

"A DEVELOPMENT FRAMEWORK FOR COMPUTER-
SUPPORTED CONFLICT RESOLUTION "

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CONFLICT RESOLUTION*

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ABSTRACT

Integrative Bargaining is a theoretical negotiation framework for achieving high joint benefit agreements between conflicting parties. However, this framework suffers from major implementation obstacles that include cognitive biases of negotiations, socio-emotional factors, and analytical processing difficulties. To date, computer-based Negotiation Support Systems (NSS) have not addressed these obstacles. They have concentrated only on providing analytical assistance for negotiation processes.

This paper suggests a comprehensive framework for developing NSS that can address all three types of Integrative Bargaining obstacles in a mediation setting. Special attention is given to applying computer support for overcoming the socio-emotional and cognitive difficulties of negotiators. The first part of the paper describes the basic theoretical concepts and design features of the proposed framework. The second part presents an implementation methodology that addresses the entire Integrative Bargaining process. Finally, a number of further research issues are identified.

KEY WORDS AND EXPRESSIONS:

Group Decision Support Systems; Computer-Assisted Negotiation; Negotiation Support Systems; Conflict Resolution; Integrative Bargaining.

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I. INTRODUCTION

Two very visible trends, one social and one technological, have been occurring in our society. First, the rising incidence of social conflicts between individuals, organizations, and nations is a pervasive fact of modern life. Unfortunately, effective means of negotiation and bargaining for peacefully resolving these conflicts are not nearly so prevalent. A second trend is the explosive growth of affordable and powerful computer systems, electronic communication networks, and applications software designed to support group activities. How can we use these new technologies to assist in resolving social conflicts?

This paper attempts to answer the first problem stated above by suggesting a comprehensive framework for developing information systems tools that can help in the negotiation process between conflicting parties. These tools are referred to as Negotiation Support Systems (or NSS). Their objective is to improve: (1) the quality and acceptance of negotiated agreements; (2) the relationship between negotiators; and (3) the conflict resolution skills of negotiators.

Integrative Bargaining (IB) is a theoretical framework for achieving the above goals, using a structured set of activities to develop high joint benefit agreements. However, it is the authors' belief that NSS support should address analytical processing, socio-emotional, and cognitive obstacles associated with the implementation of IB techniques. To overcome these obstacles, NSS must be able to assist negotiators' interactions during all stages of the negotiation process. Unfortunately, existing NSS focus solely on the analytical negotiation activities and few of them directly support the interactions among negotiators. None provides assistance for the entire IB process.

The NSS framework suggested in this paper addresses all three types of obstacles, supporting negotiators in a decision room setting during face-to-face bargaining. The framework illustrates where NSS and group decision support systems (GDSS) software can be applied to activities in the IB process, and proposes design requirements for software development.

Section II of this paper reviews negotiation models, with a special focus on the distributive and integrative bargaining approaches. In

particular, general process, goals, and obstacles to employing IB concepts are discussed. Section III describes the main features of existing GDSS and NSS software. Section IV details the design framework for computer-supported conflict resolution. Section V illustrates implementation issues associated with this framework at each step of the IB process. Section VI raises a number of NSS research issues requiring further investigation.

II. NEGOTIATION MODELS

1.0 Introduction

Negotiation activities belong to a set of tasks called mixed-motive tasks [32]. In other words, participants are motivated both to cooperate and compete with one another. Competition results from differing outcomes desired by each party. Cooperation is required, however, due to the interdependence of these outcomes -- neither party can achieve its goals unilaterally. It is this basic interdependence that initially brings the parties to the table. From there, it is the competing goals which distinguish negotiation from cooperative group problem solving tasks.

Negotiation is a process for resolving conflicts between two or more parties. It represents a constructive alternative to other means of resolving conflicts, such as violence or avoidance. It involves negotiators who, as individuals or teams, represent their own interests or those of larger organizations. Also, a neutral third party may be included either as a mediator, to help manage the interactions and make suggestions for the negotiators to consider, or as an arbitrator, with the power to draft and perhaps dictate settlements for the parties. Our focus in this paper is on situations involving two individual negotiators interacting with the assistance of a mediator.

