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Modeling Distributive and Integrative Negotiations. Review and Revised Characterization [1]

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Abstract

The development of user-friendly negotiation support systems enabled negotiators to obtain advice directly from the system rather than via an intermediary. The emergence of e-commerce and the development of negotiating software agents further contributed to the automation of negotiation activities. These developments exposed inconsistencies in the descriptions of integrative and distributed negotiations. They also showed limitations of the existing modeling methods. These methods were designed to support negotiation experts who themselves had to make distinctions between distributive and integrative processes. Inconsistent descriptions and the lack of formal models that could be embedded in systems often contribute to a mechanical approach to negotiations compounding the difficulty in the design and development of software that can be used in real-life situations. The contradictions between the characteristics of integrative and distributive negotiations are discussed and assumptions for these two types as well as qualitative differences between them are proposed. Negotiation literature suggests that it is the negotiators' perception of the problem that leads to the their focus on either distributive or integrative conflict resolution. This may be the case for negotiations that are not supported with software. In case of the latter it is the design principles and information processing that that differentiates these two types of negotiations. Negotiation representation based on the information requirements for different types of conflict is proposed.

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1. Introduction

Since Walton and McKersie (Walton and McKersie 1965) proposed to distinguish between *distributive* and *integrative* negotiations many of those who study and teach negotiations, and who observe and advise negotiators have been strongly influenced by the limitations and opportunities offered by each of the two types. Although Walton and McKersie did not suggest one type being superior to the other, over the years, it has become conventional wisdom that the integrative type allows for "better compromises", "win-win solutions", "value creation" and "expanding the pie" (Fisher and Ury 1983; Pruitt, Carnevale et al. 1983; Lax and Sebenius 1986; Sebenius 1992; Thompson 1998; Lewicki, Saunders et al. 1999).

Walton and McKersie's classification of negotiation was the result of labour negotiation studies, which focused on negotiators' attitudes and perceptions, as well as process structuring, evolution, and outcomes. The analysis of qualitative differences between distributive and integrative types provided a basis for further descriptive studies of negotiation processes and eventually led to the formulation of numerous prescriptions regarding strategies and tactics in distributive and integrative negotiations, their informational requirements, and possible solutions (Lewicki and Litterer 1985; Pruit and Rubin 1986; Ury 1993; Fisher, Kopelman et al. 1994; Lewicki, Saunders et al. 1999).

Game theory, as opposed to behavioural and descriptive studies, provides formal and normative approaches to model bargaining. One of the distinctive key features of game theory is the consideration of zero-sum and non-zero-sum games, which was adopted to distinguish between distributive and integrative processes. Limitations of game theory in providing prescriptive advice sought by negotiators and their advisers on one hand, and the developments in multicriteria decision-making and interactive methods on the other, provided the groundwork for negotiation analysis (Raiffa 1982; Young 1991; Sebenius 1992; Young and Parks 1994).

Negotiation analysis integrates decision analysis and game theory in order to provide formal and meaningful support. The goal of negotiation analysis is to bridge the gap between descriptive qualitative models and normative formal models of bargaining. It adopted a number of behavioural concepts (e.g., reservation values, BATNA, integrative/distributive negotiations and principled negotiations) and incorporated them in quantitative models. This allowed advisors to conduct formal analysis of negotiations and to provide support. It also allowed the construction of models and negotiation support systems (Jelassi and Jones 1988; Bui 1994; Teich, Wallenius et al. 1995; Rangaswamy and Shell 1997; Kersten and Noronha 1999; Ehtamo, Hamalainen et al. 1999).

The contributions of negotiation analysis include: (1) a subjective perspective on the process and out-

comes, (2) concentration on the possible agreements rather than search for one equilibrium point, and (3) acceptance of goal-seeking rather than game-theoretic rationality. This makes an "asymmetrically prescriptive/descriptive" orientation possible (Raiffa 1982; Sebenius 1992). Other approaches have symmetrical orientation: behavioural studies focus on descriptions of the parties and their interactions, game theory and optimization assume that the parties are rational hence they have symmetrically prescriptive orientation. In contrast, negotiation analysis is used to generate prescriptive advice to the supported party given a descriptive assessment of the opposing parties. In other words negotiation analysis reconciled several important concepts of behavioural research and game theory. It was developed with the purpose of helping negotiation analysts and advisors, hence its external standpoint and the underlying assumption that its users possess knowledge not embedded in the model.

The development of user-friendly negotiation support systems (NSSs) enabled negotiators to obtain advice directly from the system rather than via an intermediary. The emergence of e-commerce and the development of negotiating software agents (NSAs) further contributed to the automation of some, or even all, negotiation activities (Guttman, Moukas et al. 1998; Kersten and Szpakowicz 1998; Sandholm 1999; Bichler 2000). Interestingly, these developments exposed inconsistencies in the descriptions of different negotiation types and limitations of the existing methods to model negotiators and negotiations. What can silently be asserted in the assessment and advice provided by analysts cannot be assumed when the advice is provided by software. If confusion arises regarding the experts' ability to distinguish the opportunities to conduct integrative rather than distributive negotiations (Wetlaufer 1996), then one may expect more confusion taking place in dialogs between non-experts and software.

The contradictions between the characteristics of the different types of negotiations proposed in the behavioural literature do not allow for their precise definitions. This, coupled with the quantitative approach of negotiation analysis that needs to be augmented with qualitative perspective of experts who use this approach, makes formulation of a consistent set of specifications for the NSS and NSA information and processing requirements impossible. Existing NSSs and NSAs aim at supporting or conducting one or more types of negotiations without formally differentiating between them. Occasionally, systems are erroneously marketed as supporting integrative—considered superior—negotiations. Examples include several NSA developed at the MIT Media Lab, and NSS based on multicriteria analysis, goal programming and genetic algorithms (Matwin, S. Szpakowicz et al. 1987; Holsapple, Lai et al. 1991; Kersten, Michalowski et al. 1991; Bui 1994; Teich 1996; Zlotkin 1996; Guttman and Maes 1998; Kettunen, Ehtamo et al. 1999).

In this paper the differences between integrative and distributive negotiations are considered. The literature does not provide an unambiguous statement as to the similarities and differences between

these two types. Therefore, it is not known if these two types require different design principles and processing requirements, or if they merely differ in the negotiators' perceptions. In view of this, the first objective is to specify the underlying assumptions for these two types and the qualitative differences between them. I will attempt to show that it is the design principles and processing rather than the negotiators' perception that differentiates these two types of negotiations.

