions are within the triangles spanned by the respective bliss points (of 123 and 345 respectively). The tighter the competition of 12 on the one hand and 45 on the other for player 3 is, the more they will tend to make proposals on the line connecting 13 or 53 respectively. This means that players 2 and 4 do adjust their aspirations to a distance which is NEARER to them than the bliss point of player 3. So all proposals of coalitions 123 and 345 will generally keep some distance to the bliss point of 3. This is in the interest of 3 since otherwise <4 and 1> or <2 and 3> can find an alternative solution point on their connection line taking 5 or 1 as a respctive partner who will immediately agree. So the result is obtained that THERE IS NO FORCE WHICH CAUSES PLAYERS 4 AND 2 TO INCREASE THEIR ASPIRATIONS UP TO THE BLISS POINT OF PLAYER 3. The system keeps in balance by the fear of player 3 to overdo the situation and to create a coalition of 145 or 125 as described above.

This explaines why coalition 234 has been formed so seldomly in game W. The result is similar to the avoidance behavior of the Apex-players in Apex games giving one of the Base players more than his quota value in order to avoid a coalition of the two base players.

G.3 COALITIONS WITH MINIMAL CIRCUMCENTER AS FIRST IDEAS

Another prediction of the concepts mentioned above is that players start their consideration with a coalition with minimal circumcenter (or with the coalition, which gives for all players minimal distances to the gravicenter). This criteria has been quite successful as a prediction for the first coalition in games with free communication. As we will see below the coalition prediction is still correct for the communication condition here, however the the payoff distribution can be essentially different from the circumcenter. We suggest that this is the case for two main reasons:

(1) In the face to face free communication condition that player made the first proposal, who took himself the right to speak first. It sounds reasonable that this is usually that player who has the simplest structure in his ideas, so that he is ready first to explain his ideas to the others. So it makes sense to expect that prominent points are preferably proposed in the first offers of these games. - However in the games played here a subject is selected from outside to create the first proposal. This subject will act less spontanosly.

(2) Different from observations in games with free face to face communication, in the early rounds players create long sequences of redistributional bargaining within a given coalition, sending messages only within the coalition to coalition partners. (In one game such a chain reached a length of 24 proposals within the same 3-person group.) This gave the bargaining process more similarity to 2-person bargaining, where players approach their ideas to one another stepwise starting from comparibly high initial demands, which usually increases the chances for the subsequent bargaining process. It seems that in the first rounds of bargaining the subjects percieved the situation more in a way like this.

This assumption explains why players in their first offers sometimes proposed points which clearly deviated from points of fairness, with the aim to improve their initial bargaining positions for the following subsequent redistributional bargaining process.

G.3.1 SELECTION OF COALITIONS WITH MINIMAL CIRCUMCENTER FOR FIRST PROPOSAL

The following paragraph considers the additional theory that in the beginning of their negotiations subjects preferably select the coalition with minimal circumcenter. (Note that this coalition is the most attractive one, if players predict the agreement point within a coalition by its circumcenter.)

To check this theory we considered the very first proposals of a game, and restricted ourselves to that cases, where the proposing player was a member of one of those coalitions the theory predicted.

The first question then is, whether the player selected predicted coalitions. The over all rate was 46 of 62, i.e. 74% of correct predictions.

To evaluate the power of the prediction we compare the hit rate with the base rate , which can be given by the coalitions of final results or by the coalition of all proposals. The result is given in table G2. It shows that the fit of theory easily fulfilles high levels of significance for the A- and the F-game. For the H- and the M-game significance is reached not that easyly.

TABLE G2: Test of the of the coalition prediction for the first proposal for different types of figures

(+ = coalition predicted 1) for first proposal, - = other coalition)

	first propos		base rate by final result		level of sign by FISH	base rate by second propos		level of sign by FISH
	+	-	+	-		+	-	
game A	8	1	2	10	0.17 %	93	247	0.03 %
F	10	2	1	8	0.17 %	35	179	0.000%
H	10	3	6	7**	11.31 %	102	189	0.33 %
M	4	8*	.	9	8.27 %	20	303	0.69 %
W	14	2	11	4	30.45 %	220	108	6.89 %
all	46	16	20	38	0.002%	470	1026	0.000%

1) The predicted coalitions are for game A:234, game F:234, game H:234, game M:135, game W:123,135,345. In game M two players on top of the figure are not right above the midpoints of 23 and 34 respectively.

*) Restriction to those games where the proposing player did not play the same type of game before gives (+/-) values of (3/1) which gives FISHER-test values of 1.40% and 0.12% for the two base rates.

**) Extension to the 2 last tentative decisions gives (+/-) values of (9/16) and a FISHER test value of 1.9%.

For game H the base rate is not that extreme, but already the extension from final results to the last two tentative decisions gives significant results.

For the M-game the coalitions of the observed results do only give a low base hit rate. The reason is that for this game coalition 234 is quite attractive as a first proposal, especially for player 3. In all cases where player 3 could select he selected coalition 234 (instead of 135 as predicted). This explains 4 cases of deviations from the predictions and the question arises, if an adequate theory could really expect player 3 to propose 135 instead of his blisspoint in coalition 234. The other deviation in this game were coalitions 123 or 345 proposed by 1 or 5. It is, however, remarkable that the restriction to the initial proposals of those games, where the players did not play the same figure before, did fulfill the predictions in three of four cases, so that FISHER's exact gives a 1.40% level of significance for the final results base rate. This fact suggests that the dislearning of the most prominent ex ante coalition happened quite quickly in these games. And in fact, this dislearning has good reasons: the coalition selected by the best equal share value is not predicted by the demand solution concept. When players adjust their demand levels to adequate demands for this game, the coalition 135 is excluded since it cannot fulfill the demands of its members.

Figure W gives the lowest level of significance and lacks to meet the 5% level even for the base rate of all proposals. The reason is easy to say: for this game the set of predicted coalitions containes the most frequent coalitions of the game, (123 and 345), so that the base rate gives already high values for the predicted coalition. Since it happened also in this game - similar as in game M - that coalition 234 (with the circumcenter in the blisspoint of player 3) became a reasonable alternative and was selected in 2 cases, the lack of significance is explained. In this context it may be mentioned that - different from game M - here player 3 did also select coalitions different from his favourite coalition 234. In fact he selected 315,321, 351,324,321 (ordered by experience). Deviation from the theory did NOT occur in those games where the proposing player had not played the game before.

Summing up, we showed that the coalition predictions for the initial proposal do explain the behavior quite well, with an overall hit rate of 76%.

Restricting considerations only to those cases, where a player did not play a game of the same type before gives an essetially higher hit rate, namely 19 of 22 cases, i.e. 86%.

Deviations accur for three main reasons:

The first is that in figure M player 3 prefered coalition 234 (with the blisspoint of 3 as the obviously corresponding solution point).

The second reason is that the shape of game M can look visually on the screen as if the triangles 123, 135 and 345 are identical. However, the blisspoints of players 1 and 5 are for 77.5 points nearer to the axis of symmetry, so that the circumcircles of 123 and 345 are larger than the one of 135. For this reason the adjustment concept predicts coalition 135 exclusively, while players selected 123 and 345 as well. Permitting these deviations explains 4 cases and thereby increases the overall hit rate up to 50 of 62 cases, i.e 81%.

The push towards a selection of coalitions 123 and 345 is intensified by the fact that at reasonable levels of demand the players 135 cannot find a point which fulfills all three demand levels, so that, at a certain level of experience, they will probably not start the game with coalition 135. Since 135 is the only prediction for the initial phase of the game, failures of theory must happen when a considerable level of experience is reached. This explaines three failures of game M.

