経営情報研究
Vol.7. No. 2

研究論文

Negotiation Analysis for Constructive Conflict Solving

Fumiko SEO

Abstract : Negotiations generally include the value conflict among the parties concerned between the competition for claiming individual values by remaining in no agreement and the cooperation for creating new values by forming an agreement. In this paper, the conflict solving problem is discussed with the value trade-off assessment on the utility possibility frontier over the negotiation zone for the possible agreements, which is treated to be changeable. The author presents a technique to search in a constructive negotiation process the compromise point where the joint distribution of the negotiators' utility values is determined. We call this process the evolutional negotiation process (ENP). Uncertainty in this process, which forms the probabilistic evolutional negotiation process (PENP), also is taken into account.

Keywords. Negotiation analysis, Constructive conflict solving, Negotiation curve, Value trade-off, Evolutional negotiation process.

1. Introduction

Negotiation analysis has been emerging for presenting the method to manage the conflict of interest among parties concerned and studied by many authors, such as T. C. Shelling (1960), H. Raiffa (1982), D. A. Lax and J. K. Sebenius (1986), J. L. Mumpower (1991), Sebenius (1992), etc. Although this approach seems to come from decision analysis and game theory, that is much more than those for the field to be treated and the problem to be structured. On the other hand, the concept of the constructive conflict has been discussed by M. Follett in the field of organization theory since 1925, whose importance recently is attracting much attentions. This paper presents an extended and analytical discussion based on Paretian approach for treating the constructive conflict solving.

Negotiations generally include the value conflict among the parties between the competition for claiming individual values by remaining in no agreement and the cooperation for creating new values by forming an agreement. In this paper, this problem is discussed on the utility possibility frontier over

the negotiation zone which is defined by a feasible region in the existing negotiators' perception but assumed to be changeable during the evolution in their perception. The author discusses the process to search the compromised point where the joint distribution of the negotiators' utility values is determined. In this context, we assume the negotiators neither to be strident antagonists, nor fully cooperative partners, but to be the cooperative antagonists in Raiffa's sense.

We discuss first the utility function for the eligible negotiators as a composite utility function which is composed of the individualistic utility function for claiming the individual value and the cooperative utility function for creating new common values, from which the utility possibility frontier is derived. We further discuss more constructive approach based on the evolutional process for the negotiation which includes the varying perception of the negotiators for the possible negotiation zone and for the utility possibility frontier. The change in the perception for the negotiation is derived with the reevaluation of the value tradeoffs between the claiming values for their own interest and the creating values for their common interest. In result, the feasible negotiation zone of the possible agreement is enlarged and the utility possibility frontiers are enhanced for both parties on the social utility indifference curve in the final agreement. We call this process the evolutional negotiation process (ENP).

In the negotiation processes, however, parties can not assume the rationality in behavior of their opponents. The response in the attitude of the opponents is uncertain. For treating this uncertainty, a probabilistic approach is presented in expanding the possible negotiation zone. We call this the Probabilistic evolutional negotiation process (PENP).

In the following, in Section 2, general concepts for negotiation analysis are examined. In Section 3, Paretian approach to negotiation analysis is discussed and its limitation is reconsidered. In Section 4, the traditional Paretian approach is extended and the constructive conflict solving is discussed on the expansion of the negotiation zone. Finally, in Section 5, some concluding remarks are presented.

2. Problems in Negotiation Analysis

Our first question is "what is the negotiation?" Negotiation is to manage the conflict of interest among parties concerned. Then what is the conflict? It should be noticed here that the conflict is not warfare, but the appearance of difference of interest, or opinions (Follett 1925). The problem in negotiation is to recognize how to manage the conflict, or the difference. For this purpose, negotiators should uncover the *true* differences among interests and understand the structure of their negotiation zone as their feasible region, which are usually latent and not revealed in the negotiators' original perception. In other words, in the construction of the fields of desire for the parties, they should be concerned with the perception of the existence of the latent possible negotiation zone.

In this process, however, we should consider the difficulties in the negotiation problem. In the subsequent discussions, we often call the participants in negotiation or the parties Player in an analogy to game theory. Similarly the negotiation is called game.

First, differing from the theoretical game theory, the common knowledge for the payoffs for players of a game can not be assumed in the negotiation problem. Players often hide their real interest.

Second, the rationality such as the expected utility hypotheses can not always be assumed for the other Players in negotiation. Therefore we should take the asymmetrically prescriptive/descriptive approach for negotiation analysis following Raiffa (1982) in contrast with game theory that is constructed on the symmetrically prescriptive approach for both sides. If negotiators take the fully descriptive approach, then many empirical findings for strident antagonism will lead to the pessimistic and unfruitful results for the negotiation. On the other hand, if the negotiators take the symmetrically prescriptive approach, then the negotiation will also be failed due to the mutual suspicion for the opponents' behavior,. The negotiators should seek the third direction if they really wish the successful results.