One outcome of the lack of unambiguous descriptions is the claim that negotiations can be replaced with single- or multi-attribute auctions (Reeves, Grosof et al. 1999; Segev and Beam 1999; Teich, Wallenius et al. 1999). Negotiation is a time consuming process, requiring the parties' attention and efforts and leading to globally inefficient distribution of resources. Replacing negotiations with auctions would make them efficient and requiring less time and effort. This suggestion reflects the perception that negotiation is inherently a distributive process which does not involve learning and adaptation. It also reflects the tendency to reduce and simplify social problems so that mechanical approaches could be applied. Only a very simple negotiation can be represented with an auction (Kersten, Noronha et al. 1999). Providing rich support for difficult negotiations requires—we argue here—the reconsideration of the richness of negotiation processes leading to the formulation of models in which this richness is incorporated.

The second objective of this paper is to initiate discussion on expanding formal models of negotiations in order to make them more useful for NSSs and NSAs. System designers who want to base the system on the results of behavioural and analytical studies often have little choice but to choose between contradictory or vague statements. It seems that there is lack of interest to provide behavioural prescriptions for model and system development. The effect of the explosion of computing and communication technologies is that NSSs and NSAs are being developed irrespectively of the state of the negotiation theory. We propose to build on recent work that disputes earlier concepts of negotiators' performance measurement and suggests complementary measures to utility (Gupta 1989; Clyman 1995; Kersten and Noronha 1998; Clyman and Trip 2000), and provides a formal basis for NSS (Shakun 1996; Kersten 1997; Holsapple, Lai et al. 1998).

2. Negotiations: exchange of offers for the purpose of achieving a compromise

2.1 Preliminaries

We consider two-party negotiations, with parties denoted A and B, and describe negotiations using initially only three constructs: offers, objectives and utilities. The set X, ($X \subset R^n$), is the set of feasible offers (decision alternatives) and is assumed to be convex; the dimensions of X represent negotiated issues (decision attributes). Party i, ($i = A, B$), has certain objectives and we assume that each party prefers to achieve these objectives through the negotiation at the higher rather than lower level. The

objectives are represented with vector function $\boldsymbol{f}_i = [f_{ji}]: X \rightarrow Y_i \subset R^{m_i}$, $(j = 1, \ldots, m_i)$. A utility function $g_i : Y_i \rightarrow U_i \subset R$, can be defined for each party; U is the joint utility space, $\boldsymbol{u} = [u_A, u_B] \in U$. Functions $\boldsymbol{f}_i$ and g_i are assumed pseudo-convex (concave).

Using the above notation we may now present a simple negotiation model:

$$N = \{ A, B, X, Y_A, Y_B, U \} \tag{1}$$

Although real negotiations do not follow (1), this model is sufficiently general to encompass different formal approaches and to allow for discussion of different types of negotiations. Several important concepts such as BATNA and reservation values are not explicitly stated but they may be incorporated, for example, as additional constraints imposed on Y_i or U_i, $(i = A, B)$. Note also that the utility optimization assumption is not required and the two parties may accept any offer. The simplification is in the assumption that A and B use objectives and utilities in negotiations and that the model parameters do not change during the process, preventing introduction of new issues, learning, and problem restructuring.

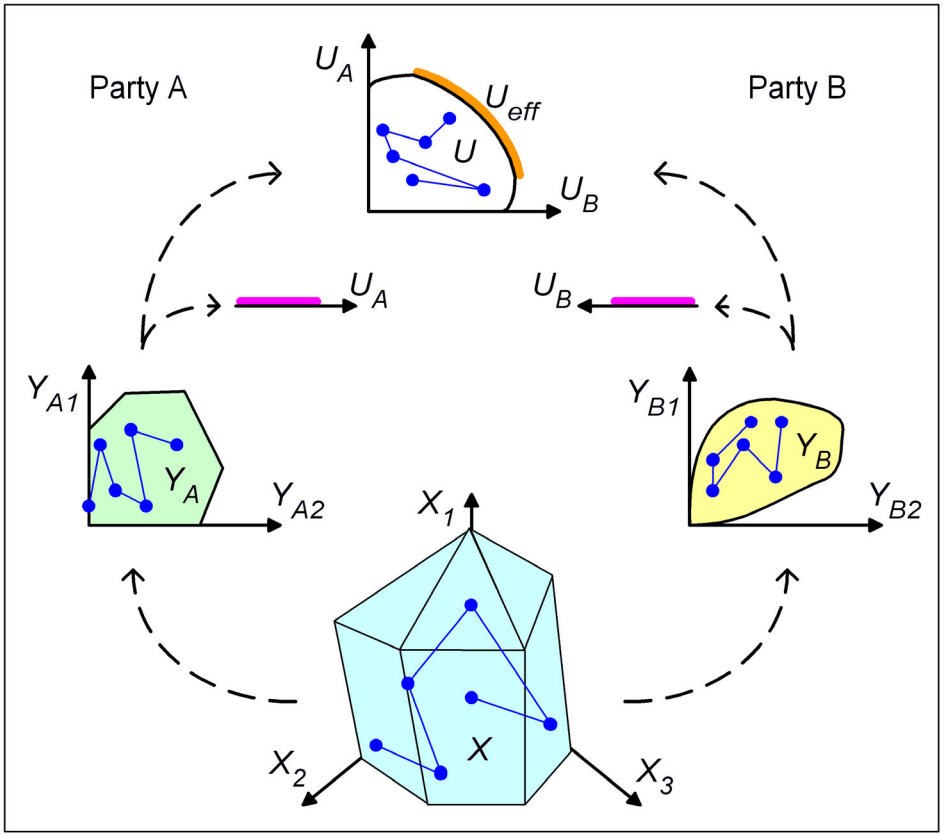

Figure 1. Offers in the offer, objective and utility spaces.

A significant element of negotiation is argumentation for a proposed offer and against the acceptance of an offer made by the opponent. We limit our discussion here, however, only to the exchange of offers and counter-offers (represented with elements of set X), and their assessment in the objective and utility spaces. The schematic process of negotiation conducted in the offer, objective and utility spaces is presented in Figure 1.

Party i, ($i = A, B$), may compare offers in the offer space X, and their objective Y_i and utility U_i spaces. Both parties may compare offers in X and—if they agree to share relevant information—in the utility space U. Since the negotiation is conducted in the offer space, comparison in X is natural. Rarely is it possible to make comparisons in U because of the parties' unwillingness to unveil information about their objectives, and trade-offs. Often this unwillingness to share information necessitates extended argumentation.

2.2 Measurements

Comparison of offers requires measurement of the gains or losses that they bring. Defining and measuring gains and losses is an important issue for every negotiation. In game theory it is assumed that a gain/loss is measured with utility or with a pay-off that represents utility. Knowledge of the payoffs allows players to determine equilibria and efficient solutions. In the negotiation the parties often don't know each other's objectives and utilities, and negotiate by exchanging a number of offers selected from X. That is, the division of "the pie" is defined by the element of X.

