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Negotiators' cognition: An experimental study on bilateral, integrative negotiation

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**Negotiators' cognition:
An experimental study
on bilateral, integrative negotiation**

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Negotiators' cognition: An experimental study on bilateral, integrative negotiation

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Abstract:

Many negotiations offer a potential for integrative agreements in which the parties can maximize joint gains (through logrolling) without competing for resources as in a 0-sum game; nevertheless negotiators often fail to exploit this potential and settle for suboptimal, distributive agreements. In this study a situation of two-issues bilateral negotiation has been considered. Our aim is to get some insight on the causes that prevent negotiators from reaching integrative, Pareto-optimal agreements. We ran two experiments (one with policy makers and one with students) in which we tested the “fixed pie bias” of negotiators, and we introduced a new explanation for suboptimality, based on the hypothesis of a satisficing (not optimizing) behavior of negotiators, which leads them to a “zone of agreement bias”(ZAB).

JEL-Classification: C91

Keywords: integrative negotiation, logrolling, cognitive bias, satisficing

1. Introduction

Negotiation has been defined as the process by which two or more parties attempt to resolve perceived incompatible goals (Carnevale and Pruitt, 1992).

Many models derived from game and bargaining theory have treated almost exclusively the conflictual and distributive aspect of negotiation. The issues to be negotiated are considered as falling along a single dimension, with opposed positions at each end, and the dynamics are supposed to be largely restricted to making initial offers, making concessions and retractions, and eventually converging toward agreement or breaking off negotiations, without possibilities of expanding or redefining the bargaining space.

The focus of negotiation research has recently been shifted from distributive bargaining theory toward the integrative bargaining approach which emphasises the importance of joint problem solving. “Many negotiations provide opportunities for integrative agreements in which the parties maximise their outcomes, or achieve greater resources, without competing with the other party in a direct win-lose fashion” (Thompson and Hastie, 1990a). Integrative analysis, rather than seeing a process that works from fixed points of discord to a common point of convergence, stresses the need to create new solutions by manipulating conceptualizations of the problem through a process of inventive and cooperative problem solving, so as to reconcile the interests of all parties and reach joint benefits, or attain “win-win” goals (Pruitt, 1986; Putnam, 1990; Brett et al., 1990; Fisher and Ury, 1991; Brett, 2000). The different parties are likely to have different interests, priorities, and resources, and these asymmetries frequently produce cross-cutting cleavages among actors and opportunities for tradeoffs among issues which could be positively exploited. The parties may be divided differently depending on the kind of issue to be negotiated. Parties may find that their enemy on one issue is their ally on others, so that simple concession-convergence bargaining becomes virtually impossible; there is no single dimension along which parties can converge. Moreover, a large number of parties enhances the possibility to form coalitions which may be used strategically by the parties to achieve their goals.

A growing branch of integrative analysis focuses on precise mechanisms for identifying the best tradeoffs among the parties’ interests, and thereby insure the greatest optimality to the outcome (Zartman, 1999). This doesn’t mean that the distributive component of bargaining is completely eliminated from the negotiation process, but simply that the parties “can cooperate in order to change the pie that they eventually will have to divide” (Raiffa, 1982).

There exist various techniques which are adopted in integrative negotiation: logrolling (or issue-aggregation), issue-disaggregation, bridging, circular barter, cost cutting, nonspecific compensation (Touval, 1982; Brett, 1990; Hopmann, 1996). In order to limit our research we will focus our

attention on logrolling (see next section). Many negotiations offer a potential to maximize joint gains through logrolling; nevertheless negotiators often fail to exploit this potential and settle for sub-optimal, distributive agreements. Our aim is to run some experiments in order get some insight on the causes that prevent negotiators from reaching integrative, pareto-optimal agreements. In particular, our purpose is to test the already known “fixed pie bias” of negotiators (see next section) in a situation of two-issue bilateral bargaining, and to introduce a new, additional, explanation for suboptimality in integrative negotiation: a zone of agreement bias (ZAB) which is due to a satisficing and not optimizing behavior of negotiators.

2. Logrolling and fixed pie bias

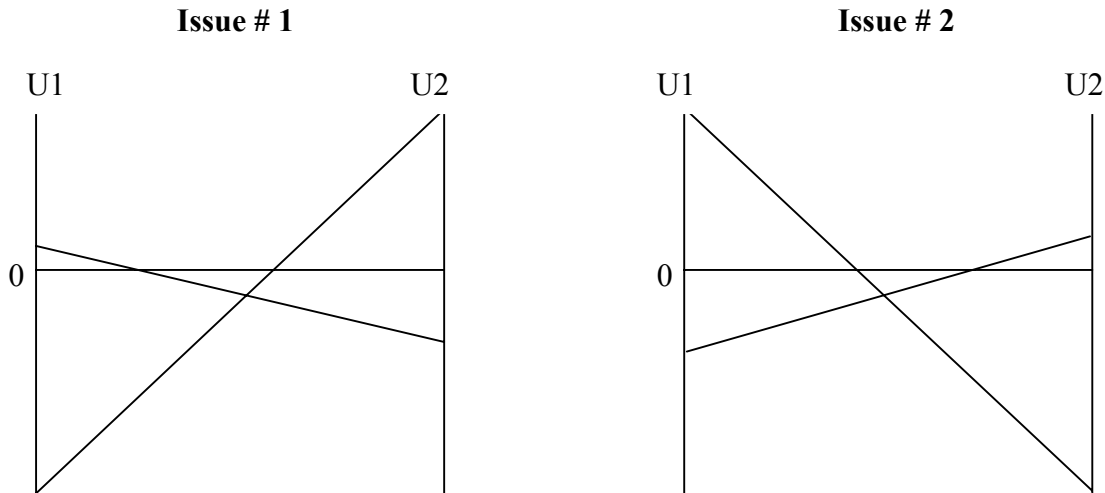
The technique of logrolling consists in redefining the issues by aggregating them into interlocking issues. Sub-issues are linked together “to create package agreements out of components that would be nonnegotiable if treated separately” (Hopmann, 1996). This approach involves identifying interests, prioritising them, and creating tradeoffs in which parties concede on low-priority interests in order to receive satisfaction of high-priority interests (Brett et al., 1990).