In this context note again that the theories we are presently addressing, do say that inexperienced players who have no a priori knowledge about the game are in the selection of their first proposals guided by fairness considerations as equal sharing. The theory does not at all say that player keep to this pattern. In contrary, the theory tries to model the process how people adjust their first rough ideas to the power structure of the game.- The fact that by considering the proposals of all games (including data of high experience) of more than 20 hours of bargaining sessions) it still can be shown that the prestructure guides the coalition selection of the players, is a really suprising result which may be seen as a limit how essential this a priori prominence structure is.

G.3.2 PAYOFF-DISTRIBUTION WITHIN COALITIONS WITH MINIMAL CIRCUMCENTER

We now turn to the payoff distribution within the predicted coalitions. We cannot expect that players did only apply equal sharing. A mixture of gravicenter-idea, equal sharing and reflections about the expected stability of a point will probably govern the individual point selection process. It can be expected that with growing experience a player will switch the point he assumes to be ideal for a given coalition in a direction which gives higher stability.

Table G3 gives an overview over the motivation which seems to have caused players to select their proposed points. To present things more easily we formulated the results from the point of view of the circumcenter concept. We distinguished:

- HITS, i.e. Points which met the circumcenter with a distance of at most 5 points (assuming that the hits of two equalities in the same point should be possible with an exactness of +-5 points under zoom 0).

- TREMBLE, this refers to points which have slight deviations from the circumcenter which cannot be explained by inaccuracies of the system. (We permitted deviations up to 12 points.)

- GRAVICENTER, here we subsumised all cases in which offered points between gravicenter and circumcenter, were doing an essential step in the direction of the gravicenter - so that the gravicenter idea could be recognized. - we applied this category also to those cases, where the gravicenter was "overshooted" in the sence , that the gravicenter was between the selected point and the circumcenter; However, this idea was only applied when it seemed reasonable that the player might have thought that they selected the gravicenter.

- EGOISTIC, here we subsumized all those proposals, where the players deviated from the circumcenter or gravicenter - idea with the direction of their own blisspoint.

- EXPERIENCE, this refers to all points, which do not fulfill the catecories above, and which deviate from the range between circumcenter and gravicenter in a way which makes it reasonable to assume that the deviation was what they learned during the game.

(Note that we ordered the cases hierarchically, i.e. in a way that a subceding case can only occur when the preceding ones are not fulfilled.)

It was not difficult to seperate the cases according to these categories by expert opinion. The categories can be made more precise. It seems, however, that the issue itself is not important enough to do this. (Anyway the results will to a certain extent depend on the figures of the games. Of interest is only the general pattern of selection behavior. - To enable the reader to get an impression of these categories the first proposals of the first 6 games a player was in are given in table G4. - Note that in tables G3 and G4 we predicted coalitions 123, 345 and 135 (not only 135) for game M.)

TABLE G3: motives of the players to deviate from the cicumcenter in the initial proposals of a game

	cases with correct prediction of coalition — motive to deviate from circumcenter					incorr. prediction of coalition	line total
	hit d<=5	tremble d<=12	gravi-center	ego-istic	expe-rience		
game no. 1	1*	2	2	1	.	.	6
2	.	.	.	2	.	.	2
3	1	1	.	.	1	1	4
4	1	.	.	3	1	1	6
sum 1-4	3	3	2	6	2	2	18
later A,B	6	.	4	1	3	2	16
C	7	.	3	1	7	6	24
total	16	3	9	8	12	10	58
in percent :							
1-4	17	17	11	33	11	11	100
later A,B	38	.	25	6	19	13	100
C	29	.	13	4	29	25	100
total	28	5	16	14	21	17	100

*) This deviation is motivated by the "don't be greedy" for the proposing player, who therefore selected a point outside the convex closure of the blisspoints of the proposed coalition (in game H). Since the nearest point to this within the convex closure of the blisspoints is the circumcenter, we subsumized this point as a hit.

TABLE G4: initial proposals of the first 6 games the proposer participated in

game no	fig	coalition	distances to blisspoints			dist to eq. share	dist to circumcen	motivation to deviate
1	H	324 +*	244	442	482	-20	-54	not greedy
	H	324 +	154	461	459	- 1	-18	gravicenter
	M	153 +	128	493	466	-14		egoistic
	M	153 +	447	457	502	- 5	-23	gravicent
	W	435 +	405	422	420	+ 1	- 9	trem/exper
	W	435 +	405	415	427	- 6	-11	trem/exper
2	A	342 +	145	481	480	- 1		egoistic
	A	324 +	119	499	503	- 2		egoistic
3	H	234 +	458	190	460	- 1	- 1	tremble
	H	213 -	430	604	595	- 5		-
	W	315 +	408	427	420	- 4	-10	trem/exper
	W	321 +	263	501	520	- 0		experience
4	F	324 +	299	376	319	-10		egoistic
	H	324 +	194	400	588	-44		egoistic
	M	123 +	502	498	496	- 1	- 3	tremble
	M	153 +	390	499	538	- 4		egoistic
	W	432 -	712	4	719	- 1		-
	W	453 +	310	476	478	-55		experience
5	A	234 +	330	382	330	- 0	-26	gravicenter
	A	234 +	292	521	308	- 8		experience
	F	234 +	245	419	245	- 0		gravicenter
	F	324 +	318	325	321	- 2	- 4	tremble
	F	243 +	175	179	585	- 2		experience
	F	213 -	133	619	481	-69		-
	H	342 +	138	461	463	- 1	-52	gravicenter
6	H	213 -	177	803	459	-141		-
	W	513 +	414	418	416	- 1	- 2	tremble

*) the + and - refer to the coincidence of the coalition with the prediction of the aspiration adjustment theories

The results of this classification for all initial proposals of games are presented in table G3. It can be seen from the table that the percent of overall incorrect coalition predictions increases (from 11% in the beginning to 25% for experienced players), however this result is not significant. Trembles in the initial offers are only observed in the first 4 games a player played. The share of hits and trembles, i.e. the share of points which are mainly motivated by the circumcenter concept are under all degrees of experience around 1/3.

The egoistic motivation influences the selection behavior quite essentially in the first 4 games (1/3 of cases) but looses its importance after this initial phase (only 50% of later games, FISHER's exact 2.3%). It seems that players recognized that it did not pay to try to kick the game in one's favor: other players do notice this and seem to penalize such behavior. Gravicenter ideas have a mean share of 10-20%. The influence of experience increases from 11% in the beginning to 25% at the end. This was expected. It refers to the information a player collects during the bargainig sessions and which cause him to select points which are different than those given by the simple apriori principles.

lition prediction" to joint underlying pattern, namely to deviate from the initial behavior.

Both of these deviations are increasing with growing experience. This seems reasonable, if one assumes that players adjusted more and more to the special structure of the games they played. However, this effect is not significant (FISHER's exact: 17.3% comparing the first 4 games of the proposer and the games under experience 3 and 4.)

So the main effects of learning are (1) that players learn to adjust to the specific situation of the game in a rational way, and (2) at the same time reduce their attitude to influence the selected point egoisticly towards their own blisspoint.

H. PROMINENCE WITH RESPECT TO THE NUMERICAL VALUES OF DISTANCES

A question of interest is, if the perception of the spatial games as presented here has been mainly structured by visual or by numerical perception. As we pointed out above, a point could only be selected from the screen, which is from the first point of view a visual task. But this selection could be (and generally was) controlled by plotting the distances to the blisspoints of other players.

H.1 POINT SELECTION AND PERCEPTION OF DISTANCES

When a player was selecting a point he could easily check the distances of different points to the blisspoints of the others by approaching them with crosshairs and controlling the correspoining plotted distances. Moreover the reference to the last tentative decisions (or to the last proposal offered by another player) was supported by showing the corresponding circles through the point and round the blisspoints of the players on the screen.