To measure gains and losses we use model (1) obtaining the following six possibilities. The measurement can be done in:

1. Offer space for each issue separately: $l(x_j, x'_j)$, ($j = 1, .., n$).
2. Offer space jointly for all issues: $L(\boldsymbol{x}, \boldsymbol{x}')$, ($\boldsymbol{x}, \boldsymbol{x}' \in X$).
3. Objective space for each objective separately: $l(y_{ji}, y_{ji}') = l(f_{ji}(\boldsymbol{x}), f_{ji}(\boldsymbol{x}'))$, ($j = 1, .., m_i$; $i = A, B$).
4. Objective space jointly for all objectives: $L(\boldsymbol{y}_i, \boldsymbol{y}_i') = L(\boldsymbol{f}_i(\boldsymbol{x}), \boldsymbol{f}_i(\boldsymbol{x}'))$, ($i = A, B$).
5. Individual utility space: $l(u_i, u_i') = l(g_i(\boldsymbol{f}_j(\boldsymbol{x})), g_i(\boldsymbol{f}_i(\boldsymbol{x}')))$, ($i = A, B$).
6. Joint utility space: $L(\boldsymbol{u}, \boldsymbol{u}')$ ($\boldsymbol{u}, \boldsymbol{u}' \in U$)

Functions l and L are measures defined on one- and on multi-dimensional spaces respectively, $\boldsymbol{y} = \boldsymbol{f}(\mathbf{x}) = [f_{ji}(\boldsymbol{x})]$, ($j = 1, .., m_i$; $i = A, B$); $u = g(\boldsymbol{y}(\boldsymbol{x}))$; and $\boldsymbol{u} = [g_i(\boldsymbol{y}_i(\boldsymbol{x})), g_j(\boldsymbol{y}_j(\boldsymbol{x}))]$, ($i,j = A, B$).

Measurement in the offer space for each issue separately is typical of sequential negotiations. This form of negotiation does not allow to compare complete offers and it often breaks negotiations into n separate processes making them highly inefficient. Consideration of preferences and making trade-offs between issues becomes very difficult; it may require backtracking to issues the parties have already resolved and reopening of negotiations.

Comparison of complete offers in the offer space does not allow taking into account negotiators' objectives and preferences. Since offers are relevant in so much as they allow the parties to achieve their objectives they cannot be used directly to determine gains or losses. However, measurement in the offer space provides some information about the progress of negotiations. Clearly, if $L(\boldsymbol{x}_A, \boldsymbol{x}_B) = 0$, then compromise is achieved. If during the process the distance decreases then one may observe that the parties might be getting closer to consensus. The parties may differ in the issues that are most significant for them but observers and perhaps the parties themselves may judge that the negotiation progresses. This measure is not precise but it provides information that needs to be used in the absence of knowledge of the parties' objectives and preferences.

The limitations of measurement on a single objective are similar to those of a single issue. With some exceptions (e.g., complete pre-emptive ordering of objectives and no relative preferences between objectives) such a measurement should be avoided. Otherwise measurement in the objective space makes little sense as it includes only part of the subjective information, namely objectives, but not preferences between them.

From each party's perspective the only relevant comparison is in their own utility space (u_A or u_B). Taking into account the perspective of both sides, one needs to consider the two-dimensional utility space U. In this space one can verify the dominance of offers and their efficiency (Pareto-optimality).

2.3 Perspectives

Evaluation of offers in the utility space implies that the division of "a pie" is relevant to the extent that it impacts the utility values. Each division of the pie corresponds to an element of X, it allows achieving the objectives at some level and thus produces some utility value. We therefore take the perspective that negotiations involve offer exchange but that offer acceptance or rejection can only be determined on the basis of comparing its utility value with another value (e.g., BATNA).

The common assumption underlying decision models and support systems constructed for a single decision maker is that the person for whom a model is constructed and who uses the system is able to define the set of alternatives (implicitly or explicitly) and objective functions, and—with the help of the system—select the best alternative. The user of the system may actually be an analyst who helps

the decision maker to determine optimal alternatives. However, whether the system is used directly or indirectly, decision science makes no distinction in defining the process and in specifying the model. We also take this perspective here and formulate the following assumption on information distribution:

> No one has information: (1) about the negotiation problem that is not available to both parties, and (2) about the party that is not available to this party.

The above assumption does not preclude an external entity having complete information about the set of offers, objectives and utilities, and the parties having only information pertaining to the set of offers and their own interests. Both parties, however, have information about the problem, i.e., issues, offers and feasibility constraints. The external entity may be entrusted with information that one party has if this information describes this party's objectives, preferences and utilities.

If complete information about the set of offers, objectives and utilities is available to both parties or an external entity then, taking also into account the parties' preferences to achieve objectives at the highest possible levels, any negotiated compromise must be efficient. This is the case of full rationality and there is no reason for the parties to knowingly accept an inefficient compromise. This situation corresponds to a game, with the difference that no particular efficient compromise can be suggested without formulating additional assumptions. With the addition of assumptions a unique compromise may be determined automatically. For example, if utility is the only measure of offers, and the principles of independence of equivalent utility representation, symmetry, and independence with respect to irrelevant alternatives are assumed, then the compromise would be Nash bargaining solution (Nash 1954). In general, every efficient offer is a potential compromise and only the two parties can decide on the selection of one offer over another.

Full rationality is rare. One party does not know the objectives and preferences of another and therefore has to make decisions in the situation of incomplete knowledge, which leads to bounded rationality (Pietrula and Weingart 1994). While it is possible—and happens in real-life—that the parties do not know their own objectives and preferences, and that they cannot define a utility function even implicitly, we do not consider such a situation here. We assume here that the negotiation can be formally represented and that offers can be compared (at least on the ordinal scale).

In the absence of complete knowledge, the parties follow a weaker form of rationality, formulated by Newel (1981). We reformulate Newel's rationality principle as follows:

> If a party has knowledge about an offer allowing for the achievement of their objectives at the higher levels than other offers then the party selects this offer.

This principle does not imply optimization within the feasible set of offers. Instead, it implies the existence of preferences within the context of problem space search (Pietrula and Weingart 1994). The knowledge-dependent rationality modifies model (1); the parties may know only some elements of X. Note that the principle may contradict the assumption of information distribution stated above. This is because the parties' knowledge of the negotiation problem may differ. In this section we keep this assumption, as it does not contradict the writings discussed in the following section.

A number of writings aim at educating present and future managers. This may be the reason behind the perspective considering distributive and integrative negotiations in a purely subjective manner. That is, the type of negotiations parties face solely depends on their perception and attitude. The implication is that most if not all negotiations can be approached as integrative or distributed ones. We note here that this indeed might be possible but not within the model (1).