This approach is represented in Fig.1. On both issues the bargaining spaces of the parties don't overlap, since the preference curves intersect below the line of neutrality or indifference. In a situation of distributive bargaining this would create a stalemate on both issues. However, if we consider that party 1 has stronger interests about issue 2 and is more neutral on issue 1, and party 2 has stronger interest on issue 1 and is more neutral on issue 2, a solution can be found by agreeing to let party 1 win on issue 2, and party 2 win on issue 1. If party 1's gains on issue 2 exceed its losses on issue 1, and party 2's gains on issue 1 exceed its losses on issue 2, then both parties will still find the overall agreement beneficial.

In order for logrolling to take place, and thus achieve Pareto-optimal outcomes, the parties should possess the cognitive capabilities required to represent and analyse the whole space of the negotiation problem. From the traditional point of view of rational-choice theory, which underlies most economic models, the problem of understanding the complexity of a problem would not subsist since the parties are considered to be able to construct complete and objective representations of reality. Under this approach the agents are assumed to possess perfect knowledge of the whole set of alternatives available to achieve their goals, and of the consequences that would flow from each of them, to have a well defined and stable structure of preferences over alternatives, to be driven by maximisation motives, to be endowed with unlimited computational ability, and to choose the tactics most likely to produce an optimal realisation of their goals. Under these

assumptions the parties would always be able to recognise and take mutually advantage of the integrative potential of negotiations.

Figure 1 – Issue aggregation –



Note: the utility curves U1 and U2 respectively of party 1 and 2 intersect below the horizontal line of indifference, thus the two parties don't have a zone of agreement on neither issue. By aggregating the two issues (party 1 wins on issue 2 and party 2 wins on issue 1) however, the two parties can both reach a convenient agreement.

A large amount of empirical research (see for example Ho and Weigelt, 1996; Schotter et al., 1994; Selten, 1997; Legrenzi and Girotto, 1996; Zhang and Norman, 1994; Johnson-Laird, 1990; Ripps, 1994; Evans and Over, 1996; Tversky and Kahneman, 1986;), nevertheless, has demonstrated that individuals don't actually behave in such a perfectly rational way. When a complex problem situation arises, individuals are not able, because of their limited computational abilities, to develop an objective and complete representation of the problem; rather, they construct a subjective, simplified, partial, and sometimes even idiosyncratic, mental model of the situation, and then use this mental model to make projections and predictions about the future. As problem representations are generally prior to the generation of solutions, poor decision making and biases may derive not from the way preferences and alternatives are handled, but rather from the assumptions that underlie the generation, evaluation, revision, and selection among those preferences and alternatives.

Research on negotiation has recently begun to focus attention on the study of how negotiators define and perceive a negotiation game. Experimental evidence has demonstrated that negotiators use various presumptions or simplifying strategies to interpret the situation and construct a response. As will be explained in more detail in the following, the more complex and ill-structured the negotiation problem, the more biased the negotiators' representations.

Bazerman (1983) suggested that negotiators' mental models are subjected to the "fixed-pie bias". They perceive negotiation as a purely distributive or competitive game in which there's a fixed pie of resources to be divided up among the parties, and better outcomes for one can be obtained only at the expenses of another. Bazerman (1985) found that in a negotiation task with integrative potential, individuals concentrate first on competitive issues and it takes them significant experience to overcome the fixed pie bias and recognize the integrative potential of the situation.

Hammond et al. (1975) suggest that negotiators frequently have poor and inaccurate perceptions of their opponents' importance weights for multiissue conflicts. "The fixed pie assumption actually may derive from the presumption that the other party has the same concerns regarding the relative importance of the issues, thus eliminating the possibility for mutually-beneficial trades" (Carroll and Payne, 1991). This presumption is due to a social perception bias known as "false consensus effect". It refers to the tendency of people to overestimate the proportion of other people who have interests similar to their own (Ross et al., 1977), and in negotiation it might result in distributive, win-lose perceptions of the task (Thompson and Hastie, 1990 b).

Neale and Bazerman (1983) found that negotiators displaying a greater perspective taking ability obtained better results in a complex integrative bargaining exercise, suggesting that they might have been better at identifying those issues that were most valuable to their opponents than those with less perspective taking ability.