Our discussion is based on three assumptions for the negotiators.

First is the cooperative antagonist assumption(Raiffa 1982). Players are neither stringent antagonists nor fully cooperative partners. They have major concern with their own interest, but have no fully malevolent intention as well as fully altruistic intention.

Second is the ready-for-concession assumption. The negotiators are ready for concession through the value trade-off evaluation on their utility functions if they can recognize an additional gain in the concession. They have the willings to give up something in order to get something else in return if the value trade-off for an additional gain is indifferent or more preferable for their benefit or the utility level. These two assumptions lead to the Paretian approach that is based on a compromise of the parties.

In addition, however, we should assume the third assumption, the unrevealed existence of the negotiation zone. This assumption asserts that neither side knows all about the location of Pareto efficient frontier, although it theoretically exists.

The third assumption assures the possibility of the extension of the negotiation zone in the original perception of Players.

Before proceeding to the detailed discussion for this extension, however, we shall discuss the fundamental concepts in the Paretian approach for negotiation.

3. Paretian Approach to Negotiation

3.1 Player's utility function

We construct the feasible negotiation zone on the Players' utility space.

An elementary illustration of the Pareto efficient frontier with two Players is depicted in Fig.1 (*cf.* R. Dorfman 1972). The compromise point is located at *E*. The utility distribution for Player 1 or Player 2 is *A* or *B* respectively. In general, however, the compromise point is not unique, which is varied with changing the slope of the social indifference map defined on both Players' utility functions.

In this paper, however, the Player's utility function is constructed as a composite utility function, where the existence of the empathizing with the other person, or some altruistic attitude to some

extent, is assumed (A. Smith 1811-12, H. Margolis 1982). The composite utility functions for n Players are defined as

$$\begin{aligned} U_1 &= f(u_{1I}, u_{1C}) \\ U_2 &= g(u_{2I}, u_{2C}) \qquad (1) \\ &\vdots \\ U_n &= h(u_{nI}, u_{nC}) \end{aligned}$$

where $u_{jI}(x, y)$ is the individualistic utility function of Player j, $j = 1, 2, ..., n$, for his own interest in the claiming value and $u_{jC}(x, y)$ is the cooperative utility function of Player j for the common interest in the cooperation with other Players.

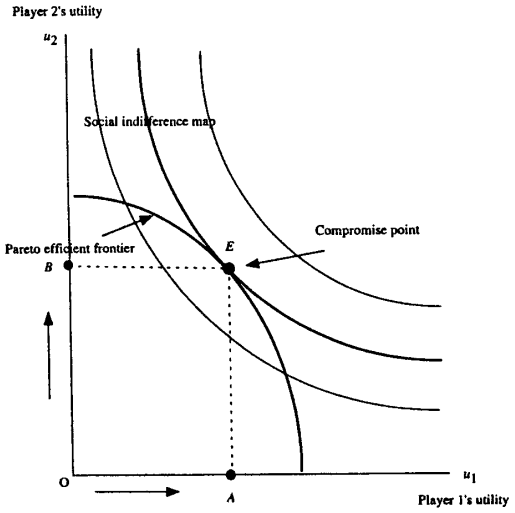


Fig.1 Illustration of Paretian approach

These functions are defined on the claiming values x for own interest and the external benefit y to be obtained from the attainment of a compromise. The variable y is unknown beforehand and thus the perception of the common utility is undetermined in advance.

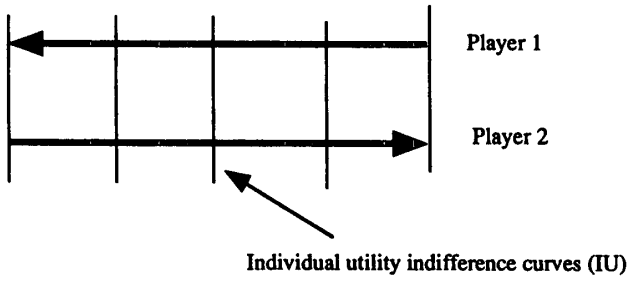
Alternative structures of negotiation are depicted as in Fig. 2. When we take a fully antagonistic structure, only the conflict of interest exists in negotiation. The utility function of each player is represented with $0 \leqq u_{jI}(x, y) \leqq 1$, $u_{jC}(x, y) = 0$ (Fig. 2 (A)). In this case, the interests of both players never meet in negotiation. When full cooperation exists, $0 \leqq u_{jC}(x, y) \leqq 1$, $u_{jI}(x, y) = 0$. In this case, the interest of both Players is enhanced in parallel with each other and a compromise is always attained, which is unrealistic case (Fig. 2 (B)). These two cases are represented by one-dimensional utility indifference curves. In the negotiation structure having the composite utility function, $0 \leqq u_{jI}(x, y) \leqq 1$, $0 \leqq u_{jC}(x, y) \leqq 1$, and the utility indifference curves are two-dimensional (Fig. 2 (C)). In this case, both players construct their own composite utility functions.