In Section 4 we discuss the required extensions of (1). These extensions can be presented in terms of a formal model without relating it to the existing work on negotiation and negotiators. Because this might be seen as abstract divagations about complex decision processes it is important to precede them, in Section 3, with behavioural and normative observations that I find unclear and confusing. These observations lead to inability to formally define the differences between types of negotiations and negotiators. Research on negotiation modelling and support might have been criticized as being removed from the practice. In the next section a number of issues discussed in the literature are compared and the contradictions presented in order to propose a basis for both behavioural analysis and normative modelling of different negotiations.

3. Distributive and integrative negotiations in the literature

3.1 Fixed-pie, goal incompatibility and win-lose

Distributive negotiations have been described as win-lose, zero-sum, pure conflict, and competitive. It is a process in which a gain for one party is a loss for the other and in which each party maximizes own outcome. Walton and McKersie note that distributive bargaining is often a competition over the division of resources; who achieves more depends largely on the strategies and tactics employed [Walton, 1965 #450]. Parties have a fixed-pie perception and focus on their differences, ignoring what they have in common (Thompson 1996).

> "Central to such conflict is the belief that there is a limited, controlled amount of key resources to be distributed—a 'fixed pie' situation. Both parties may want to be the winner; both may want more than half of what is available. … The goals are mutually exclusive and hence lead to conflict. ... In contrast, in integrative negotiation the goals of the parties are not

> mutually exclusive." (Lewicki, Saunders et al. 1999, p. 107).

Thompson (1998, p. 44) avoids the distinction between distributive and integrative types. Instead she considers pure conflict, pure coordination and mixed-motive negotiations. The pure conflict situation is a zero-sum game and it also corresponds to the distributive type: parties' interests being directly opposed, that is, whatever one side wins the other one loses. There is no conflict in the pure coordination type; the parties' interests are perfectly compatible and their utility functions are identical. The mixed-motive situation is the one in which:

> "Some of these possible settlement points are better for *both* parties than are others. … The **integrative potential** of negotiation is the increase in joint profit available to negotiators over and above the joint profit afforded by a fixed-sum solution." (op. cit., p. 46)

Although these statements appear to refer to the same type of negotiations, there are significant differences between them. The concept of a "fixed pie" implies that the pie corresponds to the set of alternatives X. The assumption that set X is fixed is, however, typical for many behavioural and analytical writings on every type of negotiation. This is not to say that the change of X is not possible or even advocated by some authors, rather to state that there have been only a few formal approaches that address this issue [Kersten, 1991 #72; Matwin, 1991 #533; Sycara, 1993 #73]. The issue of expanding the pie is closely related to value creation that is considered one of the key characteristics of integrative negotiation which we discuss below.

The distinction based on "fixed-pie" may have—contrary to the above suggestions—little to do with the integrative versus distributive dichotomy. In the case of pure conflict the sides always want more of the same and have to make concessions. Increasing the pie allows the sides to take more, however, they still want "more than half of what is available." On the other hand, in the pure coordination case the pie may be fixed and yet there is no conflict and both sides may take all they want. In the well-known story of sisters dividing an orange there is only one orange. One sister needs the orange to make juice and the other wants peel. If both know it, the case is of pure coordination with a fixed number of alternatives. Otherwise, it is pure competition with both sisters asking for the orange.

In the pure conflict situation every feasible offer is efficient [Kersten, 1998 #400]. With the exception of pure conflict there are always solutions that are better than others. Hence Thompson's "integrative potential" is present as long as there are offers in X for which the objectives take lower values than for other offers and it cannot be used to differentiate negotiations. Further, if we agree that parties negotiate to improve their status quo then every negotiation has an "integrative potential." Hence, the integrativity condition does not allow making a distinction between negotiation processes with the excep-

tion of pure conflict. The joint improvement requirement, proposed in the literature [Gupta, 1989 #526; Sebenius, 1992 #311; Thompson, 1998 #449] is not sufficient.

Another characteristic of distributive negotiation is that the parties' goals are mutually exclusive. This implies that the parties' objectives are the same but the criteria are reversed, that is, an objective that one party wants to realize on the highest possible level, the other party wants to achieve at the lowest possible level. This, however, also is not a sufficient condition for the negotiation to be a zero-sum game (or have fixed-sum solutions). In a fixed-sum game, which can always be transformed to a zero-sum game, the parties must have mutually exclusive goals, exactly the same preferences and the utility function has to be the same. Even if we assume that a party has only one goal, which is mutually exclusive with respect to the opponent, the function transforming offers to the goal value has to be the same for both.

Thompson equates a pure conflict situation with fixed-sum bargaining (Thompson 1998, p. 44). This is only one form of a "win-lose" process in which one party's gain is equal to the other party's loss and vice versa. Gains and loses need not be equal for a "win-lose" bargaining. The point here is that although in fixed-sum bargaining every offer is efficient, bargaining in which the sum of gains and losses differs for different offers may also comprise only efficient offers.

3.2 Negotiations and compromise efficiency

Negotiation analysis has incorporated many of the concepts proposed by behavioural scientists allowing for the formulation of the prescriptions for the supported party based on the descriptions of the opponents' actions. It has also had an impact on behavioural studies mainly in the analysis of offer efficiency. Negotiation analysis provides a clear and succinct description of the set of offers, the process, the parties' interests, and the efficient and inefficient compromises. All this is done within the confines of model (1) and therefore characteristics of integrative negotiations, as they are postulated by the negotiation analysis, are moulded to fit the model.

We see, in the set U presented in Figure 1, that some offers yield higher utility for both parties than other offers. The thick boundary U_{eff} depicts the efficient frontier; all other offers are inefficient. Negotiators often accept inefficient compromises, hence one may want to help them and suggest a compromise that dominates the accepted compromise. Such a solution is a "win-win" situation or at the very least "win-not-lose". This has led many to state that integrativeness in negotiations is equivalent to the movement towards the efficient frontier. For example, Bazerman and Neale make the following comment about a series of Kelly's-type experiments (Kelley 1966):

> "As can be observed, a simple compromise solution of E-E-E results in a $4,000 profit to

> each side. However, if the parties are able to reach the **fully integrative solutions** [emphasis added] of A-E-I (by trading issues), then each receives a profit of $5,200." (Bazerman and Neale 1991. p. 117)

Thompson (1998, p. 47) states that

> "**Integrative negotiation** refers to both a process and an outcome of negotiation. Parties to negotiation may engage in behaviors designed to integrate their interests, but that is no guarantee they will reach an integrative outcome. An **integrative agreement** is a negotiated outcome that leaves no resource unutilized."

Thompson then proceeds to show that the highest-level integrative agreements are efficient (op. cit, p. 48).