The nature of the negotiation process itself can greatly improve the depth and enactment of agreed upon change. Likewise, it can contribute to, or destroy, prospects for a more positive relationship in the future, thus influencing the conflict potential of future differences. The Integrative Bargaining (IB) process, which emphasizes cooperative problem solving, is advocated by many negotiation practitioners and researchers as an improvement over an alternative, more commonly practiced, competition-oriented negotiation model, Distributive Bargaining (DB). This section

will begin by briefly describing DB, then focus on the IB process and the obstacles to its implementation.

2.0 Distributive Bargaining

The most common approach to a conflict situation is to view it as a win-lose proposition. An example is that of a car buyer and seller. The buyer wants the lowest price possible, and so initially offers a deflated price. The seller, on the other hand, wants the highest price possible and so begins with an inflated price offer. During the negotiation, each party makes small or large price concessions toward the other's position. Eventually, either a compromise price is reached somewhere between the two initial positions or a deadlock occurs.

This approach to negotiation is labeled "Distributive Bargaining" (DB), "Win-Lose", or "Positional Bargaining" [10, 26, 29, 36, 44]. Although clearly preferable to "fight or flight" options for resolving conflict, DB operates on the notion of a "fixed pie" which must be distributed between negotiators. The underlying assumption is that the parties' goals are in direct, fundamental conflict with one another -- i.e., that both parties want to maximize their own goals without concern for the other.

The DB process is based on deception, capitalizing on power differentials, threats, and manipulating information because each party's goals are placed in direct opposition [29]. Cooperation is viewed as a form of weakness. DB can lead to suboptimal agreements, escalating hostilities surrounding the current conflict, and a poisoned relationship for handling future interdependent situations [10].

3.0 Integrative Bargaining

3.1 Overview

An alternative bargaining approach begins with parties discussing their needs or criteria, rather than jumping straight into opening bids. For example, in the car buyer-seller case, price may well be the most important criterion for each party. However, other factors may also have an impact, such as financing, delivery, or trade-in. First the parties spell

out their criteria, then they search for alternatives based on trade-offs among these factors. Perhaps the seller would accept a lower price in return for cash, delayed delivery or a suitable trade-in. On the other hand, the buyer might be willing to pay more if she could stretch out payments, or drive the car off the lot that day. After a variety of alternatives are generated, the buyer and seller evaluate the available options and select one that fulfills their joint interests. This contrasting approach is Integrative Bargaining (IB), often referred to as "Win-Win", "Positive Sum", or "Principled Negotiation" [2, 10, 15, 29, 31, 36, 40, 44]. "Integrative bargaining is the process of defining these goals and engaging in a set of procedures that permit both sides to maximize objectives" [29].

Lewicki and Litterer [29] point out that pure integrative situations seldom exist in practice. "Most situations are 'mixed motive', containing some elements that require distributive negotiation processes, and others that require integrative ones" (p. 107). Here we do not argue that distributive approaches are never appropriate. However, integrative solutions provide higher joint benefits, and could be obtained, at least to some degree, in most bargaining situations. Thus, where a distributive approach is necessary, it should be used within an overall integrative framework. For example, price may require a distributive, split-the-difference give-and-take. However, instead of treating price as a separate issue, as in DB, this factor should be bargained with regard to its trade-offs with other factors as one activity within an overall IB process. The price difference might be resolved in the seller's favor in exchange for a longer warranty contract.

There are numerous benefits of IB with regard to the high joint benefits it can produce. These include [10, 36]:

1. Intrinsic validity of greatest good for the greatest number (Bentham's Law);
2. High expectations prevent agreement without alternatives that generate high joint benefits;
3. Agreements with high joint benefits are more likely to be carried out;

4. Agreements with high joint benefits enhance attraction and trust between parties, contributing to a more positive relationship;
5. The final agreement is less determined by relative power; and
6. In intra-organizational settings, organizational effectiveness and "total power" can be enhanced.

3.2 The Integrative Bargaining Process

Numerous authors have addressed how to carry out the IB process [10, 26, 29, 36]. In particular, Sheila Kessler [26], based on her own mediation experience and interviews with 30 renowned mediators around the country, has developed a structured, four-stage process model (here referred to as Creative Conflict Resolution -- or CCR). CCR is representative of the variety of IB approaches found in the negotiation literature. It places heavy emphasis on techniques for addressing socio-emotional and cognitive bias issues inherent in conflict situations. This paper suggests ways in which computer support might be applied to implement these techniques.