Generally it was possible to plot these circles through any point of interest, however, the plotting itself is not easy, it has to be done in two steps:

STEP 1: (selection of point) the player has to click the field plot. A menu was pulled down, from which he had to click "plot point". Then he has to select the point on the screen. (This selection can be omitted when the player wanted the circles to be drawn through a point which already is on the screen.)

STEP 2: (make circles being drawn) the player has to click the field "plot" again. The pull-down-menu appeared again. He has to select "plot lines through point selected from screen". Afterwards the system waits for him to give the point, and he has to click the point again.

In total this is a procedure which takes some time. If a subject already had a somehow precise idea where to put the point, it could reduce this time by just comparing the distances to the blisspoints which were always shown on the screen for every position of the crosshairs, and then select the prefered point. This saves an essential bit of time. Although it implies two necessary conditions:

1: the player can only compare points pairwise. So he has to know the new position of the point somehow. (Although he can quickly try a lot of different positions by moving the crosshairs around.)

2: the player has to keep the distances which he wants to compare in mind.

The second necessary condition has an important consequence: comparing different radii is usually not done by drawing radii, but by comparing the numerical values of radii. This means, that the subjects - if intentionally or not - do have to PERCEIVE THE NUMERICAL DISTANCES TO THE BLISSPOINTS (at least for those players who are most likely to switch the coalition, and these are just the critical distances). So, from this point of view, there is no doubt that the players did perceive the numerical values of distances.

The next question is to which extend players paid attention to the distances. In fact, several players told us after some experience the distances which players in different positions should get, when entering a coalition.

An additional question is in which way such reference distances were created: by numerical values or by figural elements of the figure.

In this context it seems helpful to distinguish between MICRO-PROMINENCE (i.e. the selection pattern on the integer level) and MACRO PROMINENCE (which we here model as the selection pattern on the level of multiples of ten).

The basic prominence pattern on both levels is the same (up to a factor of 10). Before we go into details, we first give a short introduction into the theory of the prominence of the decimal system.

H.2 PROMINENCE OF THE DECIMAL SYSTEM

(For first approaches see ALBERS & ALBERS (1982), and an extended version in SELTEN(1985/1987). The theory as presented here is modified according to recent empirical results.)

The theory of prominence as introduced here presents the prominence structure of numbers as it is created by the intrinsic structure of the decimal system itself. The theory has been developed in face of experimental results of numeric bargaining data, and empirical observations of price setting behavior. As we will see, the basic elements structuring the numerical prominence of numbers are the powers of 10, numbers obtained from these by doubling, and halving. Thereby the "prominent numbers" are obtained. Any decimal number (with a finite number of digits) can be presented as a sum of these numbers. Observed frequencies of number selection indicate that people select numbers depending on the degree of "complexity" of its composition from prominent numbers, where a number is selected more frequently when its presentation as a sum of prominent numbers is less complex.

The most prominent numbers are the powers of 10, i.e.

...,10,100,1000,10000,...

The first extension of this sequence is obtained by adding halves

...,5,10,50,100,500,1000,...

The second extension can by done either by adding halves or by doubles, where doubling gives

...,5,10,20,50,100,200,500,1000,2000,...

and the operation of halving gives

...,2.5,5,10,25,50,100,250,500,1000,...

Coin/banknote systems show this general structure, where for instance the Dutch system corresponds to the second type (halving), the German and the Swiss system correspond to the first type (doubling), other systems, as for instance the US-system, use doubling above and halving below the central unit, which is one dollar in the US. In the context addressed here the first system (using doubling in the second step of extension) seems to be important. The corresponding basic values are called "prominent numbers". Let them be denoted as

...,p-2=0.2, p-1=0.5, p0=1, p1=2, p2=5, p3=10, p4=20, p5=50,...

Every decimal number z with a finite number of digits can be constructed from these as

z = sum (zi*pi, i e Z, all zi e (-1,0,+1))

where Z is the set of integer numbers, the coefficients zi are all either -1, 0 or +1, and only finitely many values zi are non-zero.

The following characteristics of such a "presentation" of z by (zi*bi, i e Z) can be defined:

The COMPLEXITY of the presentation is

C(zi*pi, i e Z) := #(i e Z, zi <> 0)

the SPAN OF PROMINENCE is

D(zi*pi, i e Z) := max (i e Z, zi <> 0) - min (i e Z, zi <> 0) + 1

(if z is a power of ten, then its complexity and its degree of prominence are defined to be 0, instead of 1)

the LEVEL OF PROMINENCE is

L(zi*pi, i e Z) := min (pi, zi <> 0)

So the complexity informs about the number of coefficients of the prominent numbers which are different from 0, the span of prominence informs about the "extension" of the range of prominent numbers which are needed in the presentation, and the level of prominence gives the smallest prominent number needed for the presentation.

It seems reasonable to ask whether the presentation of a given decimal number (with a finite number of digits) can be made unique. Such a selection can be done by using several of the following principles of selection

- minimal complexity
- minimal span of prominence
- minimal level of prominence.

Different ways of canonic presentation can be constructed from these criteria using lexicographic methods. Depending on the framework, one or the other criterion may get higher importance.

In our present state of experience the following way of definition seems to select the most reasonable presentation:

RULE OF PRESENTATION
Let z be a decimal number with finitely many digits. A presentation z = sum (zi*pi, i e Z) is called PROMINENCE STRUCTURE of z, if
(1) for any k e Z the distance of z to sum (zi*pi, i>k) is minimal among all numbers which can be presented with the same span of prominence as sum (zi*pi, i>k), and
(2) the span of (zi*pi, i e Z) is minimal among all presentations of z.

It should be remarked that this rule does not imply uniqueness of the presentation. For instance 115 can be presented as 100+10+5 and as 100+20-5. In fact it can make sense to permit different presentations of one number, since this might reflect different ways of perception. On the other hand nonuniqueness does only occur in cases, where the relative degree of prominence (i.e. the quotient L(z)/z) is smaller than 5 percent, and these cases are not of empirical relevance.

To give an impression of the way in which numbers are presented, the prominence structure, the span of prominence, the level of prominence, and the complexity of selected numbers between 1 and 100 are given in table H1.

TABLE H1: presentation, degree of prominence, level of prominence, and complexity of selected numbers between 1 and 100

i=	6	5	4	3	2	1	0	span of prom	level of prom	complexity	comments
pi=	100	50	20	10	5	2	1				
1=							1	0	1	0	
2=						2		1	2	1	
3=						2	+1	2	1	2	here not 5-2
4=					5		-1	3	1	2	not 2+2,(zi=0 or +-1)
5=					5			1	5	1	
6=					5		+1	3	1	2	
7=					5	+2		2	2	2	
8=				10		-2		3	2	2	not 5+2+1
9=				10			-1	4	1	2	
10=				10				0	10	0	
11=				10			+1	4	1	2	
12=				10		+2		3	2	2	
13=				10	+5	-2		3	2	3	not 10+2+1
14=				10	+5		-1	4	1	3	
15=				10	+5			2	5	2	
16=			20		-5		+1	5	1	3	not 10+5+1
17=			20		-5	+2		4	2	3	not 10+5+2
18=			20			-2		4	2	2	not 10+5+2+1
19=			20				-1	5	1	2	
20=			20					1	20	1	
21=			20				+1	5	1	2	
22=			20			+2		4	2	2	
23=			20		+5	-2		4	2	3	
24=			20		+5		-1	5	1	3	not 20+10-5
25=			20		+5			3	5	2	not 50-20-5
27=			20		+5	+2		4	2	3	
28=			20	+10		-2		4	2	3	not 20+5+2+1
30=			20	+10				2	10	2	here not 50-20
32=			20	+10		+2		4	2	3	
33=			20	+10	+5	-2		4	2	3	
35=			20	+10	+5			3	5	3	
37=		50		-10	-5	+2		5	2	4	
38=		50		-10		-2		5	2	3	
40=		50		-10				3	10	2	not 20+20 (z=0 or +-1)
45=		50			-5			4	5	2	
50=		50						1	50	1	
55=		50			+5			4	5	2	
60=		50		+10				3	10	2	
65=		50	+20		-5			4	5	3	not 50+10+5
70=		50	+20					2	20	2	
75=		50	+20		-5			4	5	3	
80=	100		-20					3	20	2	
85=	100		-20		+5			5	5	3	
90=	100			-10				4	10	2	
95=	100				-5			5	5	2	
100=	100							0	100	0	

Empirical observations show, that normal perception does usually not exceed a span of prominence of 2 or 3. A finer scale is used only when more than one item has to be evaluated (in price, in length, in speed, etc.) and when the necessity to inform about the differences by the numerical values forces subjects to use finer values.