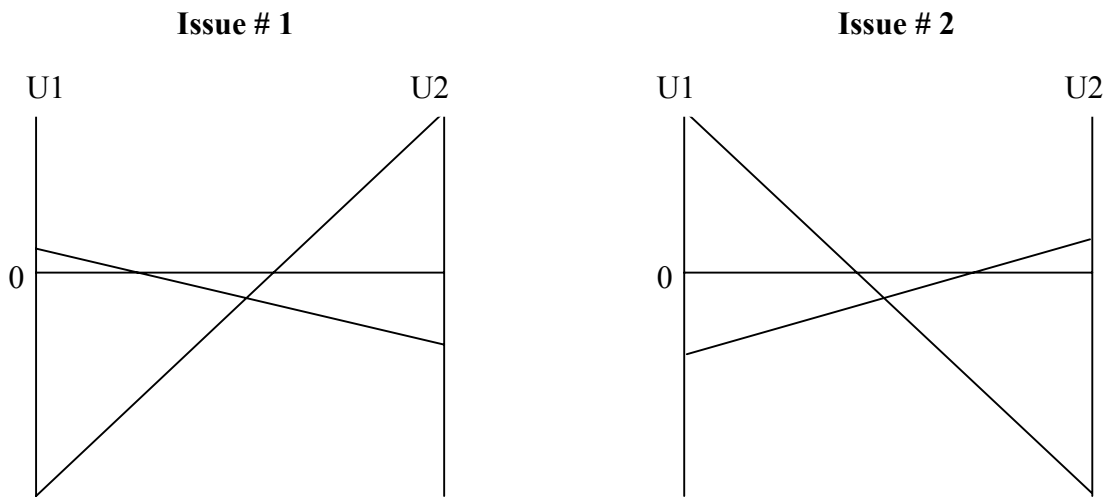
Thompson and Hastie (1990) found that individuals enter negotiation situations with fixed-pie perspectives, and with the assumption that their interests are diametrically opposed to those of the other party. Negotiators who modify their fixed pie or zero-sum assumption by disclosing their preferences and searching for information about the other party's preferences, do so immediately at the onset of the interaction; otherwise the fixed-pie assumption tends to persist throughout the negotiation. They showed that fixed-pie biases result in lower payoffs for the parties, because the latter fail to capture gains from integration.

3. A new hypothesis to explain suboptimality

In our research we hypothesise that, besides the fixed pie bias, there might exist an additional factor which could explain the suboptimality observed in integrative negotiation. This factor is represented by a "zone of agreement bias" (ZAB for simplicity) which might be due to the fact that negotiators behave in a satisficing, and not optimizing, way.¹ In other words, we hypothesise that in a situation like the one described in figure 3, in which the bargaining spaces of the two negotiators overlap in both issues, negotiators explore only a limited part of the negotiation problem's space, and, as soon as they are able to find a suboptimal solution falling within their zone of agreement, they stop

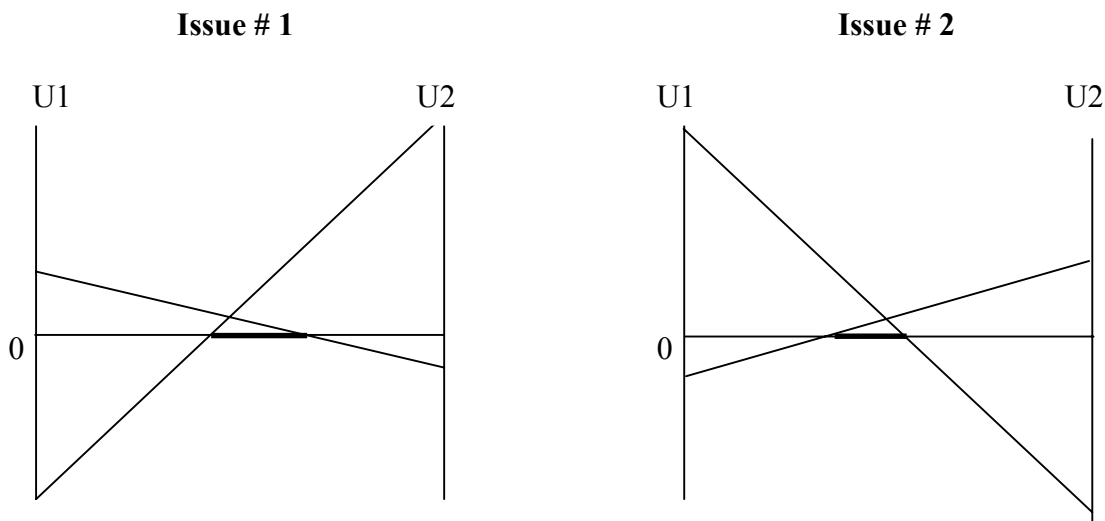
searching for the optimal solution falling outside of it, and remain blocked in the suboptimal one. To test our hypothesis, we compare negotiators' behavior under two different treatments (A and B). Treatment A is the one described in Fig. 2, in which the bargaining spaces of the two negotiators don't overlap in neither issue. Treatment B is the one described in Fig. 3, in which the bargaining spaces of the two negotiators overlap in both issues (see also next section). Our hypothesis is that the level of suboptimality will be higher when negotiators have a zone of agreement (treatment B). In this case indeed, it seems plausible to think that the possibility to find an agreement on the two issues separately, could prevent negotiators from exploring the space of more efficient agreements achievable through the aggregation of the two issues. Negotiators might remain blocked in the suboptimal agreements falling within the zone of agreement of each issue, and not consider the Pareto optimal ones falling outside of it. Negotiators under treatment A, in contrast, not being able to find a suboptimal solution, might be forced to consider the two issues jointly and eventually find an optimal agreement.