Kessler's hypothesis is that the more socio-emotional obstacles are present in a conflict, "... the more structured (controlled) the resolution process needs to be and the lower the prognosis of successful resolution" (p. 15). She advocates use of a mediator in such situations to provide the needed structure, as well as to help deflate the charged emotional atmosphere. An NSS may be designed to assist a mediator on both fronts. Table 1 outlines pre-negotiation activities and CCR session stages (adopted from Kessler's CCR model): 1) setting the stage; 2) formulating the problem; 3) processing the issues, and 4) resolving the issues. A mediator plays an active role in assisting the participants throughout the process.

INSERT TABLE 1 about here

We suggest in Section III that information technology provides useful tools for some of the IB activities. However, there is no integrated support for the entire negotiation process. The NSS implementation framework in Section IV addresses all stages of the IB process as outlined in Table 1.

3.3 Obstacles to Using Integrative Bargaining

In principle, the IB process can substantially improve joint outcomes, although there are a number of practical difficulties in using it successfully. Our review of the negotiation literature identified three such difficulties: cognitive bias of the negotiators, socio-emotional impediments, and difficulties in analyzing complex sets of solutions. These obstacles, and NSS ways to overcome them, are discussed below.

COGNITIVE BIASES: A major problem in using IB is that the distributive, fixed pie assumption is so entrenched in our thinking. "Negotiators have a systematic intuitive bias that distorts their behavior: They assume that their interests directly conflict with the other party's interests. ... Such a focus inhibits the creativity and problem-solving necessary for the development of integrative solutions" [3].

Bazerman [3] further argues that even training in IB techniques may not prevent the negotiator from reverting to "past intuitive fixed-pie strategies" in potentially integrative situations. To overcome this bias, he advocates applying Lewin's change model to improving negotiator judgment [30]. This includes: (1) unfreezing the negotiator's established frame using simulation and feedback; (2) instruction in the appropriate techniques; and (3) refreezing the change to become an established element of the negotiator's future frame.

Computer support has the potential for contributing to Lewin's stages 1 and 2. Instruction is accomplished via a NSS which invokes a structured progression through IB steps, with full explanation of what each step entails. Refreezing is assisted in a couple of ways. First, mutual satisfactions with high joint benefits can carry over after the agreement has been reached, thus reinforcing the learning process. Second, repeated use of the NSS itself, as a tool in subsequent negotiations, can serve as a refreezing mechanism.

Another cognitive limitation involves the negotiators' "framing" of issues in the course of discussion. Tversky and Kahneman [42] have shown that positive cognitive frames (evaluating gains) induce risk aversion. Conversely, negative frames (evaluating losses) induce risk-seeking behaviors. Because risk aversion is an important element in the motivation

to negotiate, explicit emphasis on mutual gains can improve the willingness of the parties to seek agreement.

Developing positive cognitive frames could be supported by a NSS module which explicitly engages the parties in identifying their separate and mutual gains in undertaking negotiation. Identifying these interests early in the negotiation session can help construct this risk-averse frame.

SOCIO-EMOTIONAL FACTORS: Conflicts are exemplified by a number of socio-emotional characteristics. These are generally regarded to be among the most difficult to overcome in conflict situations. They include [26]:

1. Intense mutual distrust and little positive foundation in the relationship;
2. Intense emotional involvement in the issues;
3. Issues are abstract rather than specific;
4. An unconscious or pre-conscious issue underlying the presented problem; and
5. Tremendous imbalance in the financial or personal power of the two individuals.

There are a number of ways NSS might help overcome the above hindrances to a positive socio-emotional IB climate. First, distrust can be addressed by a signed rules contract governing interactions between the parties [26]. This can help to foster trust -- if not in the other party then at least in the bargaining process. Explicit rules contribute to a more secure belief that a party will get a fair hearing. The NSS may assist in developing this rules contract. Second, NSS modules would require the parties to explicitly communicate their views of the problem and issues, in order to build clear and specific boundaries around items for negotiation. This can contribute to a more "rational", less emotionally charged atmosphere. Third, using the computer as an input and display device can improve the clarity, accuracy and specificity of communication. Employing the keyboard for input encourages people to be more explicit in their comments. Also, public display can help the parties to concentrate on specific subject matters, instead of on personalities, and to avoid trailing off into vague abstractions [7, 43]. Likewise, discouraging abstractions can contribute to a more rational climate. "Frequently abstractions are

loaded that preclude mediation... because values are so emotional or central to one's being" [26, p. 31].