Consideration of integrative negotiation in terms of offer efficiency contradicts the attitudinal perspective in which the parties have an opportunity to engage in either type. After the parties formulate all the elements of model (1) there is little they can do regardless the information they have about each other. All offers may be efficient because the parties are in strict opposition (their utility functions have strictly opposing gradients). Even if there is a significant overlap in the parties' interest, the set of offers may have such properties that each offer is efficient (Kersten and Noronha 1998). In the extreme case, the parties may share all the objectives but the differences in utility functions and the shape of X and the mapping to objectives and utility spaces may cause that all feasible offers are efficient (Mumpower and Rohrbaugh 1996).

This latter case is illustrated in Figure 2A with an example of budget allocation; the parties allocate funds to projects. There is no conflict, if the budget equals B_3 because all projects may be funded and there is only one feasible offer with utility $\boldsymbol{u}(B_3)$. If the budget is insufficient to fund all projects (equals B_1 or B_2), and the condition is that all available funds must be allocated, then the feasible set corresponds to $U(B_1)$ or $U(B_2)$ as indicated in Figure 2A. Note that although both parties share the objectives (funding of all projects) and want to achieve them on the same levels, they differ in the preferences and/or the shape of the utility function. Because of insufficient resources the alternatives maximizing their utilities differ and therefore a conflict may take place.

If we were to use the description of the negotiation types given in this and the preceding sections (and in many other writings), we would not be able to characterize simple negotiations illustrated in Figure 2. Negotiations over a fixed budget (e.g., B_1 and B_2) should be considered distributive because they are clearly win-lose: for every pair of alternatives one alternative is better for party A and the other for party B. On the other hand, because the parties don't have mutually exclusive goals they should be

considered integrative. They should also be considered as integrative because any compromise the parties achieve is efficient.

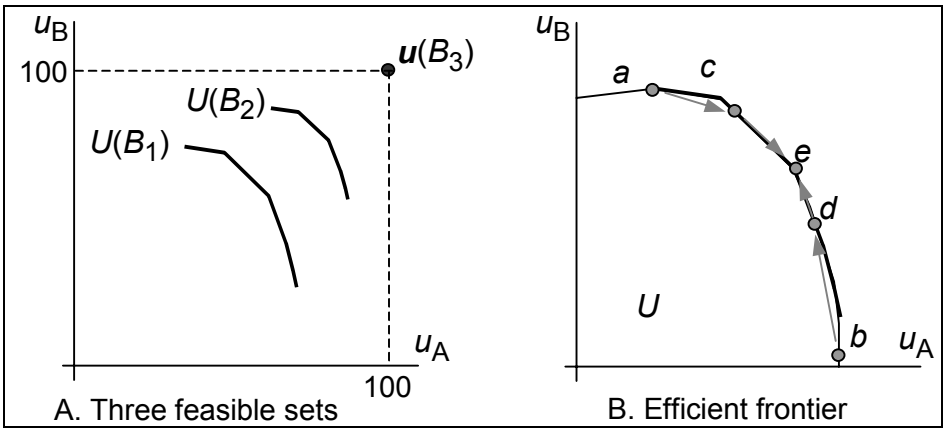

Figure 2. Examples of distributive negotiation in the joint utility space.

One could add that the distinction between the two types requires that both inefficient and efficient offers exist in set *X*; this case is illustrated in Figure 2B. This postulate is not convincing. One cannot differentiate between the two types, if some parties negotiate using only efficient offers. This situation is illustrated in Figure 2B. The parties may realize that it is a waste of time and effort to exchange inefficient offers and—using some strong analytical tools—move solely on the efficient frontier.

An additional requirement might be that the parties negotiate over inefficient offers and end with an efficient compromise. However, in addition to the above criticism, this argument requires that the parties consider offers which they should never choose. It refers to the parties' strategies and tactics rather than to their objectives and utilities, and to the structure of the negotiation problem. It also suggests that if one faces a distributive negotiation and proposes offers that are very "bad" for both sides (are strongly dominated) then such a negotiation becomes integrative.

Paradoxically, stating that integrative negotiation produces efficient offers equates them with the "win-lose" description of distributive negotiations. A strictly efficient offer is, by definition, one that if there is another offer that produces gains only for one party it must also produce losses for the other party (measured with utility). Hence, an efficient offer creates a win-lose situation that is typical for distributive negotiation implying that there is no analytical difference between the two types of negotiation.

Another and related view of integrative negotiation is that it must end with an improvement of the

parties' situation. There are three possibilities here: (1) the status quo, (2) the alternative that is defined with reservation values; and (3) BATNA. It makes no sense for the parties (unless they are forced to negotiate) to engage in a time consuming process without an expectation that it would improve their situation. A similar argument may be made regarding the reservation values. Moreover, since the reservation values correspond to the offer that is unacceptable, it is obvious that the compromise has to dominate this offer. BATNA, by definition gives the party a utility (value) that this party may achieve, if the negotiation breaks down. Again no rational party (bounded rationality including) accepts an offer that has lower utility than the utility of BATNA. Thus, if the negotiation ends with a compromise, then this compromise dominates all three alternatives.

3.3 Value creation

The four key characteristics of integrative negotiation, which allow one to distinguish it from distributive negotiation, are: *creation of value*, *focus on interests not positions*, *openness and exchange of relevant information*, *learning and problem restructuring* (Fisher and Ury 1983; Lax and Sebenius 1986; Sebenius 1992; Ury 1993; Fisher, Kopelman et al. 1994; Raiffa 1996; Bazerman 1998). Different authors highlight the significance of these characteristics and their impact on the parties' willingness to collaborate rather than compete, to seek new possibilities rather than defend their own positions, to work jointly on solving problems rather than demanding more resources.

Within negotiation analysis value creation is often equated with "win-win" or the search for offers dominating those currently on the table (Young 1991; Sebenius 1992; Young and Parks 1994; Clyman 1996). In this situation the same arguments as stated in the previous section apply. Wetlaufer points out that such a form of value creation appears in both distributive and integrative negotiation:

> "The first of these forms is found where the pie can be made larger only in the sense that is true to all bargaining including all bargaining that is merely distributed. In such circumstances, there is a zone of agreement within which both parties will be better off than they would have been in the absence of the agreement. Thus, in this minimal sense, purely distributed bargaining can be said to "create value" … Though it involves the "creation" of value, Form I does not involve integrative bargaining and is not a situation in which the more open tactics associated with integrative bargaining will promote the immediate pecuniary self interest of a party." (Wetlaufer 1996, p. 5)

Wetlaufer does not consider formal approaches to model and conduct negotiations; his discussion lacks definition of the set of offers X as well as distinction between the "pie" and "value". Although he limits his discussion to the status quo alternative and alternatives that dominate it, his arguments

behind seeing Form I correspond to the arguments we formulated above. Extending these arguments to a convex set X, we see that also in distributive negotiations the parties may jointly improve their situation and move towards efficient frontier.