The comparison of frequencies of numbers used for spontaneus numerical estimates in questionnaires (probabilities of certain events in %, estimates of inhabitants of different towns, etc. have been asked) show a high correlation between the frequency of the selection of a certain number and its degree of prominence.

H.3 THE PROMINENCE SELECTION RULE

The restriction to maximal span 1 of prominence gives the numbers

...,1,2,5,10,20,50,100,...

maximal span 2 gives

...,1,1.5,2,3,5,7,10,15,20,30,50,70,100,...

maximal span 3 gives

...,1,1.2,1.5,2,2.5,3,3.5,4,5,7,8,10,12,15,20,25,30,35,40,50,70,80,100,...

(Where each of these scales contains with a value x also its multiples by powers of 10.) 1)

A central question for emperical analysis is, which level of prominence a person uses, when he selects a number. A corresponding theory may be helpful for the reader when analyzing data. ALBERS made some field studies of this type, in which he approached the following problem: subjects had spontaneously to answer questions for numerical values (as the estimate of the probability of certain events, the estimate of the number of inhabitants of towns as Kairo,..). In the number selection pattern of the answers pure prominent numbers were significantly more frequent than less prominent ones. To approach the question, which number subjects selected they were asked in a seperate set of questions (about one hour before or later) for the distribution of probabilities that the correct value was at certain values.

The theory predicts:

> PROMINENCE SELECTION RULE
> A person selects the span of prominence minimal subject to the condition that there are three points within the 80% range of the distribution (omitting the 10% tails on both ends).
>
> POINT SELECTION RULE
> Of these three values it selects that one for which its response-signal is highest. If there are no noticable differences in the response-signals, then the middle of the three values is selected.

(For normal distributions this pattern gives usually quite good estimates for the maximum.) The theory is supported by empirical results.

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1) We remark that for scales with fixed reference points (as 100 in the percent scale) the DIFFERENCE to the reference point can be treated with the theory of prominence as well.

H.4 NUMERIC MICRO- AND MACRO- SELECTION BEHAVIOR ON THE SCREEN

Point selection can be considered on a micro- and a macro- level. On both levels the theory of prominence can be applied.

The general decision, in which region to select a point has to be done on the macro level. On this level a player may make the decision to select a distance from his own (or from other's) blisspoints of "around 450", or of "at most 450". Then going down motorically to the point selection instrumentarium the general decision has to be made precise by selecting the point with the mouse.

The distances showing on the screen and changing with the slightest movement of the mouse (even if somebody knocks at the table, this changes the values of distances) invites players to look at these values and it seems reasonable that they also perceive the last digits of the numbers. We will see below that - if this is done willingly or not- the players seem really to take the last digits of numbers to account.

Back to the prominence selection theory: this theory predicts, which number a person selects, when it is free to select and when there are no offers for points from outside.

Selection of a point from the screen is different from this: here he gets different offers created by the distances of the points he touches with the mouse, and has to decide for one point just in that moment when he touches it by clicking his mouse.

THE MACRO SELECTION: the first tough selection is done visually (or by a tough numeric pattern). In normal selection (not on the screen) the process is then ended by adding zeros, as for instance when a player wants to make an offer around 4 times 100, he will usually make the decision just by saying "400".

THE MICRO SELECTION: if, however, he has to select a point with a distance of around 4 times 100 to his bliss point from the screen, then he moves his mouse into that direction, has to move it very slowly when approaching 400, has to go backward and forward to get a chance to hit. This procedure cannot be abbriviated by selecting the most prominent number within the region, in the contrary: the decision to select 400 exactly imposes additional time to hit the point in a try-and-error procedure. (To hit a given point exactly can easily take a time of 30 seconds or over 1 minute. - In a few cases we had crashes of the system and we had to set the system into the position of the last tentative decision, using exactly the same point as before. We always did this selection ourselves. The subjects needed essentially longer time to select the given point precisely, some of them did not perform within a one or two minutes.) What we are describing is a micro motoric process by which the point is selected in a try and error procedure. It is as if the system makes some proposals which can be accepted or rejected by the subject. (If it wants to get more precise offers it can increase the zoom, and if it is content with the values, it can stay in the low zoom mode.)

H.4.1 NUMERIC MICRO SELECTION IN DETAIL

Figures 1 and 2 inform on the micro selection behavior under the high zoom condition (figure H1) and under all zoom conditions (figure H2). The figures show the frequencies of the integer values (modulo 100) of distances to the blisspoints for proposals of players in the proposed coalition, i.e. the frequencies of distances of 3, 103, 203, 303, 403, .. are added and presented at 3, etc. . So we can see the points selected in the micro-pattern, after by the macro-pattern the general range once had been selected. (Entries Z,Y,X,W refer to final results in experience 4,3,2,1, entries D,C,B,A refer to tentative decisions in experience 4,3,2,1 and entries 4,3,2,1 refer to simple proposals in the respective degrees of experience. We selected this order of presentation, to give the reader the opportunity to omit less important cases visually in the ends of the tales.) The result is surprising: there was a tremendos number of hits exactly at multiples of 100 (115 cases). Players who really intended to hit this value have been quite successful, as the frequencies around 100 show. At values not too high above the multiples of 100 the subjects seem to have prefered numbers with a high span of prominence, as 5, 7, 12, 15, 20, 25, 30,.. ,i.e. they selected on prominence level 2 (see figure H1). On the other hand, however, the value 10 has been clearly avoided. Thereby and by the distributional pattern of the numbers between 30 and 50 one gets the impression that the prominent numbers 40,50 have rather been avoided than selected, where subjects seem to have prefered values just below these prominent numbers. Between 50 and 80 no clear pattern can be recognized, but the numbers 65, 76, 87 are preferably selected. (Does this result from the fact that a number looks smaller when the second integer is below the first?) At the end of the scale 89 (avoiding 90) and 93 (keeping a distance of 7 to 100) seem to have been preferred.

Generally it can be concluded that the selection behavior seems to have been guided by one of the following four different patterns:

(1) "exact hit": Hit the multiple of 100 exactly.

(2) "just an epsilon more than the multiple of 100":
Select a point not too high over 100, where borders of pain seem to be at around 7, around 20, at 25, and at 30.

(3) "avoid next step of prominence":
a) For higher values than 30 this "epsilon more"-behavior could not be observed or became a different character. The data give the impression that prominent values (40,50,70 have a span 2 of prominence) have been avoided.
b) For values shortly below integer multiples of 100 it is again the avoidence behavior (65,76,87,89 are selected) which seems to show. The prominent numbers 70,80,90 are only comparatively seldomly selected.