Addressing the fourth and fifth problems, the NSS should provide both equal access to the electronic communication channel and help separate idea generation from evaluation. It is important that each party has ample opportunity to fully express its perspectives, free from critical evaluation or interruption by the other party. Structured group process techniques which help to accomplish this have been implemented in GDSS software [1, 7, 31]. These techniques generally involve a two-stage process: (1) individually generating items; and (2) evaluating the generated items as a group. In GDSS settings, separating the stages has been shown to contribute to a more equal and active participation in the idea generation activity [43]. Also, the electronic communication channel helps to counteract power imbalances between parties which surface through one person dominating the verbal channel.

It is very important to address the socio-emotional climate or tone early in the negotiation process. The initial stages of a negotiation session are generally acknowledged to be the most difficult, yet the most critical to setting a cooperative tone. Pilisuk and Skolnick [35] found that parties tend to "lock in" on opening moves and continue them through the process. Thus, the longer trust and cooperation continue, the easier it is to restore the positive climate should difficulties occur [27, 38, 41]. To establish a cooperative tone early on, an NSS session should start with activities for which agreement and cooperation are most likely to exist. These activities may include defining interaction rules (e.g., to share information, to treat the other's concerns fairly) or/and identifying joint interests in the negotiation process (e.g., a positive future relationship, putting the past behind).

ANALYTICAL PROCESSING: Moderately to highly-complex conflict situations will usually entail many problem dimensions, issues, criteria, and alternative solutions. As the complexity grows, it becomes increasingly difficult for individuals to adequately comprehend and evaluate all of the items one-by-one. Furthermore, identifying potential trade-offs at both the issue and solution levels is even more difficult, though central to effective integrative bargaining.

IB involves four types of analytical activities (which may occur in any order). The first activity is eliciting each party's preferences on issues. A variety of techniques may be used. It is important to note, however, the critical role of overcoming distributive cognitive biases. Both parties must share their actual preferences and not attempt deceit to hide their real needs. This would make it impossible to subsequently identify high joint benefit agreements. A second activity is to identify alternative solutions based on trade-offs between these preferences. For example, a trade-off opportunity may exist if one party values Issue A highly and Issue B mildly, while the other party values them in an inverse order. A third activity is analyzing the extent to which alternative solutions address issues. Issues without solutions must be identified and dealt with; alternative solutions which do not address any issues should be rejected or redefined. Fourth, external data sources (such as historical databases, purchased data sets, ...) may be used to generate and/or evaluate alternatives. (For a detailed discussion of related techniques in negotiations, see [16]).

Existing NSS designs have focused, almost exclusively, on the analytical processing of subjective preference and/or objective data. A variety of implemented techniques support preference elicitation, alternatives generation and analysis, and trade-off identification. These techniques should be part of any "effective" NSS, and will be discussed in detail in Section III.

4.0 Summary

Thus far we have discussed the Distributive and Integrative Bargaining approaches to negotiation. The IB model is more effective for generating high joint benefit agreements. However, it can be more difficult to implement due to the cognitive biases of negotiators, their analytical demands, and the socio-emotional factors inherent in the conflict. This paper suggests that information technology could improve negotiation effectiveness by supporting the following activities:

1. Training and assistance with structured IB techniques;
2. Early development of positive frames;
3. Starting out with cooperation and agreement;
4. Clear problem and issue definition;

5. Use of structured group process techniques;
6. Communication support; and
7. Assisting with analytical processing activities.

The next section discusses NSS and GDSS design features and compares existing software systems in terms of the support they provide to each stage of the negotiation process.