Figure 2 – Treatment A –



Note: the two parties don't have a zone of agreement on neither issue.

Figure 3 – Treatment B –



Note: the two parties have a zone of agreement (the bold line) on both issues.

4. Experimental design

The experiment has been run with 28 European policy makers and then it has been repeated with 28 undergraduate students from the faculty of economics. Subjects were asked to take part in an experiment aimed at analysing negotiation behavior. They were randomly paired in couples. Seven couples were assigned to treatment A and seven couples to treatment B (see section 3). Each couple was asked to negotiate on two different issues that were simply identified with the value of two numbers. Each subject was given a sheet with two tables representing her incentive in the negotiation about the two issues. The first column of each table contained numbers from 0 to 10, representing the possible agreements on that issue, and the second column contained the points associated to each agreement. Subjects were requested to negotiate with their counterpart on one number from 0 to 10 in the first table and one number in the second table, in such a way to maximise their own total number of points (for instructions see appendix A).

Within each couple a subject assumed the role of player one and the other the role of player two. As can be checked out in the payoff tables contained in appendix B, in each treatment for player one the higher the number the higher her payoff (both for the first and the second number) so that the best agreement from her standpoint is (10, 10). However, for player one the first number is “more important” than the second: the maximum that she can get out of it is 50 points and she loses 10 points for each unit reduction, while the maximum that player one can get out of the second number is 10 points under treatment A and 20 points under treatment B, and she loses 3 points for each unit reduction. Actually, denoting by x and y the value of the first and, respectively, the second number, the payoff tables for player one have been obtained as follows:

$$[1] \quad P_{1,A}(x) = P_{1,B}(x) = -50 + 10x \quad P_{1,A}(y) = -20 + 3y \quad P_{1,B}(y) = -10 + 3y$$

where $P_{1,i}(x)$ and $P_{1,i}(y)$ denote the amount of points under treatment i (for $i = A, B$) associated with x and, respectively, y .

Player two preferences over the two numbers are induced in a symmetric way: she prefers smaller numbers to larger ones (the best agreement would be (0,0)), but the second number is now more important. Indeed, player two payoff tables are obtained from:

$$[2] \quad P_{2,A}(x) = 10 - 3x \quad P_{2,B}(x) = 20 - 3x \quad P_{2,A}(y) = P_{2,B}(y) = 50 - 10y.$$

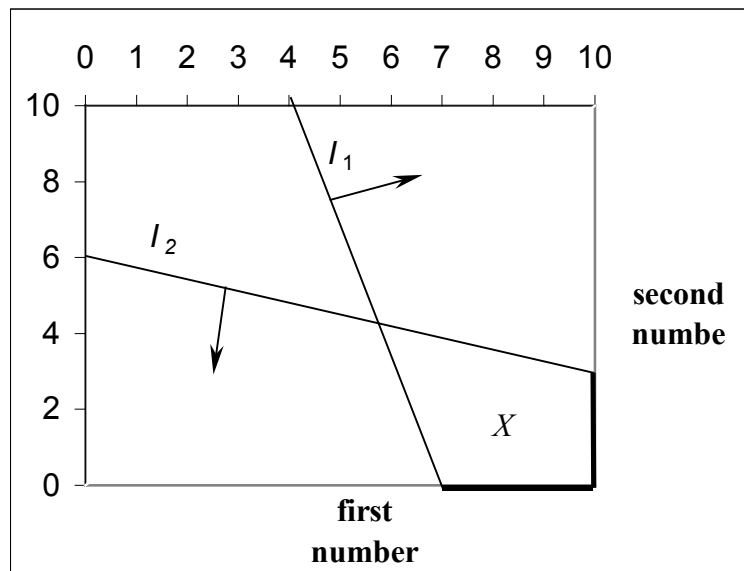
This payoff assignment exactly reproduces the situation described in figures 2 and 3. Under treatment A the two players cannot both obtain a positive payoff on none of the single issue (i.e. there's not a bargaining space on each single issue considered separately from the other). On the other hand, under treatment B if the first number is either 5 or 6, both players get a positive payoff on that issue and, similarly, if the second number is either 4 or 5 both gain out of it.

In figure 4 is represented the space of all possible couples of agreements on issues 1 and 2 under treatment A. Along the line I_1 we can find all the joint agreements inducing a total payoff of zero for player one (i.e. the equation of I_1 is $P_{1,A}(x) + P_{1,A}(y) = 0$; furthermore, the arrow indicates the hemiplane containing agreements with a total payoff greater than zero. Similarly, I_2 is defined by $P_{2,A}(x) + P_{2,A}(y) = 0$ and the arrow has a similar meaning. The region X contains all the possible agreements in which both players obtain a positive total payoff, and the bold line represents the Pareto frontier of such region. As we already know, under treatment A there are no joint agreements in which both players obtain a positive payoff on both issues. Region X represents then the bargaining space which emerges when the two issues are aggregated (through the logrolling mechanism). In particular in the agreement (10, 0) each player is winning on her most important issue and is losing on the other. In figure 5 is represented the space of all possible agreements on issues one and two under treatment B. Lines and arrows have here the same meaning as in figure 4 but now we can also observe a new region (the box denoted by Z) containing those agreements in which both players obtain a positive payoff on each issue (and then a positive total payoff). It is worth noting that any agreement in the area Y Pareto dominates any other agreement inside Z . In particular at the point (10, 0), where each player wins on her most preferred issue and loses on the other, both players are better off.