Figure H2 gives the distances to all blisspoints of players in the proposed coalitions for all proposals under all zoom conditions. The corresponding cases are given in the right side of the table. These data show an essentially higher noise level than those of zoom 1 and 2 (definitly above 30, while there was nearly no noise under zoom 1,2). We can observe maxima at 5, 8, 12, 15, 20, 25, 28, 38, 40, 48, 50, 58, 60 where the numbers 8, 28, 38, 48, 58 seem to indicate an avoidence behavior, as known from price setting behavior of retail prices, while other values indicate the intention to hit prominent numbers (5, 15, 20, 25, 30, 40, 50 and perhaps 60). Interisting is that some of these numbers seem to have been hit exactly (5,15) while others seem to stam from distributions (as the distributions around 12, 20, 25). This gives the impression as if numbers 12, 20, 25 have been intended to hit, where players stopped the search process, when they had found a point which did approximate the intended value well enough, while numbers as 5 or 15 may have been selected "by accident" , where a subject, when getting the proposal from the system, spontaneously agreed. (It would not make sence to assume that players who wanted to select 5 were more careful than those who selected 20.)

H.4.2 NUMERIC MACRO SELECTION BEHAVIOR IN DETAIL

The results of the following section will show, that macro- selection behavior is influenced by numerical and by figural prominence, where it seems, that players do apply numerical prominence just there, where figural prominence does not give anchor points. (This is for instance the case near the bliss-point of player 3 in game M, since all points with figural prominence - except from the bliss point itself - are "high up in the M".) Therefore it seems reasonable to consider the influence of numeric prominence on macro selection behavior jointly with the influence of figural prominence. This will be done in the next paragraph.

I. MACRO SELECTION BEHAVIOR: DECIMAL VERSUS FIGURAL PROMINENCE

We study the macro-selection behavior by considering aggregated data, where we aggregated frequencies of the distances 0 to 9, 10 to 19, 20 to 29, etc. The overall experiments do not show any informative pattern. Therefore we selected 3 examples showing the macro selection behavior of player 3 in games M, H and A. The figure gives the freqencies for aggregated distances (where for example 14? means the values (140,141,142,143,...,149)), where each distance of a point to the bliss point of every player within the proposed coalition is counted. (Again Z,Y,X,W denote final results, D,C,B,A denote tentative decisions, and 4,3,2,1 denote proposals in experience 4,3,2,1.)

The macro behavior of player 3 in game M is given in figure I1. We selected this game, because it seems to have the highest proportion of numerical prominence. Again we can find the hit-becavior, where distances around 10?, 150, 200, (and 450) are hits on the macro-level (prominence 1 and 0), the avoidence behavior seems to have motivated 29?, 31?. Most of the other peeks can be explained by figural prominence. The high frequencies at 33?/34? and around 66? might indicate that some players tried to cut the 100 into thirds. However these points have a low span of prominence in their decimal presentation.

The data show quite clearly, that in experience 1 the distances to player 3 were essenially higher than under the high experience condition (see the ones at values over 39?.) Also in tentative agreements and the final results of experiece 1 (i.e. the letters A and W) show higher values than in the other degrees of experience:

W:450, W:390, X:360, X:330, Y:260, X:250;

see also the sequence of tentative decisions (low to high values):

AAABAAABAAAADBBBBACBCACDBBBCBBDCCCBCBBBDBDB quota BDCB

It is an interesting phenomenon, that the median of selection over the rounds of experience 2 to 4 (except from the values below 100 which belong to other coalitions in which player 3 recieves essentially more than his quota value) nearly hit the quota value. The same is true for the median of final results of rounds 2-4, where the 4 final results under experience 2-4 may be identified to stam from the two extreme tales of a cluster centering at around the quota value.

Overall one gets the impression that numerical prominence as well as structural prominence seems to be responsible for the selection of figures, where numerical prominence becomes important in that regions of the scale, where figural prominence does not give any hints. However as soon as any elements of figural prominence can be found, it seems to dominate the numerical prominence.

The second example, player 3 in game M (see figure I2), shows a selection pattern, which is essentially more structured by numerical prominence. (This is a selected extreme result, which shows the opposite pattern to that of the preceding example.) The reason, why this result has been obtained here, is that there are not enough reference points in the figure, to which the players can refer, because midpoints and crosspoints are too far away from the region where adequate final results are obtained after some experience. (The reference points are too "high up in the M".)

Again it can be seen that the general learning pattern went from high distances from position 3 under experience 1 to lower distances, where the final results under experience 2,3,4 are loosely distributed around the quota value (note that results with distances below 100 have been obtained in coalition 234, where the agreements are made between players 2 and 4, so that these results do not inform on the quota value of player 3.) The observation that in the first sessions players obtained higher distances to 3 as results than in later sessions, seems to have its reason in the fact that the prestructure by equal share considerations only creates reference points in substantial distance from player 3. (Equal share in 135 gives 476, equal share in 123 or 345 gives 500.)

The data of player 3 in game A (figure I3) give an example of a siuation, where the reference points of the figure can explain the whole substructure of the selected points. The numerically prominent points of the region are either explained by structural prominence as well (300, 400, 600) or were rather seldomly selected (250, 350, 450, 500). Again the quota value turns out to be a good predictor of the result.

As a conclusion of these three examples it can be formulated:

(1) players selection pattern is governed by figural as well as by structural prominence.

(2) numerical prominence seems to serve as a selection criterion, preferably in those regions, where figural prominence is not available.

(3) among the selection principles of points the equidistance and the gravicenter (i.e. the fair solution patterns) clearly dominate, intersection points of lines are selected rarely.

(4) the data in the examples are loosely distributed around the quota values, although the range of distribution is relatively large.

It seems that in their search for adequate solutions the players do first look for simple fairness rules (equal sharing or gravicenter), by which they can reduce their selection problem, and which - on the first view - gives the selected points higher chance of stability. Then they are learning, that some points are more, others are less successful and revise their first selection. (By finding finer selection criteria as for instance the "construction" of the midpoint "40" in game A and dropping old solution alternatives). - In the high experience level of our observations they had still a wide range of alteratives motivated by different fairness criteria. It may be that on this higher level of experience the general pattern to look for equal share or gravicenter points (i.e. to look for points with internal fairness properties) may even prevent a quick learning process.

K. PROMINENCE BY COLORS

In the experiment players positions have been denoted by colors not by numbers, as we use them in the presentation here. We selected five colors, the first letters of each were the same in English and German, namely blue (blau), green (grün), orange (orange), red (rot) and violet (violett). In the log, in which the players could recheck the history of the bargaining process, and from which they could see the proposals of the players, the colors were given by their initial letters. The players' blisspoints, all circles which were drawn around blisspoints and all points which were selected by players did appear on the screen in the color of the player they belonged to.

To avoid errors and to make the results of different games comparable we played every figure under identical colors. But for most figures we switched the colors after the first two sessions (experience 1 and 2) of the first 15 subjects. Thereby we obtained data of the first 15 subjects (group A) versus the second 15 subjects who played the same games, however with different colors (group B). The remaining sessions (group C) were played in the same colors as in group B. Table K1 gives the selected colors for three-person coalitions of the final results:

TABLE K1: color-combinations of the selected 3-person coalitions of final results

game	group	BGO	GOR	ORV	BRV	BGV
A	A	2(123)*	.(234)	2(345)	1(145)	.(512)
	B	1(512)	1(123)	.(234)	3(345)	.(451)
	C	.(512)	2(123)	1(234)	3(345)	.(451)
F	A	.(123)	.(135)	.(345)	4(245)	.(412)
	B	.(345)	.(452)	1(412)	3(123)	.(135)
	C	2(345)	.(452)	.(412)	3(123)	.(135)
H	A	.(123)	3(234)	.(345)	1(451)	1(512)
	B	1(123)	2(234)	.(345)	1(451)	2(512)
	C	1(123)	1(234)	2(345)	.(451)	3(512)
M	A	1(123)	.(234)	2(345)	1(451)	.(512)
	B	.(451)	.(512)	1(123)	4(234)	.(345)
	C	2(451)	3(512)	.(123)	2(234)	.(345)
W	A	1(123)	.(234)	2(345)	.(451)	2(512)
	B	.(234)	3(345)	.(451)	.(512)	2(123)
	C	.(234)	3(345)	.(451)	1(512)	3(123)
total	A	4	3	6	7	3
	B	2	6	2	11	4
	C	7	11	5	9	6
	ABC	11	14	13	27	13

*) the terms in brackets give the coalitions.
**) in the (symmetric) star all coalitions have been obtained with frequency 2, except from BRV with frequency 1.