Sebenius in his influential article states that:

> "In general, the benefits of cooperation are not fully known at the outset of a negotiation. Moreover, the manner by which parties try to create value, or press out toward the potential Pareto frontier, normally influences the allocation of that value. … Colloquially, the parties often do not know how large a pie they can make. The way in which they attempt to expand the pie affects its final division, while each side's efforts to get a larger share of the pie often prevent its expansion in the first place—and may lead to no pie at all, or even to a fight." (Sebenius 1992, p. 30)

Sebenius' perspective on search for dominating offers within the set X seems both restrictive and inconsistent. Arguments against viewing simultaneous offer improvement as a sign of integrativeness were already presented above. The benefits of cooperation may indeed initially be unknown. If the parties realize such benefits it is because of learning and creating a potential for value creation. The word "create" means—we believe— more than trying to "press out toward the potential Pareto frontier". Three interpretations of value creation are possible:

1. The parties know the set of offers from the outset and select offers that dominate their previous offers.

2. The set of offers is unknown to the parties but known to someone else (e.g., analysts). The parties select dominating offers and the third party guides them in achieving an efficient compromise.

3. No one knows the set of offers; during the negotiation the parties realize the possibilities to achieve more and select offers which dominate the previous offers.

We have already discussed the first interpretation and shown that such negotiations don't require cooperation and are distributive. If the parties know the Pareto (efficient) frontier, then they should select an efficient compromise—no learning or creating is required. Cognitive limitations, biases, side payments, external pressures, deadlines, etc. may satisfy the parties with an inefficient compromise but these aspects of negotiations—though very important—are not considered here.

The second interpretation contradicts the assumption about information distribution. Further, it makes

little sense to distinguish between integrative and distributive processes based on information external to the parties. This situation often takes place in negotiation experiments with researchers recognizing that the parties' select inefficient compromises for the above-mentioned reasons.

If the final set of offers is unknown—as Sebenius suggests saying that the parties often do not know how large a pie they can make—and the parties create new offers during the negotiation thus expanding the initial set of offers, then we deal with the process that negotiation analysis does not consider. In such a process, the set of all feasible offers X is unknown and therefore there is no Pareto frontier. Thus, the offer efficiency cannot be determined. However, if the parties do not know about offers that dominate the negotiated compromise, then this compromise is efficient but only with respect to all offers considered.

The process of discovery of new offers during, and because of, the negotiation is indeed a process of value creation but it has not been considered within the negotiation analysis framework. We know of no approach within this framework that deals with the ongoing construction of X and truly reflects the lack of the parties' knowledge of "how large a pie they can make". To the contrary, negotiation analysis and the experimental studies influenced by its descriptions, assume the existence of X.

Creation of value in the sense of both expanding the set of offers and negotiating when, as Sebenius says, "the parties often do not know how large a pie they can make" (op. cit.) refer to the situation in which the set of feasible offers may never be well defined. The parties begin their negotiation with the knowledge of a subset of offers. Party A expands the set by adding a new offer followed by party B expanding it further and so on. The cooperation is caused by each party attempts to get a bigger portion of the pie without taking away from the other party. These efforts lead to having the pie increased, redefined or multiplied. The final pie and its division should dominate all offers considered earlier and in this sense it is efficient. There may, however, be a dominating offer which has not been created because the parties decided to finish negotiations.

Fisher and Ury present a short story about two men quarrelling in a library (Fisher and Ury 1983, p. 41). Their set of offers comprised two points: "window opened" and "window closed". The librarian invented a new offer "window opened in the next room" which created value for both men. The key point here is that the value has been created through *inventing options for mutual gain*. We believe that other characteristics and requirements that are presented in the literature are either irrelevant or caused by the *requirement to modify the set of offers in a beneficial way for the parties*.

Trading off between issues has to take place in every negotiation and cannot be limited to the integrative type. Expert negotiators attempt to address needs and interests, use objective criteria for stan-

dards of performance, exchange information and ideas, and focus on commonalities in distributive situations. Although some authors claim that these elements are indicative to integrative negotiation (Bazerman 1998; Thompson 1998; Lewicki, Saunders et al. 1999) they can and should be present in all negotiations. It is the invention of offers that makes the negotiation different.

4. Negotiation

4.1 Integrative model

We can now state that the negotiation model (1) presented in Section 2 can be used to describe distributive but not integrative negotiation. The latter requires restructuring of the set of offers possibly leading to changes in the parties' objectives, tradeoffs and utilities.

A simple model of integrative negotiation that corresponds to distributive model (1) is:

$$N = \{ A, B, X_t, Y_{A,\,t}, Y_{B,\,t}, U_t, t = 1, \ldots, T\}, \tag{2}$$

As indicated in (3), modification of X_t may cause changes in the parties' objectives and utilities. This modification may be done in terms of one or more of the following activities:

1. The modifications of one or more constraints defining X (e.g., additional resources may be discovered).
2. The addition of new offers which expand X.
3. The change in the dimensionality of X (e.g., a new attribute may be discovered that is indicative to the parties' joint interests or an attribute on which the parties strongly disagreed may be considered redundant and thus dropped).

Each of these activities introduces a *qualitative difference* to the negotiation process as opposed to the *quantitative difference* when the parties move from one offer to another within a fixed set X and change the offer utility values. The first two activities introduce the following *restructuring condition* on the new set of offers X_{t+1}:

$$X_{t+1} \supset X_t \tag{3a}$$

and the condition for the third activity is:

$$X_{t+1} \subset R^n,\ X_t \subset R^m \text{ and } n \neq m. \tag{3b}$$

Restructuring of X is a necessary but not sufficient condition for integrative negotiation. The restructuring that leads to the new set of offers X_{t+1} has to be beneficial for the parties, that is an offer $\boldsymbol{x}^*$ proposed at $t+1$, where $\boldsymbol{x}^* \in X_{t+1}$ and $\boldsymbol{x}^* \notin X_t$, has to be viewed as an improvement or a joint gain. The *improvement conditions* depend on the specification of the set of offers, the negotiation history and the negotiation protocol (e.g., the use of the single negotiation text SNT or sequential exchange of offers).