Negotiation was carried out face to face and subjects were allowed to speak freely. The only restriction was that they could not show their sheet with the tables to their counterpart. They had about 7 minutes to reach an agreement on the two numbers. If they didn't find an agreement on one of the two numbers they got 0 points for that number.

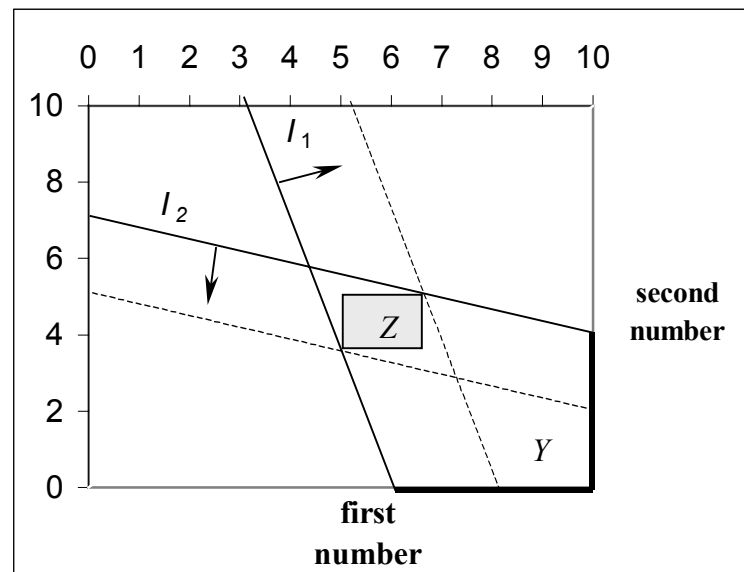
As an incentive the policy makers were given an amount of gifts directly proportional to the number of points they obtained in the experiment. The students instead were paid a show-up fee plus an amount of money dependent on their performance in the experiment, i.e. directly proportional to the number of points they obtained.

Figure 4 – Treatment A –



Note: here is represented the space of all possible couples of agreements on issues 1 and 2 under treatment A. The region *X* contains all the possible agreements in which both players obtain a positive total payoff through logrolling, and the bold line is its Pareto frontier.

Figure 5 – Treatment B –



Note: here is represented the space of all possible agreements on issues one and two under treatment B. The region *Z* contains those agreements in which both players obtain a positive payoff on each issue singularly (and then a positive total payoff). Any agreement in the area *Y* Pareto dominates any other agreement inside *Z*.

5. Theoretical predictions

The bargaining situation we are analyzing is characterized by incomplete information (actually, each player does not know the payoff tables of her counterpart). There is a very large strand of literature dealing with this topics and it is generally accepted that some kind of inefficiency will emerge in the final outcome even if agents are assumed to be fully rational. The particular nature of the inefficiency crucially depends on the specific rule that the agents have to follow in the bargaining process (the rule of the bargaining game), hence these models do not help us in making a specific prediction in a rule free bargaining situation like the one we are interested in.

If we assume that individuals are not perfectly rational and are subjected exclusively to the fixed pie bias, we should expect that not all couples of subjects are able to reach a Pareto optimal agreement, and that the number of couples reaching a suboptimal agreement is the same in treatment B and A.

If, as we hypothesise, individuals behave in a satisficing (not optimizing) way, and are subject to the ZAB, we should expect that not all couples of subjects are able to reach a Pareto optimal agreement, and that the number of couples reaching a suboptimal agreement under treatment B is higher than under treatment A. In particular the prediction is that the suboptimal agreements under situation B fall within the cartesian product of the two zones of agreement of each couple. Namely, we expect to observe a high proportion of agreements inside the region *Z* in figure 5.

6. Experimental Results

Hereafter, within each subject pool we will identify with letters from A to G the seven couples subjected to treatment A, and with letters from H to N the seven couples subjected to treatment B. Tables 1 – 4 show the experimental results that we obtained in the two subject pools. In order to interpret our results we will use figures 6 – 9 in which the same data sets are reported.

Table 1: experimental results of the policy makers

treatment A					treatment B			
Couple	1st N°	2nd N°	Time		Couple	1st N°	2nd N°	Time
A	10	0	7		H	6	5	7
B	9	1	7		I	10	0	7
C	10	0	7		J	10	2	7
D	4	5	5		K	NO	4	7
E	10	0	4		L	4	7	7
F	0	0	7		M	6	4	6
G	8	1	7		N	6	NO	7

Table 2: experimental results of the students

treatment A					treatment B			
Couple	1st N°	2nd N°	Time		Couple	1st N°	2nd N°	Time
A	10	0	2		H	6	4	5
B	9	1	2		I	6	4	3
C	NO	NO	5		J	5	4	3
D	10	1	7		K	6	4	4
E	10	0	4		L	10	0	5
F	8	0	4		M	10	1	5
G	10	0	2		N	10	0	5