The aggregated data suggest that there was a certain preference to select BRV, however the color selection is also influenced by the type of coalition. Therefore we compare cases where unusual differences between the two color presentations (round A, round B) occured. All of these cases included coalition BRV. Therefore we compared all those cases of group A and group B, where BRV were colors of the coalition in one of the groups. These are given in Table K2.

TABLE K2: the preference of colors BRV (blue,red,violet) in different figures

game	coal.	group A	group B
A	145	1(BRV)	.(BGV)
	345	2(ORV)	3(BRV)
F	245	4(BRV)	.(GOR)
	123	.(BGO)	4(BRV)
M	234	.(GOR)	4(BRV)
	451	1(BRV)	.(BGO)
W	512	2(BGV)	.(BRV)
	451	.(BRV)	.(ORV)
total		13(BRV)	4(other)

The data support clearly that BRV was a preferred color combination. For other color combinations no significant results have been obtained, in contrary there does not seem to be a prefered color combination among them. It seems that the fact that BRV was prefered can be explained: all three colors appear darker in the screen than orange and green which are perceived as light colors. Moreover, violet is the "mixture" of blue and red, so that RVB (i.e. R before V before B - and that is the sequence in which these colours have been ordered round the figures in all cases) appear to be presented in a "natural way", according to the rainbow.

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positions for proposals under zoom 1,2

```
1,2,3,4 :  proposals in experience 1,2,3,4
A,B,C,D :  tentative agreements in experience 1,2,3,4
W,X,Y,Z :  final results in experience 1,2,3,4

di fre cases (note that some tails are cut)
--------------------------------------------------------------------------------
 0 126 YYYXWCCCBBAAA4444333333333322222222222222222222221111111111111111111111
 1  11 33111111111
 2   8 DB322221
 3   4 BB22
 4   3 311
 5   3 B31
 6   2 Y4
 7   5 22221    7:
 8   4 B111
 9   2 B2
10   0
11   2 B3
12  14 43222211111111   12:
13   8 A3111111
14   4 YB11
15   7 ZX33111
16   5 W3332
17   5 43211
18  10 XBBA321111
19  21 XB43332222111111111111
20  33 BB333211111111111111111111111111111    20
21  23 XBB4332222222111111111111
22   5 11111
23   3 332
24   1 A
25   8 33211111 : 25
26   5 C2111
27   1 Y
28   1 1
29   7 3331111
30   9 422111111:  30
31   2 11
32   5 33111
33   1 1
34  10 XXXBB33111
35   3 431
36   4 3221
37   8 D3221111
38   7 W311111
39   9 BA2111111:
40   6 XC2111
41   0
42   8 32111111
43   4 X111
44   6 D33311
45   6 A31111
46   9 333111111:
47   7 B211111
48   4 2111
49   5 42111
50   4 3211
51   1 3
52   0
53   9 Y33111111:
54   3 211
55   6 221111
56   3 111
57   6 BA2111
58   7 3222222
59   9 ZYWBA3211:
60  13 YYXAAAA332211   60
61  20 YW33221111111111111
62   7 WBB2211
63   1 1
64   4 C111
65  21 YYWWWBB44443333332211   65
66   8 X2211111
67   0
68   9 BB2222211:
69   4 3321
70   8 Y4321111
71   3 111
72   7 A332211
73   4 W331
74   6 BBB111
75   6 B11111
76  14 XW332222222111   76:
77   4 XW32
78   0
79   3 X31
80   5 33211
81   7 Z333311
82   4 ZA21
83   2 21
84   6 Z22111
85   4 ZY11
86   0
87  10 A331111111   87
88   2 21
89   8 A2221111
90   1 2
91   4 2221
92   5 32211
93  10 3111111111   93
94   7 B321111
95   5 B3331
96   5 BB221
97   7 B111111
98   9 B43311111:
99   9 221111111:
```



```
 0 126 YYYXWCCCBBAAA44443333333333222222222222222222222211111111111111111111111
 1  11 33111111111
 2   8 DB322221
 3   4 BB22
 4   3 311
 5   3 B31
 6   2 Y4
 7   5 22221    7:
 8   4 B111
 9   2 B2
10   0
11   2 B3
12  14 43222211111111   12:
13   8 A3111111
14   4 YB11
15   7 ZX33111  :15
16   5 W3332
17   5 43211
18  10 XBBA321111
19  21 XB43332222111111111111
20  33 BB333211111111111111111111111111111
```