The Paretian approach is constructed for the third case.

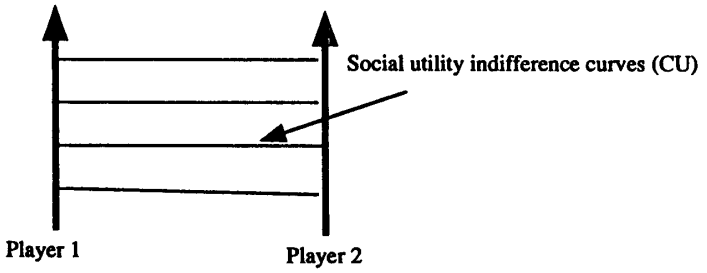
3.2 Paretian approach for negotiation

The compromising process by two Players, 1 and 2, with the composite utility functions is depicted in Fig. 3. The vertical axis, O_1 - A_1 or O_2 - A_2, shows the scale of the Player 1's or Player 2's individualistic utility value respectively and the horizontal axis, O_1 - B_1 or O_2 - B_2, represents the scale of Player 1's or Player 2's cooperative utility value respectively. A_0 and B_0 are the starting points of both players, where only self-interest for each Player is concerned. According to their awareness of their common interest in negotiation, both Players intend to climb up on the latent social utility surface, which is

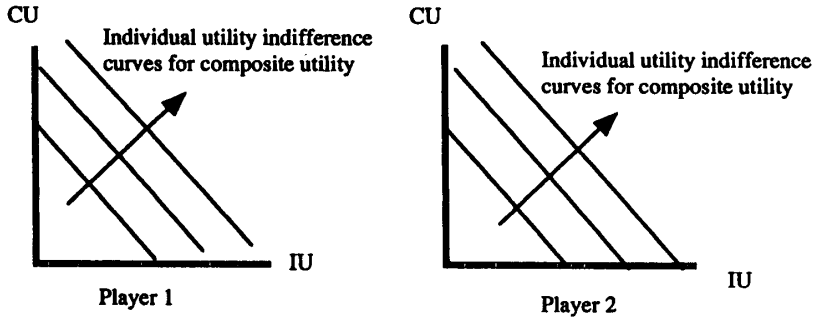
shown by moving on the social indifference curves toward the inside directions. The dotted lines shows the social utility indifference map defined on the Players composite utility functions. Suppose that the social indifference map is latent, but given for both Players. Suppose that the social indifference map for the both players is unchangeable. In the points A' and B', each Player's utility indifference curve does not coincide to the latent social utility indifference curve. Thus these points are not effective for the given social indifference curves. Each player can further move to Point A or B respectively. In this case, however, they can not reach to the compromise point E. The social indifference curve is not efficient



(A) Antagonistic situation



(B) Full cooperation



(C) Partial cooperation with composite utility

Fig. 2 Structure of negotiation

for the negotiation.

The compromise utility distribution point (E) for both Players can mathematically be derived from the optimality conditions.

Let composite utility functions be defined on the individualistic and cooperative utility functions for Player 1 and 2. Suppose the utility functions are all additive for simplicity.

$$U_1\ (u_{1I}, u_{1C}) \tag{2}$$

$$U_2\ (u_{2I}, u_{2C}) \tag{3}$$

and

$$u_{1I} + u_{2I} = u_2{}^{O}, \qquad u_{1C} + u_{2C} = u_C{}^{O} \tag{4}$$

where $u_I{}^{O}$ and $u_C{}^{O}$ are the definite, but latent and unknown values. In order to maximize each Player's utility function subject to the other Player's utility distribution taken as given, the Lagrangian functions are formed and maximized.