Figure 6 – Experimental results of the policy makers: treatment A–

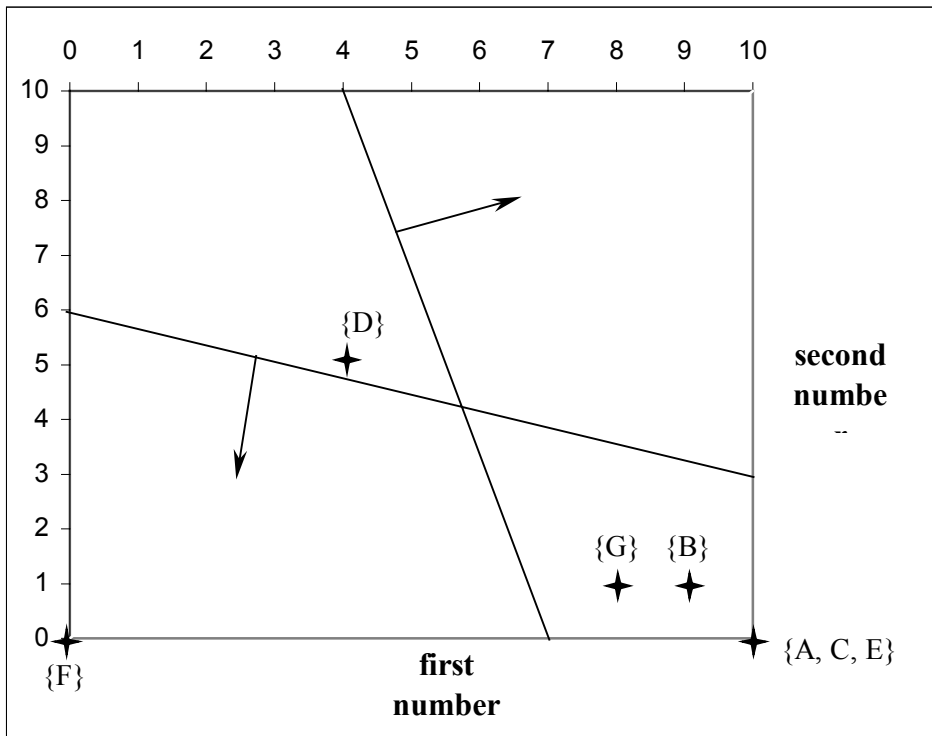
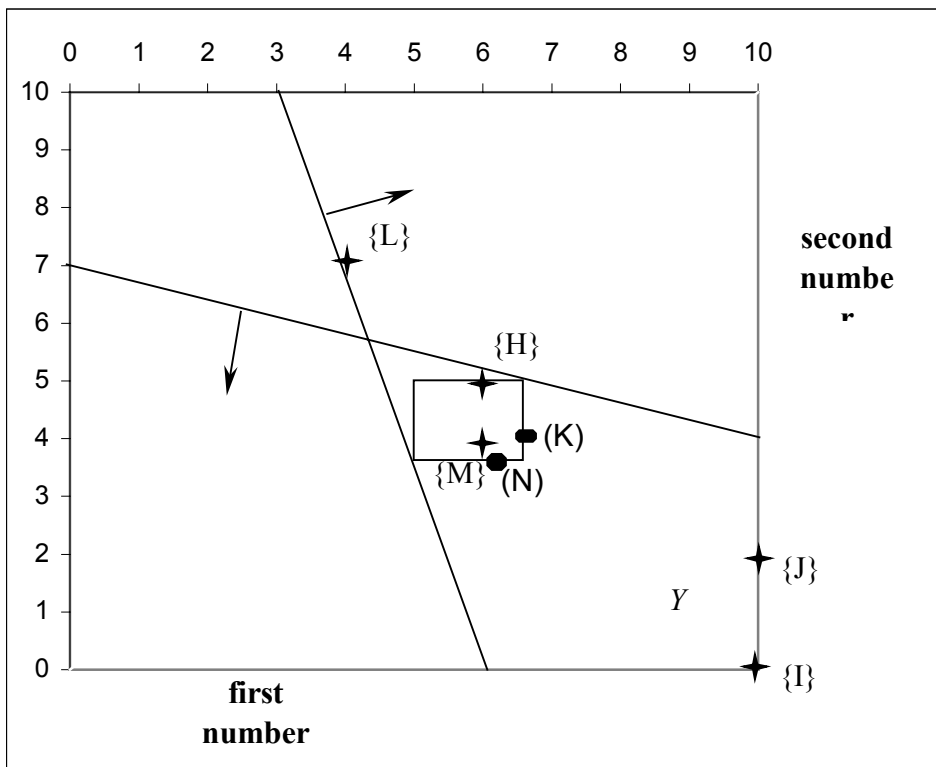
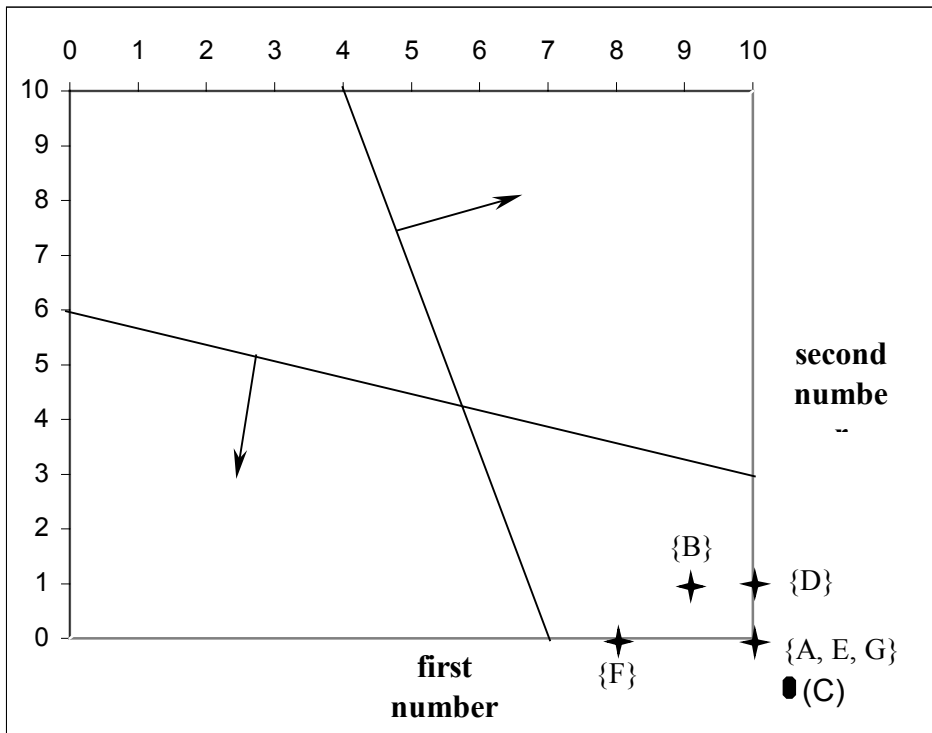