Let $\boldsymbol{u}^* = [u_A, u_B] = [g_A(\boldsymbol{f}_A(\boldsymbol{x}^*)), g_B(\boldsymbol{f}_B(\boldsymbol{x}^*))]$ be the vector of utilities of offer $\boldsymbol{x}^*$. Examples of the improvement conditions are as follows:

1. Offer $\boldsymbol{x}^*$ strictly dominates every offer the parties considered prior to proposing $\boldsymbol{x}^*$ with utilities $\boldsymbol{u}^*$, that is:
   $$\forall\, \boldsymbol{x}_j \in \{\boldsymbol{x}_1, \ldots, \boldsymbol{x}_t\} : \boldsymbol{u}^* > \boldsymbol{u}_j = [g_A(\boldsymbol{f}_A(\boldsymbol{x}_j)), g_B(\boldsymbol{f}_B(\boldsymbol{x}_j))]. \quad (4a)$$

2. Offer $\boldsymbol{x}^*$ strictly dominates at least one efficient offer of X_t that is:
   $$\boldsymbol{x}^* \in X_{t+1}/X_t, \exists\, \boldsymbol{x} \in \mathit{Eff}(X_t): \boldsymbol{u}^* > \boldsymbol{u} = [g_A(\boldsymbol{f}_A(\boldsymbol{x})), g_B(\boldsymbol{f}_B(\boldsymbol{x}))], \quad (4b)$$
   where $\mathit{Eff}(X)$ denotes the efficient set in X.

3. Offer $\boldsymbol{x}^*$ strictly dominates every efficient offer of X_t that is:
   $$\boldsymbol{x}^* \in X_{t+1}/X_t, \forall\, \boldsymbol{x} \in \mathit{Eff}(X_t): \boldsymbol{u}^* > \boldsymbol{u} = [g_A(\boldsymbol{f}_A(\boldsymbol{x})), g_B(\boldsymbol{f}_B(\boldsymbol{x}))]. \quad (4c)$$

Condition 1 is the weakest of the three; it doesn't require knowledge of the set of offers hence the efficiency also is not considered. The cooperation of the parties is required in that each new offer has to bring joint gains and therefore the strict domination is required (i.e., the utility value has to increase for both parties). The degree of cooperation is limited to the parties' general agreement that the new offer is better than the previous offers. They need not discuss their objectives or utilities in any detail. The parties may engage in sequential negotiations and discuss one issue or one constraint at a time.

Condition 2 requires at least partial knowledge of the set of offers and its one efficient element. This requires significantly more cooperation and exchange of information on behalf of the parties. They need not to discuss their objectives and utilities explicitly, at least however, they need to discuss and compare many offers in order to determine an efficient one. This situation may also require additional mechanisms reflecting the willingness to cooperate or fairness. Otherwise one party may begin with an offer that maximizes its utility function and has a very low utility for the second party. Any subsequent discussion will improve both parties utility leaving the second party at a clear disadvantage.

Condition 3 is the strongest of the three and it requires complete knowledge of the set of offers and

the parties' objectives and utilities. It seems improbable that the parties may engage in negotiations under this condition without a support system that has information about the problem and the parties.

4.2 Comparisons

Using the two models of negotiations we may now illustrate differences and similarities between the two types. First let's recall that while we do not postulate full economic rationality we find it natural to assume Newel's rationality principle. This implies that when the parties know the efficient set then they negotiate an efficient compromise. The fact that compromises negotiated in experimental and real-life situations are often inefficient may be contributed to many reasons extensively discussed in the literature (see, for example, Alemi, Fos et al. 1990; Weingart 1996; Kersten and Mallory 1999), and it does not undermine the rationality principle. That is if an inefficient compromise is selected then there have to be a reason for doing this or the efficient set is unknown.

Distributive, integrative and mixed negotiations are illustrated in Figure 3. Two distributive situations are presented in Figure 3A and 3B. The distributive 1 process (Figure 3A) can be viewed as an example of a supported single negotiated text (SNT) process suggested by Roger Fisher (Raiffa 1982). An initial offer *a* is made that yields very low utility by both parties and can easily be improved. Each party points the flaws of this offer and the next better offer *b* is proposed. This situation continues until the efficient offer *e* is proposed that cannot further be improved.

The condition for offer construction (usually done by the third party) is that each subsequent offer has to dominate the previous one. Note that this condition is a weaker form of the improvement condition (4a) and that an SNT process can be conducted under the strict dominance condition (4a). Nonetheless I claim that this is a distributive rather than integrative negotiation. In addition to formal arguments formulated above we note that SNT was introduced in the Camp David negotiation precisely for the reason that the two parties were strongly antagonistic but the U.S. had the power to bring them to the negotiating table.

The process depicted in Figure 3B is a simple example of positional bargaining. The parties begin with making offers that yield very high utility values for them irrespectively of the utility values for their opponents. In response to the counter-offers each party makes a small concession and the process continues. A compromise (if it is achieved) may not be efficient but under certain conditions the parties may be able to achieve a compromise that lies near the efficient frontier. Such a condition may be that each party has to propose several offers that yield the same utility for this party, and the other party selects one offer. Consider the process in which party *A* makes offer *a* to which party *B* replies with counter-offer *b*. Then party *A* proposes *c'* but party *B* rejects *c'* because it sees it as a reverse concession and therefore asks *A* to make another offer. Party *B* searches for offers that do not require

making concessions and proposes offer *c*. Party *B* considers this offer as an improvement over *a* and replies with offer *d*.