blisspoints for all proposals.

```
1,2,3,4 :  proposals in experience 1,2,3,4
A,B,C,D :  tentative agreements in experience 1,2,3,4
W,X,Y,Z :  final results in experience 1,2,3,4

di fre cases (note that some tails are cut, correct frequencies by column 2)
--------------------------------------------------------------------------------
 0 204 ZYYYYYYXXWDCCCCBBBBAAAAAAAA444444444433333333333333333333333322222222222222
 1  72 ZYXDDCCCBBAA44444443333333333333322222222222222111111111111111111111111
 2  53 YXWWDDCCCBBBBAA4443333222222222222222111111111111111
 3  44 ZDCCCBBBAAAA44333322222222222222111111111
 4  40 XWCCBBA44444333333333322222221111111111
 5  65 YWWDDCBBBBAAAAAAA4443333333222222222222222222222222111111111111111   5:
 6  42 ZZYXXBBBBB44444433322222222222111111111
 7  45 XXCCBBBBA44333222222222221111111111111111111
 8  53 CBBBBAA43333333333222222222222222222222111111111111111   8
 9  40 ZYDDBBBAA443333332222222222221111111111
10  42 ZZYYXXBBBB44444333322222222222222111111111
11  59 ZXCBBBBAA444444433333333322222222222222222211111111111111111:
12  60 ZYCB4444444443333333322222222222222222222111111111111111111111   12
13  53 BBBAAAAA43333333332222222222222211111111111111111111
14  32 YXDBB4444333332222222211111111
15  80 ZZZXDDCBAAAAAAAA4444443333333333333333333332222222222222222211111(15)111
16  45 YYXWDBAAAA444443333332222222222222111111111
17  48 XXXDDBBBAAAA444443333333332222222211111111111
18  67 XDBBBBBAAAAAA4333333333332222222222222222111111111111111111111111111
19  74 ZYXXDCBBBA4444443333333333222222222222222111111111111111111111111111111111
20  74 XDDDCBBB4444444333333333332222222222221111111111111111111111111111(20)111
21  70 XXXBBBBBBBB444433322222222222222222222222111111111111111111111111111111111
22  51 WDCBBBB444444333333222222222222222211111111111111
23  41 ZYWDBB444444433332222222222222111111111
24  48 YDDBBBAAA44443333322222222222111111111111111111
25  50 YYYXXWDDDBA43333322222222222222111111111111111111111   25
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27  38 YXCCCCBBB444433322222222222111111
28  44 YXXWWDBBAA4333333332222222222222221111111111
29  37 XDCBBBBA44333333333222222221111111111
30  56 YXWDBBBBB4444433322222222222222111111111111111111111111   30:
31  44 ZYCCBBBB44443333332222222222222111111111111
32  35 ZZZXCBA444433333322222222111111111
33  51 DDDBBAAAA44443333333333333333333222222211111111111   33
34  50 ZYYXXXXXCBBBBBBAA44333333332222222111111111111111
35  33 XDCBB44333222222111111111111111
36  38 XDCAA4444444433333322222211111111111
37  40 ZZXXDCCBBBBBA444443322222222222111111111
38  53 YX..BBBBAAA44444443333333322222222222111111111111111
39  46 ZDDDBBAA4444433333222222222222111111111111111
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41  35 ZYXCBAA4444443333332222111111111
42  54 ZXXCCCBBA4444333333222222222222222221111111111111111
43  37 XXXDCBBA43333222221111111111111
44  53 XDCBBBBA4433333333322222222222111111111111111111111
45  47 YDCBBAA444443333322222222221111111111111
46  54 ZYDDDCCBBAA4444444333333222222222222221111111111111111
47  53 ZXXCCCCBBBAA44443333322222222222222222111111111111
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62  47 ZWCCBBBBAAAAA444333332222222222222211111111111
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66  76 ZYYXXDDBBBBAAAAA443333333333333222222222222222222222211111111111(66)111
67  42 YYCCCBAA43333333333332222222221111111111
68  54 ZYXDDCCBBBBAAA44433333332222222222222222111111111111111
69  59 XWWCBBBBAAAAAAAAA444433333333222222222222221111111111111111111:
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71  39 WDA44444444433322222222222111111111111111:
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73  37 ZZYYWDDDCBB44433333333222222211111111
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75  52 WDBBBA444333333332222222222222222211111111111111111
76  64 ZYXXXWBBBBAAA44444433333333333222222222222222111111111111111111111   76:
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79  26 YXWWDDBBA444333222221111111
80  49 YXWCCCBBA444333333333332222222222222111111111111:
81  34 ZYXWAAA443333333333222211111111111
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83  47 YXXXWDCCBA444443333333222222222211111111111111
84  54 ZXXXCBAA44444444443333333332222222222222222211111111111
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86  36 YWWB333333322222111111111111111111111
87  42 ZXCBBAAAAAA444333333222222221111111111111111
88  60 XWWDDCCBBB44444444444444333333322222222111111111111111111
89  64 DCBBBBAAAAAA4444444444443322222222222222222222222221111111111111111   89
90  36 ZYYYXCBBBAAA44443332222222111111111
91  43 BBB44444333332222222222222222222111111111
92  47 YYWDDDDCCCBB4444433333322222222222211111111111111
93  77 ZWDDDDBBAAA44444433332222222222222222211111111111111111111111111111(93)11
94  62 YYXXWDCBBBBAAA4444433333333333222222222222111111111111111111111111
95  53 ZZYDBBBBBBBAAA33333333222222222222222211111111111111111
96  46 XWBBBBAA444444433333322222222211111111111111
97  55 ZXDCBBBB443333333322222222222222222211111111111111111111
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99  80 ZYYXXDCCCCBBBAAAA44444433333333333322222222222222222211111111111111111111111
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 0 204 ZYYYYYYXXWDCCCCBBBBAAAAAAAA444444444433333333333333333333333322222222222222
 1  72 ZYXDDCCCBBAA44444443333333333333322222222222222111111111111111111111111
 2  53 YXWWDDCCCBBBBAA4443333222222222222222111111111111111
 3  44 ZDCCCBBBAAAA44333322222222222222111111111
 4  40 XWCCBBA44444333333333322222221111111111
 5  65 YWWDDCBBBBAAAAAAA4443333333222222222222222222222222111111111111111   5
 6  42 ZZYXXBBBBB44444433322222222222111111111
 7  45 XXCCBBBBA44333222222222221111111111111111111
 8  53 CBBBBAA43333333333222222222222222222222111111111111111   8
 9  40 ZYDDBBBAA443333332222222222221111111111
10  42 ZZYYXXBBBB44444333322222222222222111111111
11  59 ZXCBBBBAA444444433333333322222222222222222211111111111111111:
12  60 ZYCB4444444443333333322222222222222222222111111111111111111111   12
13  53 BBBAAAAA43333333332222222222222211111111111111111111
14  32 YXDBB4444333332222222211111111
15  80 ZZZXDDCBAAAAAAAA4444443333333333333333333332222222222222222211111(15)11
16  45 YYXWDBAAAA444443333332222222222222111111111
17  48 XXXDDBBBAAAA444443333333332222222211111111111
18  67 XDBBBBBAAAAAA4333333333332222222222222222111111111111111111111111111
19  74 ZYXXDCBBBA4444443333333333222222222222222111111111111111111111111111111111
20  74 XDDDCBBB4444444333333333332222222222221111111111111111111111111111(20)
```

FIGURE I1: frequencies of distances of player 3 to blisspoint in figure M (aggregated by 10)

1,2,3,4 : proposals in experience 1,2,3,4
A,B,C,D : tentative agreements in experience 1,2,3,4
W,X,Y,Z : final results in experience 1,2,3,4
? : last decimal digit

dist	fre	cases		explanation
0?	29	YXWWBBBBBBA44333333322222111		
1?	4	2111		
2?	0			
3?	1	B		
4?	5	ZC111		
5?	2	32		
6?	1	X		
7?	2	42		
8?	1	2		
9?	0			
10?	9	B33222222	100	
11?	2	22		
12?	4	4222		
13?	5	D4211		
14?	3	332		
15?	8	DB222211	150	
16?	2	C1		
17?	4	B444		
18?	2	32		
19?	0			
20?	4	B222	200	
21?	2	B2		
22?	2	43		
23?	2	32		
24?	2	C2		
25?	3	X22		
26?	6	Y32222		
27?	3	C33		
28?	7	DC33331		
29?	8	CBB32111	290	
30?	7	BB32221	300	quota-value
31?	6	DB2221		
32?	1	2		
33?	6	XC3331		same dist.to 5 as midpoint 25
34?	2	C3		
35?	2	43		
36?	8	XCB22221		gravicenter of total figure
37?	3	B11		
38?	4	B221		
39?	9	WDB322111	390	
40?	6	443211		
41?	6	AAA411		
42?	8	B2111111		equidistance of 23 on line 25
43?	0			
44?	2	31		
45?	7	WAA2111	450	
46?	4	3111		
47?	9	321111111		equidistance of 135
48?	1	B		
49?	4	3211		equidistance of 123 and 345
50?	4	2111		equidistance of 123 and 345
51?	6	221111		
52?	0			
53?	7	2221111		intersection 13 x 25
54?	1	A		
55?	0			
56?	0			
57?	2	AA		
58?	1	1		
59?	1	1		
60?	0			
61?	0			
62?	0			
63?	0			
64?	0			
65?	0			
66?	3	A21		
67?	0			
68?	0			
69?	0			
70?	0			
71?	0			
72?	0			
73?	0			
74?	0			
75?	0			
76?	0			
77?	0			
78?	0			
79?	0			
80?	0			
81?	0			
82?	0			
83?	0			
84?	1	1		
85?	0			
86?	0			
87?	0			
88?	0			
89?	0			
90?	0			
91?	0			
92?	0			
93?	0			
94?	0			
95?	0			
96?	0			
97?	0			
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99?	0			
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102?	0			
103?	0			
104?	0			
105?	0			
106?	0			
107?	0			
108?	0			
109?	0			
110?	0			
111?	0			
112?	0			
113?	0			
114?	0			
115?	0			
116?	0			
117?	0			
118?	0			

FIGURE I2: frequencies of distances of player 3 to blisspoint in figure H (aggregated by 10)