Figure 7 – Experimental results of the policy makers: treatment B –



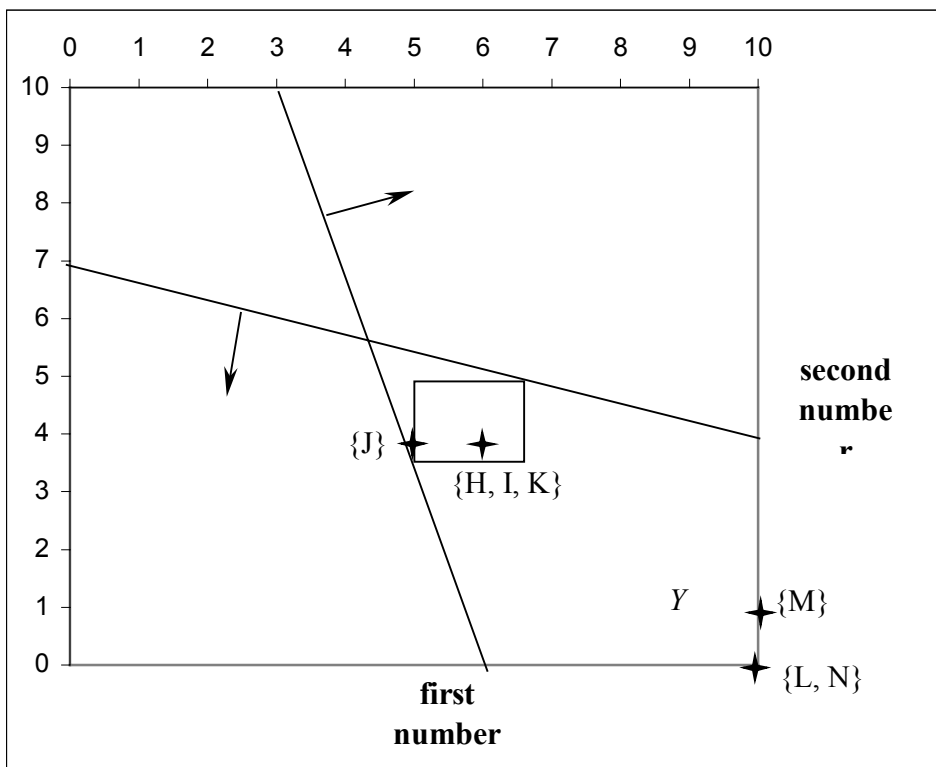
Note: couples (K) and (N) found an agreement on the second (first) issue within the zone of agreement, and didn't find any agreement on the first (second) issue. This means that they negotiated on the two issues separately, trying to find an agreement within their zones of agreement.

Figure 8 – Experimental results of the students: treatment A–



Note: couple (C) didn't find any agreement on neither issue

Figure 9 – Experimental results of the students: treatment B–



Let's consider first the pool of policy maker. As we can observe in figure 7, under treatment B only 2 couples out of seven were able to reach the pareto frontier while the other five ended up with an inefficient outcome. In particular four of them remained blocked in the rectangular region which we previously denoted as region Z (couples K and N found an agreement on one issue within the bargaining space and didn't reach any agreement on the other issue; this means that they negotiated on the two issues separately, trying to find an agreement within their zones of agreement). We ignore the results of couple L where player one obtained a loss because of a misunderstanding of the instructions.

Under treatment A, we observe 3 couples reaching the efficient outcome (10, 0). Other two couples are quite close to the pareto frontier, while the results of couples D and F have to be ignored once more because of a misunderstanding of the instructions. The discrepancy between the results under treatments A and B seems to be significant so that the existence of a zone of agreement bias is actually compatible with our data. The main problem is, of course, the small size of our subject pool which doesn't allow us to be completely confident with the reliability of our findings. However, we obtained a quite similar result in the other subject pool and that's a good indication about the validity of our hypothesis. As we can see in figure 9, in the subject pool of students under treatment B, 4 couples remained blocked inside the bias region Z, while the other three were able to reach the pareto frontier. On the other hand, under treatment A (see figure 8) 5 couple reached an efficient outcome and couple B is quite close to the pareto frontier; only couple C was not able to find any agreement on neither issue.