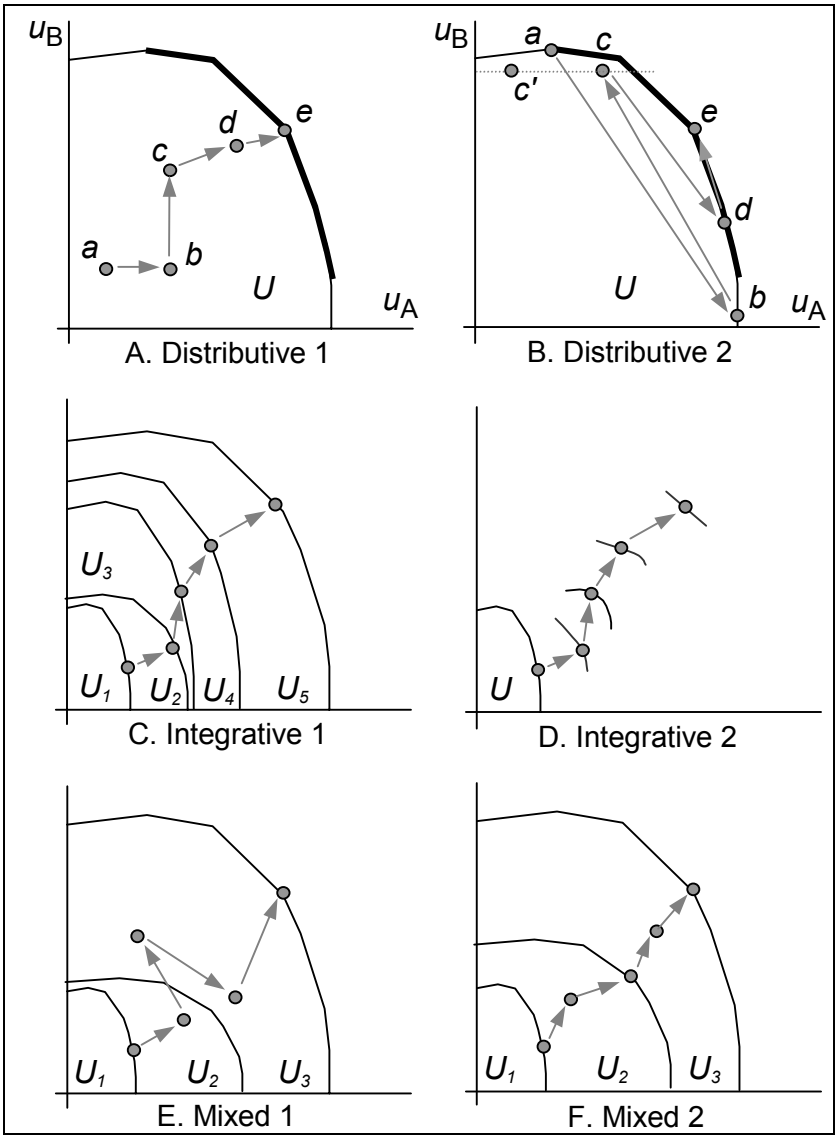

Figure 3. Negotiation types in the joint utility space.

Two examples of integrative negotiations are depicted in Figures 3C and 3D. The integrative process illustrated in Figure 3C refers to a negotiation in which the parties know the sets of offers. This situation corresponds to the modification of constraints which define sets X_t (t = 1, …, T). Knowledge of the sets of offers allows the parties to verify the efficiency of each offer. This is not the case depicted in Figure 3D; the parties begin negotiations with the initial set X (and corresponding set U) and determine an efficient offer. Then they expand X by adding offers that dominate the offers the parties considered earlier without, however, defining the expanded sets. Instead, they may know only

neighbouring offers which is indicated in Figure 3D with small intervals.

The difference between two processes illustrated in Figures 3A and 3D is—let's reiterate—in the knowledge of the set of offers. Note that although all processes are illustrated in the utility space we do not assume that this space is known to the negotiating parties and therefore to an external party (or a system). In the distributive negotiation the parties do not modify set *X* and therefore the set of offers in the utility space is (if known) *U*. In integrative negotiation the parties "push the envelope" proposing new offers that are outside of the considered feasible offers. It makes no sense to propose offers that are dominated by an offer on the table. Therefore the new offers expand set *X* and thus also set *U* as it can be seen in Figure 3D.

Activities indicative for the two types of negotiations can be present in one mixed process. Mixed negotiations are illustrated in Figures 3E and 3F. The difference between the two processes is the mutual gains (win-win) condition. In Figure 3E both win-win and win-lose offers are made, while in Figure 3F there are only offers of the win-win type.

5. Discussion

The objective of distributive negotiation is to achieve an efficient compromise. If this is the case then one should try to replace negotiations with multiattribute auctions or to automate them using negotiation software agents (NSAs). Auctions allow the participants to formulate a number of offers and counter-offers; they allow for tradeoffs and logrolling typical for negotiations. Because they involve a large number of participants (e.g., buyers and sellers) they allow realizing market-based efficiency that is impossible in traditional negotiations. They also allow for anonymity, which may facilitate the information exchange and increase process effectiveness. NSAs allow their principals to specify a strategy and the negotiations are conducted on their behalf. Both auctions and NSAs have been tested and are increasingly used in e-commerce.

Auctions and NSAs can be used in the case of pure distributed negotiations and the parties are able to choose their counterparts. Auctions can be used when the set of offers is known and the parties need to exchange information to determine an acceptable and possibly efficient compromise. Auctions are not applicable (neither are the existing NSAs) in mixed or integrative negotiations where learning about the participants and the problem is necessary, where the negotiations are carried on as much to achieve a compromise as much as to determine the opportunities and possibly establish a relationship with the counterparts.

The objective of integrative negotiation is to create a compromise. This requires inventing new offers. Formal learning methods or methods that use histories of other negotiations and construct new offers

have been proposed; for example offers were constructed using genetic algorithms, case-based reasoning and restructurable modelling (Kersten, Michalowski et al. 1991; Matwin, Szapiro et al. 1991; Sycara 1991). These approaches didn't, however, explicitly address the process's integrativeness; rather they acknowledged the need for the modification of the problem structure caused by the information exchange and the parties' cognitive efforts.

Creation of value via problem restructuring requires flexible representation and management of issues and options. This is both an ontological and a usability challenge: since new issues and options may be introduced at any time by either participant, the NSS must provide easy to use facilities for entering these issues and options symbolically and then enabling the user to associate the appropriate semantics with it; this is in contrast with most current NSSs that hardwire the issues and/or their semantics. (The semantic challenges include linking these issues to the other elements of the existing model, including the existing issues, objectives, and constraints, as well as integrating them into the descriptive model of the counterpart.) This will draw heavily from AI techniques for building intelligent systems, as well as from behavioural science techniques for understanding user interaction and cognition.

A second requirement for problem restructuring is to provide support for thinking out of the box and discovering new alternatives. This is a difficult problem; while there are a few experimental techniques (e.g., case based reasoning can help by drawing from a database of other people's experiences), new methods must be invented, both to diagnose situations when there is a strong need for non-linear thinking (e.g., to measure the distributiveness/hostility of a negotiation), as well as to provide food for thought. We suspect that techniques for the latter will revolve around transferring the focus of discussion from the offers to the objectives and providing tools for goal decomposition.

To support learning it is critical to enable easy modification of every aspect of the negotiation by each negotiator, and to make sure that all underlying representation and reasoning mechanisms are capable of working effectively with incomplete information. It is also important to provide multiple visualizations of the counterparts (and one's own) positions, objectives, history, etc., i.e., there is a rich information management problem related to the negotiation's data.

How does the system know when to recommend activities that promote creation of value, and when to focus on distributing value left on the table? A simple rule may be to focus on the latter whenever the current offer is not efficient, and focus on value creation whenever the most recent offer is efficient. However, the psychological impact of this switching is not clear. Openness and exchange of relevant information hinges upon trust, which is typically established by the surrounding context of the negotiation, not by the negotiation itself. Third-party NSS can help, if their protocols and services are perceived to be neutral to both sides.

Win-lose and win-win concepts highlight the conflict aspect of negotiation; the different or incompatible objectives of the parties. These concepts obscure the interdependencies between the parties, issues, resources and objectives. These interdependencies are often unknown; therefore, the negotiation is used to uncover some of them. Negotiations types can be distinguished with the parties' ability and willingness to provide information and to process it. Exchange of rich information may put a party at a disadvantage. It is also a costly and time-consuming process. This may be a reason for many negotiators to engage in distributive negotiation. They may consider that the possible improvement of an integrative compromise over a distributive one requires too much effort and time. NSA and NSS may play a significant role to engage in integrative activities because they can take the burden of information search, assessment and processing from their principals.

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