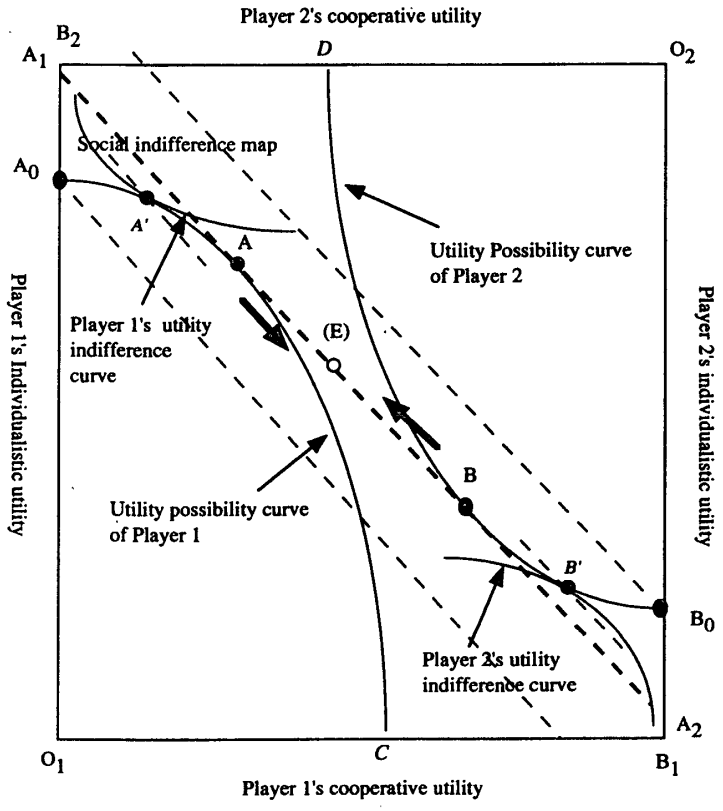


Fig. 3 Compromising processes

$$U_1^* = U_1(u_{1I}, u_{1C}) + \lambda [U_2(u_I^O - u_{1I}, u_C^O - u_{1C}) - U_2^O] \quad (5)$$

$$U_2^* = U_2(u_{2I}, u_{2C}) + \lambda [U_1(u_I^O - u_{2I}, u_C^O - u_{2C}) - U_1^O] \quad (6)$$

where λ is a Lagrange multiplier. From the optimality conditions, the compromised distribution point satisfies the condition

$$\frac{\partial U_1/\partial u_{1I}}{\partial U_1/\partial u_{1C}} = \frac{\partial U_2/\partial u_{2I}}{\partial U_2/\partial u_{2C}}. \quad (7)$$

The left-hand side of Eq.(7) is the marginal rate of utility substitution (MRUS) scaled on Player 1's utility, and the left-hand side is that scaled on Player 2's utility. Eq.(7) shows that the Pareto optimal compromise condition is the equality of MRUS scaled in terms of the composite utility for each Player. When the equality in Eq.(7) is not achieved, the utility distribution among the Players should be reconsidered.

How to reach to this compromising point? Classical Paretian approach can not answer this problem. In addition, even though the Pareto optimal point can be found, the compromised point for each Player is not unique. The Pareto optimal point for the utility distribution depends on the other Player's distribution and thus can not uniquely be determined. The Paretian compromise point primarily includes a power politics, or the conflict of interest, among the parties. In the Edgeworth type contract curve (Edgeworth box) applied to the negotiation problem, the conflicting interest is embedded. In Fig. 4, every point, *A*, *B*, ... on the contract curve C-*C*' is Pareto optimal, where the latent social indifference curves are all effective. Many effective utility distributions on the contract curve, however, include the serious conflict of interest. The traditional Paretian approach can not solve this problem.

We should proceed to the extension of the Paretian approach.

4. Extension of Paretian approach

4.1 Limitation of the compromise

The limitation of the Paretian approach is nothing but the limitation of the compromise.

First, the compromise among the parties on the Pareto efficient frontier is based on claiming, but not creative, behavior. In the compromise, each player has an unvarying self-serving negotiation stance. There is no motivation for changing the utility possibility frontier for both the Players because the negotiation zone is perceived as unchangeable. In addition, the strategic misrepresentation is not excluded.

Second, the utility distribution in the compromise is usually unstable. The conflict will occur repetitively after a conflict has once been solved, because the formation of the compromise is based on a give up of something for one party, in which the seeds of conflict often still remain. The warfare for the next conflict may occurs at a more serious level.

Therefore Players should be asked "progressive differings or progressive integratings?" (Follett 1925). Integration of interest in the negotiation processes requires the reevaluation of the negotiation zone and the utility possibility frontiers of Players, which leads to a value creation. In this context, it has been said "reevaluation is the flower of comparison (Follett)."