1,2,3,4 : proposals in experience 1,2,3,4
A,B,C,D : tentative agreements in experience 1,2,3,4
W,X,Y,Z : final results in experience 1,2,3,4
? : last decimal digit

dist	fre	cases		explanation
0?	0			
1?	0			
2?	0			
3?	3	222		
4?	0			
5?	0			** (refers to 16?) nearest to
6?	0			3 while distances to bliss
7?	0			points 2,4 as in mid 24
8?	0			
9?	0			
10?	1	3		
11?	0			
12?	0			
13?	6	B22211		gravicenter
14?	3	X32		
15?	6	311111		
16?	29	YWAAAAAAA33221111111111111111		**
17?	7	4211111		
18?	11	AA433221111		
19?	20	XBAA44322221111111111		midpoint of 24
20?	5	XAA22		(intersection of lines 24x14
21?	6	B32111		(intersection of lines 24x14
22?	3	WD2		
23?	2	43		
24?	4	2211		
25?	3	422		
26?	2	43		
27?	2	BA		
28?	7	DA44311		same distance to 1 as inter-
29?	7	C332111	290	section of lines 53x14
30?	1	1		
31?	2	21		
32?	4	ZB21		nearest to 4 on line 35 (??)
33?	3	W22		
34?	2	A1		
35?	3	D21		
36?	2	31		quota value
37?	4	Y222		
38?	4	D211		
39?	9	Y43321111	390	nearest to 2 on line 13
40?	2	21		
41?	2	AA		
42?	1	2		
43?	2	B3		
44?	3	221		
45?	3	322		
46?	4	A421		equidistance 23 on line 13
47?	0			
48?	1	1		
49?	6	AA3221	490	intersection of lines 13x35
50?	0			
51?	0			
52?	0			
53?	1	1		
54?	0			
55?	0			
56?	0			
57?	1	1		
58?	2	11		
59?	4	1111		
60?	6	A11111	600	
61?	0			
62?	0			
63?	0			
64?	2	11		equidistance to all
65?	2	11		
66?	0			
67?	1	1		
68?	0			
69?	1	1		
70?	0			
71?	0			
72?	0			
73?	0			
74?	0			
75?	0			
76?	0			
77?	0			
78?	0			
79?	0			
80?	0			
81?	0			
82?	0			
83?	0			
84?	0			
85?	0			
86?	0			
87?	0			
88?	0			
89?	0			
90?	0			
91?	0			
92?	0			
93?	0			
94?	0			
95?	0			
96?	0			
97?	0			
98?	0			
99?	0			
100?	0			
101?	0			
102?	0			
103?	0			
104?	0			
105?	0			
106?	0			
107?	0			
108?	0			
109?	0			
110?	0			
111?	0			
112?	0			
113?	0			
114?	0			
115?	0			
116?	0			
117?	0			
118?	0			

FIGURE 13: frequencies of distances of player 3 to
blisspoint in figure A (aggregated by 10)

```
1,2,3,4 : proposals in experience 1,2,3,4
A,B,C,D : tentative agreements in experience 1,2,3,4
W,X,Y,Z : final results in experience 1,2,3,4
?       : last decimal digit

dist fre cases          explanation
----------------------------------------------------------------
  0?   0            :         :         :         :         :
  1?   0            :         :         :         :         :
  2?   0            :         :         :         :         :
  3?   0            :         :         :         :         :
  4?   0            :         :         :         :         :
  5?   0            :         :         :         :         :
  6?   0            :         :         :         :         :
  7?   0            :         :         :         :         :
  8?   0            :         :         :         :         :
  9?   0            :         :         :         :         :
 10?   0            :         :         :         :         :
 11?   1 1          :         :         :         :         :
 12?   0            :         :         :         :         :
 13?   0            :         :         :         :         :
 14?   1 1          :         :         :         :         :
 15?   0            :         :         :         :         :
 16?   0            :         :         :         :         :
 17?   0            :         :         :         :         :
 18?   0            :         :         :         :         :
 19?   1 2          :         :         :         :         :
 20?   0            :         :         :         :         :
 21?   0            :         :         :         :         :
 22?   1 1          :         :         :         :         :
 23?   1 1          :         :         :         :         :
 24?   0            :         :         :         :         :
 25?   2 21         :         :         :         :         :
 26?   3 A31        :         :         :         :         :
 27?   4 3111       :         :         :         :         :
 28?   1 2          :         :         :         :         :
 29?   4 3221       :         :         :         :         :
 30?   5 11111      :   equidistance 13,24,43     :         :
 31?   8 21111111   :         :         :         :         :
 32?   2 21         :         :         :         :         :
 33?   1 2          :         :         :         :         :
 34?  10 3222211111   midpoint 234      :         :         :
 35?   5 A4111      :         :         :         :         :
 36?   8 BA433322   :   compromize *    :         :         :
 37?   4 4111       :         :         :         :         :
 38?   7 B211111    :         :         :         :         :
 39?   4 D411       :         :         :         :         :
 40?  11 YDA44443222  same to 5 as in midpoint 24           :
 41?   7 YXXB421    :         :         :         :         :
 42?   2 11         :         :         :         :         :
 43?   7 WA42111    :         :         :         :         :
 44?   8 A4221111   :         :         :         :         :
 45?   4 Z421       :         :         :         :         :
 46?   8 ZYXX3321   :   compromize between 40 and 52, quota :
 47?  10 WA32111111           :         :         :         :
 48?   5 22221      :         :         :         :         :
 49?   6 B21111     :         :         :         :         :
 50?   2 B2         :         :         :         :         :
 51?   8 Z4322211   :         :         :         :         :
 52?  55 DDBBAA4433222211111111111111111111111111111111111111111 midpoint 24
 53?   3 321        :         :         :         :         :
 5??   3 XB1        :         :         :         :         :
 55?   3 X11        :         :         :         :         :
 56?   1 1          :         :         :         :         :
 57?   2 11         :         :         :         :         :
 58?   3 221        :         :         :         :         :
 59?   2 21         :         :         :         :         :
 60?  12 CA3222111111   midpoint 35     :         :         :
 61?   1 1          :         :         :         :         :
 62?   1 1          :         :         :         :         :
 63?   1 1          :         :         :         :         :
 64?   6 211111     :   (5 of these in 1 game)    :         :
 65?   1 1          :         :         :         :         :
 66?   0            :         :         :         :         :
 67?   0            :         :         :         :         :
 68?   1 1          :         :         :         :         :
 69?   0            :    *) in this compromize on line      :
 70?   0            :       25 both players improve for     :
 71?   0            :       equal amounts compared to       :
 72?   0            :       their distances to midpoint 24. :
 73?   0            :         :         :         :         :
 74?   0            :         :         :         :         :
 75?   0            :         :         :         :         :
 76?   0            :         :         :         :         :
 77?   0            :         :         :         :         :
 78?   0            :         :         :         :         :
 79?   0            :         :         :         :         :
 80?   0            :         :         :         :         :
 81?   0            :         :         :         :         :
 82?   0            :         :         :         :         :
 83?   0            :         :         :         :         :
 84?   0            :         :         :         :         :
 85?   0            :         :         :         :         :
 86?   0            :         :         :         :         :
 87?   0            :         :         :         :         :
 88?   0            :         :         :         :         :
 89?   0            :         :         :         :         :
 90?   0            :         :         :         :         :
 91?   0            :         :         :         :         :
 92?   0            :         :         :         :         :
 93?   0            :         :         :         :         :
 94?   0            :         :         :         :         :
 95?   0            :         :         :         :         :
 96?   0            :         :         :         :         :
 97?   0            :         :         :         :         :
 98?   0            :         :         :         :         :
 99?   0            :         :         :         :         :
100?   0            :         :         :         :         :
101?   0            :         :         :         :         :
102?   0            :         :         :         :         :
103?   0            :         :         :         :         :
104?   0            :         :         :         :         :
105?   0            :         :         :         :         :
106?   0            :         :         :         :         :
107?   0            :         :         :         :         :
108?   0            :         :         :         :         :
109?   0            :         :         :         :         :
110?   0            :         :         :         :         :
111?   0            :         :         :         :         :
112?   0            :         :         :         :         :
113?   0            :         :         :         :         :
114?   0            :         :         :         :         :
115?   0            :         :         :         :         :
116?   0            :         :         :         :         :
117?   0            :         :         :         :         :
```