The discrepancy between the results under the two treatments is not negligible so that the ZAB seems to be at work under treatment B as in the previous subject pool.

7. Conclusions

The results of the experiments seem to confirm our initial hypothesis. The level of suboptimality has been higher under treatment B, i.e. when negotiators had a zone of agreement. Under this condition most of the negotiators (both policy makers and students) found an agreement on the two issues separately and remained blocked in the suboptimal agreements falling within the zone of agreement of each issue, without considering the Pareto optimal ones falling outside of it. Negotiators under treatment A, in contrast (with the exception of one couple of policy makers and one couple of students), have all negotiated on the two issues jointly and most of them have been able to find a Pareto optimal solution.

These results confirm our hypothesis that, besides the fixed pie bias, there exists an additional factor which can explain the suboptimality observed in integrative negotiation. That is, negotiators are

boundedly rational individuals that behave in a satisficing (non-optimizing) way. They explore only a limited part of the space of the negotiation problem and, as soon as they are able to find a suboptimal solution, they stop searching for a Pareto optimal one. In a situation like the one considered in our experiments, this kind of behavior leads negotiators to a “zone of agreement bias” (ZAB), i.e. as soon as they find a suboptimal solution within their zone of agreement, they stop searching for Pareto optimal agreements falling outside of it.

These findings should be confirmed by a more extensive analysis conducted on larger subject pools, but the indications emerging from our two pilot experiments allow us to be optimistic about the validity of our hypothesis. It could also be interesting to evaluate to what extent learning processes can reduce the level of suboptimality when agents can interact repeatedly.

Another interesting development might deal with a situation of multi-issue multilateral negotiation with a potential for logrolling, in which decisions on each issue are made under majority rule. The aim would be to analyse to what extent negotiators are actually able to form an optimal coalition and reach an optimal agreement. Our hypothesis is that in certain situations the ZAB might induce negotiators to form suboptimal coalitions which lead to Pareto-dominated agreements. Negotiators indeed might be induced by the ZAB to form a winning coalition (on each issue separately) only with the parties with whom they share a zone of agreement, and not to explore the space of more convenient coalitions outside the zone of agreement.

Appendix A: instructions

You are about to participate in an experimental study in decision-making and negotiation. The experiment will last for about half an hour. The instructions of the experiment are simple, and if you follow them carefully, you may win a lot of unique gifts and typical products from our region (money for students). Please, do not speak with the other player until the experiment starts.

According to how you perform the gifts (money) will be delivered to you tomorrow.

Please, write your name and the letter assigned to you for each period of experiment on the record sheet.

Decisions and earnings:

Everyone of you will be randomly matched with another participant. You have almost 10 minutes to gain as many points as you can. The number of gifts (the amount of money) will be directly proportional to the total number of points you will score in the experiment. Note that the amount of gifts (money) you will receive will be proportional to your own performance and not to the performance of the couple. At the beginning we assign you 50 points.

What to do:

As you see, you have a sheet with two tables, each made of two columns: in the left column you have a scale of numbers from 0 to 10. In the right column you have the number of points associated with each number in the left column. The tables of the other player might be different from yours. Your table and the points you get for each number of the left column is not known to the other player. Please, keep your tables secret.

You have to negotiate with the other player in order to choose a number in the left column. You have to negotiate for 1 number in the first table (called “first number”) and 1 number in the second table (called “second number”). If you both agree write it in the record sheet and call a laboratory assistant. The total points you gain are the sum of the points you get from the agreement in each table. If you do not agree, you remain with your initial points.

Please, note that you can agree with the other player on the “first number” and not on the “second number” and vice versa. In this case you will get the points corresponding to the number on which you agreed and you will get 0 points for the number on which you didn’t agree. Of course you can agree on both or neither.

During the negotiations you can speak freely with the other player but you must not show your table to the other player.

Appendix B: payoff tables

Treatment A

Player one				Player two			
1st N°	points	2nd N°	points	1st N°	points	2nd N°	points
0	-50	0	-20	0	10	0	50
1	-40	1	-17	1	7	1	40
2	-30	2	-14	2	4	2	30
3	-20	3	-11	3	1	3	20
4	-10	4	-8	4	-2	4	10
5	0	5	-5	5	-5	5	0
6	10	6	-2	6	-8	6	-10
7	20	7	1	7	-11	7	-20
8	30	8	4	8	-14	8	-30
9	40	9	7	9	-17	9	-40
10	50	10	10	10	-20	10	-50

Treatment B

Player one				Player two			
1st N°	points	2nd N°	points	1st N°	points	2nd N°	points
0	-50	0	-10	0	20	0	50
1	-40	1	-7	1	17	1	40
2	-30	2	-4	2	14	2	30
3	-20	3	-1	3	11	3	20
4	-10	4	2	4	8	4	10
5	0	5	5	5	5	5	0
6	10	6	8	6	2	6	-10
7	20	7	11	7	-1	7	-20
8	30	8	14	8	-4	8	-30
9	40	9	17	9	-7	9	-40
10	50	10	20	10	-10	10	-50

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ⁱ When a decision maker chooses the best alternative among those that are feasible he’s behaving in an optimizing way; when he chooses an alternative which is acceptable in some sense but it is not guaranteed to be the best, he’s behaving in a satisficing way. The term satisfice, a synonym of the term satisfy, has been introduced by Simon (1956) for this special use.

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