On the recognition of the limitation of simple compromise, the enlargement of the negotiation zone and the change of the utility possibility frontier should be performed with changing perception concerning the mutual interest in the negotiation.. This means the attitudinal restructuring that implies the abandon of the individual claiming value for seeking a better composite utility position. We call it the recognition of the constructive conflict, or constructive conflict solving. In other words, the constructive recognition of conflict leads to the expansion of the possible negotiation zone.

4.2 Expansion of the negotiation zone

The expansion of the negotiation zone is performed through the value trade-off evaluations between claiming the individualistic value and creating the cooperative value. The value trade-off (NTR) for each Player in negotiation is evaluated with MRUS in terms of the Player's composite utility function.

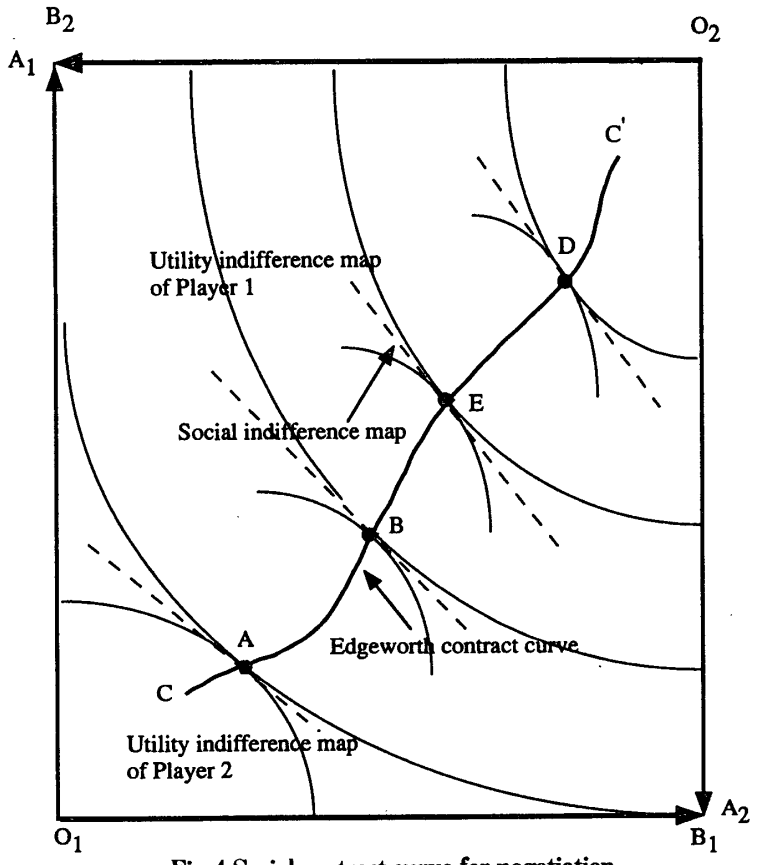


Fig.4 Social contract curve for negotiation

$$NTR1 = \frac{\partial U_1/\partial u_{1I}}{\partial U_1/\partial u_{1C}} \tag{8}$$

$$NTR2 = \frac{\partial U_2/\partial u_{2I}}{\partial U_2/\partial u_{2C}} \tag{9}$$

As discussed, the equilibrium condition in negotiation is to reach the equality.

$$NTR1 = NTR2 \tag{10}$$

The constructive negotiation process, which is called the evolutional negotiation process (ENP), is to reevaluate the value trade-off for each Player on the consideration of the creation of new values for the cooperative utility that has not been in the perception.

Fig. 5 depicts the expanding processes for the negotiation zone.

The starting point for each Player in negotiation is A_0 or B_0 respectively, where only self-interest is concerned for the Player. In this situation, the horizontal axes show the unrealistic negotiation zone because resolutions on these lines are unagreeable for the Player. The social utility indifference map theoretically exists, but is not perceived and latent.

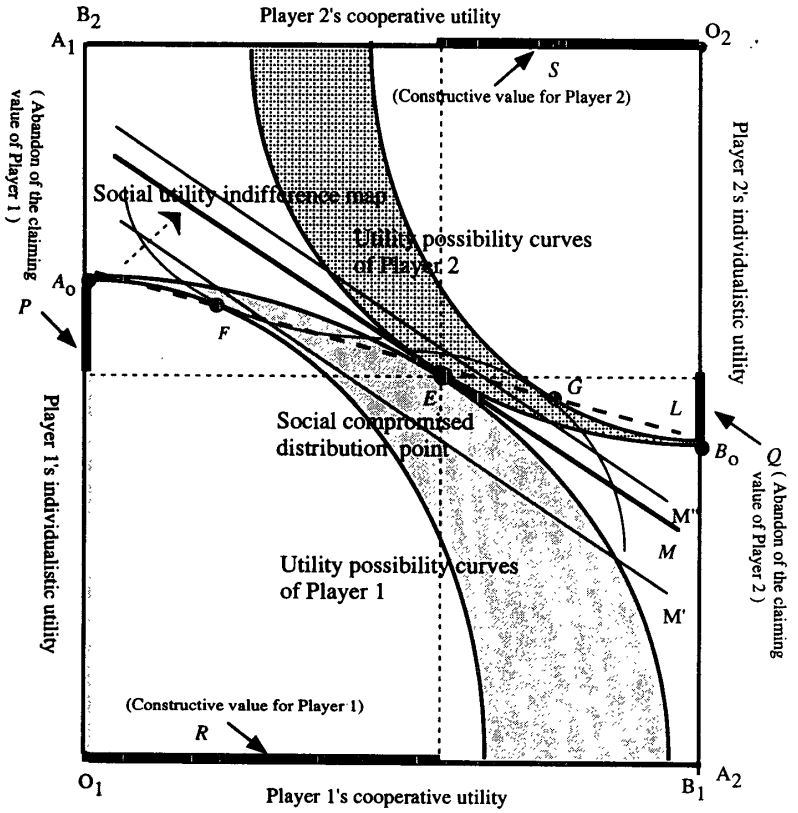


Fig.5 Expanding the negotiation zone

Suppose both Players agree to participate in a negotiation with their cooperative utility functions which are assessed with positive values. First, both Players intend to move along their own utility possibility frontiers on the negotiation zone. This process is executed by assessing the value trade-off on the utility possibility frontier for each Player.

Suppose the point F or G be the local optimal for Player 1 or 2 respectively, where the utility indifference curve for each Player (shown with the thin nonlinear curves) is tangent to the utility possibility frontier respectively. In this situation, although the social indifference curve (shown by the dotted straight line L) may be recognized by both Players, this social indifference curve is not effective because there is no resolution for the negotiation. If the conflict should be resolved, the latent effective social indifference map should be sought. The process is executed by the expansion of the negotiation zone as depicted by the shadow areas. This process is performed with constructing new perception for both Players concerning the additional benefits which can be obtained from further cooperation.

Suppose both Players reach the equilibrium point E. Then what happened? The construction of the compromise means the change of the social indifference map from L to M, M', M'', ... In particular it means the change in the slope of the gradient of the social indifference curve which reveals the change in the evaluation of the value trade-off. At Point E, the new additional value, R or S, for the cooperative utility is created on a give up of some claiming value, P or Q, for each Player respectively. Progressive perception for the common benefit from the cooperation induces the reevaluation of the value trade-off on the newly recognized utility possibility frontiers. In results, the compromised point E shows the attainment of the highest level on the newly constructed social indifference map for both Players.

4.3 Probabilistic approach to the expansion of the negotiation zone

The negotiation process is usually under uncertainty. The response of the opponents in negotiation is unpredictable. Therefore the expansion of the negotiation zone should be probabilistic for both Players. The evolutional negotiation process (ENP) should be examined as the probabilistic evolutional negotiation process (PENP).

Fig. 6 illustrates an example of the probability evaluation in the expansion of the negotiation zone.

Suppose that each Player has moved from the starting point A_0 or B_0 to Point A or Point B respectively with the intention to the constructive negotiation. Suppose that they noticed that there is no resolution at these points. This means that the social indifference map in the cognition of both Players is not effective, although the local optimal for each Player has been obtained. Suppose that both Players still intend to seek the resolution by compromise in the uncertain environment for the opponent's behavior.

Player 1 assesses the probability distribution for the possible expansion of Player 2's negotiation zone as depicted with A, D, B in Fig. 6. Point D is predicted as most acceptable for Player 2. High probability area, however, is unacceptable for Player 1, because this area is recognized as too much altruistic for Player 1. Similarly Player 2 assesses the probability distribution for Player 1 as depicted with A, C, B.

Point C will most acceptable for Player 1 but the high probability area is also unacceptable for Player 2. Even though these points bring more cooperative benefits for both Players, these benefits are under uncertainty and the results of the trade-off assessment on the utility possibility frontiers are unacceptable for both Players.

To reach the resolution, both Players should reevaluate their common benefits to be obtained and thus reconsider the value trade-off evaluation between the individualistic claiming value and the cooperative creative value. This also leads to the reevaluation of the probability distribution for the opponent's behavior in the expansion of the negotiation zone.

In the successful negotiation, the probability assessment by both Players is converged to A, E, B, and the most efficient compromised point E can be found as most probable. The reason of the success in finding the resolution in this negotiation is in the rational reconstruction of the expanded negotiation zone based on the reevaluation of the value trade-off. This process includes the repetition of the trial and error for the direction of the expanding zone.

Unsuccessful case of negotiation is illustrated in Fig. 7. In this case, the reevaluation of the probability distribution is executed on an unreasonable negotiation base. The restarting point is more beneficial for Player 1 because the abandon of the individualistic claiming value for Player 1 is much smaller than that of Player 2. Player 1 is insisting this level and Player 2 must obey this claim by Player 1. This is a one-sided negotiation structure and thus makes the compromise impossible because the

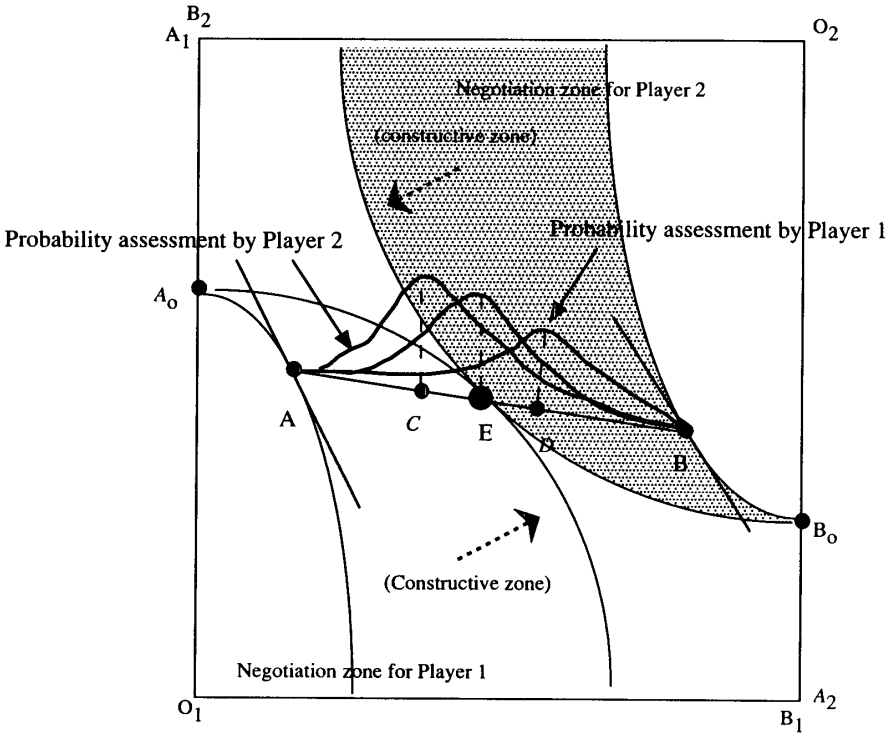


Fig. 6 Probability assessment for enlarging the negotiation zone

highest level of the latent social indifference curve M is never reached in this negotiation. To find the best compromised point for both Players, the negotiation zone should be reconsidered perhaps on the side of Player 1.

5. Concluding Remarks

For conflict resolution, there are three directions.

First is the domination of power. This approach, however, is unstable and also not effective because the domination by power always hides the possible alternatives for the resolution.

Second is the simple compromise. The Paretian approach implies this resolution. The simple compromise, however, also leaves the unsatisfaction for at least one side and is not value-creative oriented. As a result, this approach will also lead to ineffective resolution. In addition, the Paretian approach often is combined with the domination of power.

Third direction is the extended Paretian approach, which is presented in this paper. This approach is based on the integration of interest in parties by creation of values, which requires the search for the possible extensions of the negotiation zone for each Player. This approach called ENP intends to make the creative conflict resolution. This approach is executed by two methods. One is the value trade-off assessment on the local utility possibility frontier for the parties. The changing perception for the common benefit from constructing the cooperation in negotiation leads to the change of the value

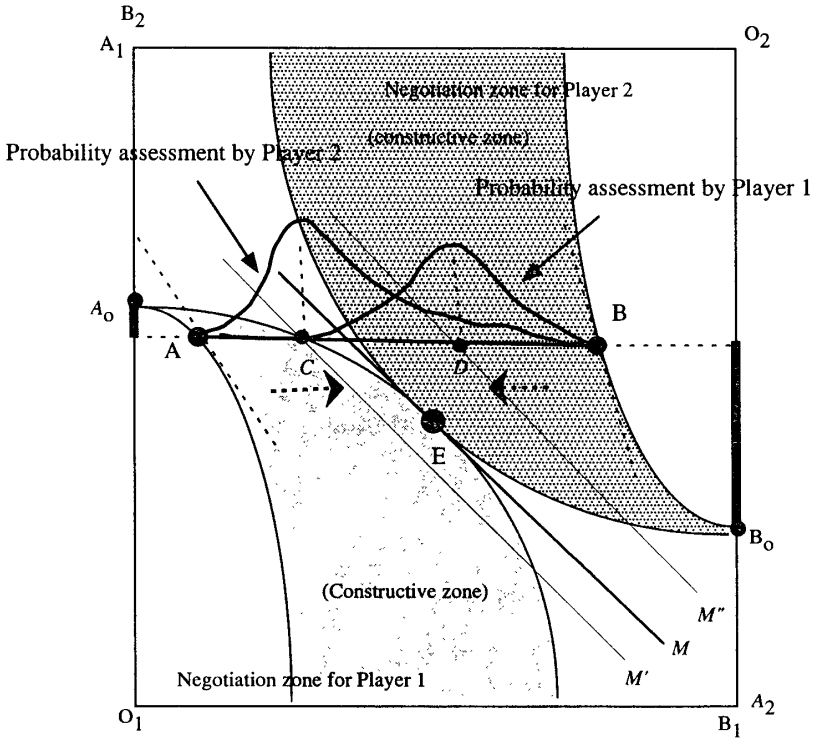


Fig. 7 Illustration of unsuccessful negotiation

trade-off evaluation and to search of the effective social indifference curve. Two is the probability assessment of the possible expansion of the negotiation zone. The reevaluation of the probability distribution of the expansion of the acceptable zone can be executed also with the changing perception for the value trade-off evaluation.

In this paper, the existence of the internal conflict in each Player has not been discussed. For treating this phase in the conflict resolution, a hierarchical configuration of the conflict findings and solving processes will be useful in further discussion (e.g. A. Wierzbicki 1983).

Decision support systems should also be developed for those work. The construction of Negotiation Decision Support Systems (NDSS) assisted by computer program is recommended, with which the execution of the complex, judgmental processes in the negotiation analysts will become easier and more effective. For this purpose, IDASS program (Seo and others 1997) can be applied and also, as its multiobjective extension, MIDASS program is under development by the authors.

Acknowledgment: The author is indebted to the Japan Ministry of Education, Science and Culture for the financial support, 1998-99, to this research.

References

[1] R. Dorfman (1972). Introduction, in *Economics of the Environment*, ed. by R. Dorfman and N. S. Dorfman, Norton & Co. New York.

[2] M. P. Follett (1924). Constructive conflict, in *Mary Parker Follett - Prophet of Management*, ed. by P. Graham, Harvard Business School Press, Boston 1995, 67- 87. Also in *the Collected Papers of Mary Parker Follett*, Pitman, London, 1973, 1-20.

[3] J. M. Henderson and R. E. Quandt (1958). *Microeconomic Theory : A Mathematical Approach*, McGraw-Hill, New York.

[4] D. A. Lax and J. K. Sebenius (1986). *The Manager as Negotiator: Bargaining for Cooperation and Competitive Gain*, The Free Press, New York.

[5] H. Margolis (1982). *Selfishness, Altruism and Rationality*, Cambridge University Press, Cambridge.

[6] J. L. Mumpower (1991). The judgment policies of negotiators and the structure of negotiation problems, *Management Science*, Vol. 37, No. 10, 1304-1324.

[7] J. F. Nunamaker, A. R. Dennis, J. S. Valacich and D. R. Vogel (1991). Information technology for negotiating groups: generating options for mutual gain, *Management Science*, Vol. 37, No. 10, 1325-1346.

[8] H. Raiffa (1982). *The Art and Science of Negotiation*, Harvard University Press, Cambridge.

[9] J. K. Sebenius (1992). Negotiation analysis: a characterization and review, *Management Science* Vol. 38, No.1, 18-38.

[10] T. C. Shelling (1960). *The Strategy of Conflict*, Harvard University Press, Cambridge.

[11] A. Smith (1811-12). *The Theory of Moral Sentiments*, Reprinted in *The Works of Adam Smith*, Vol. 1, Aallen Otto Zeller 1963.

[12] A. P. Wierzbicki (1983). Critical essay on the methodology of multiobjective analysis, *Regional Science and Urban Economics*, Vol. 13, 5-29.

[13] F. Seo, I. Nishizaki and S. Sugisaki (1997). Development of interactive decision analysis support systems (IDASS) in the IDSS environment, *Studies on Business Administration and Information*, Department of Business Administration and Informatics, Setsunan University, Vol.5, No.1. 1-30.