III. GROUP DECISION AND NEGOTIATION SUPPORT SYSTEMS

1.0 Existing GDSS Software

NSS constitute a special class of group decision support systems (GDSS) designed for noncooperative, mixed-motive task situations. Huber [14] defines GDSS as "... a set of software, hardware and language components and procedures that support a group of people engaged in a decision-related meeting" (p. 195). The GDSS configuration minimally includes participant and facilitator terminals, network and communication linkages, a public display screen device, and software for group information processing activities (such as generating, organizing, and evaluating ideas). The last, and certainly not least, element of the GDSS environment is a facilitation mechanism that prepares and runs the computer-supported group decision-making session. This role is usually played by a person called a facilitator or, in this case, a mediator.

Two of the most widely used GDSS were developed by the University of Arizona [1, 43] and the University of Minnesota [6]. Both systems are designed for a "Decision Room" setting, illustrated in Figure 1 (from [19]). The participants interact face-to-face as well as electronically through their microcomputers, which are linked together via a local area network. A public video screen is used for focusing group discussions and displaying aggregated individual inputs.

INSERT FIGURE 1 ABOUT HERE

The Arizona and Minnesota GDSS, listed in Table 2, are similar in that both systems support basic group information-processing activities of

problem definition, item generation (e.g., alternatives, criteria, issues), alternatives evaluation, and voting. The Arizona software, however, also contains tools for organizing and consolidating items, developing agendas, and formulating policies. It also supports a facilitator or mediator while the Minnesota system does not.

INSERT TABLE 2 ABOUT HERE

These GDSS were originally conceived for cooperative, common-motive tasks. However, they have some characteristics appropriate for NSS as proposed in this paper. First, the generic activities listed in Table 2 are generally applicable to both cooperative and noncooperative group decision-making tasks. Second, the Decision Room setting (see Figure 1) is useful in supporting face-to-face interactions in a negotiation session (although it has not been tried before in NSS development).

However, there are a few difficulties with using these GDSS for negotiation support without making some modifications. First, in a cooperative situation, all participants contribute to a single joint listing (e.g., generating or evaluating issues, criteria, or alternatives). The objective is group versus individual ownership of the list. In contrast, for most noncooperative situations, the objective is to encourage each party to take ownership of their own views. A joint view is subsequently contracted from clearly formulated individual views [17]. Specifically, the NSS should display each negotiator's inputs side by side, and support the human mediator in the items organization/consolidation activities (i.e., merging similar items and eliminating duplicates). Second, a NSS calls for some additional features to support preference analysis and evaluation, rules definition, and special output formats. Third, it must be possible for the mediator to automatically and flexibly integrate software tools to help apply structure to the entire IB process [4].

In sum, NSS are distinguished from GDSS primarily in the type of tasks and information-processing activities they are designed to support, and hence in the software needed. Design requirements for NSS, over and above the ones for GDSS, may include:

1. Negotiation software designed to support a structured negotiation process -- a set of pre-defined stages such as the those outlined in Table 1;
2. Input, display, and editing software designed to support defining and integrating individual views (or bargaining positions);
3. Analytical software to evaluate and compare negotiators' preferences for issues and alternatives in order to identify potential areas of compromise;
4. Accommodating a mediator with control over the system operation; and
5. Accommodating teams of negotiators (when necessary), in addition to individual bargainers.

These NSS design requirements will be described in more detail in the sections below.

2.0 Existing NSS Software

A variety of specific negotiation features are found in existing NSS designs. We identified eight negotiation-oriented software packages in the literature (see Table 3). Three of them, namely DECISION MAKER [12], POLICY-PC [8], and DECISION ANALYSIS SYSTEM [9] are commercially available. The others are in a conceptual or prototype stage. Only one NSS is known to have been employed in an actual, full-scale conflict situation; it is called "ANALYTICAL MEDIATION" and was developed by the Decision Techtronics Group of the State University of New York at Albany [34]. However, the negotiators did not interact directly with it by a "chauffeur" located at the back of the room.

INSERT TABLE 3 ABOUT HERE

Regarding the negotiation stages being supported by the NSS, three

systems (DECISION MAKER, RUNE [25], and COMPUTER DECISION TREE MODEL [46]) are used for pre-negotiation strategy formulation undertaken by a single negotiating party. The remaining NSS only support the final stage of the process: evaluation and/or selection of alternatives. Among the eight NSS listed in Table 3, none support group process structuring techniques and only MEDIATOR [18, 39] and POLICY-PC support some form of multiple-participant system input interaction. The remaining systems (e.g., ANALYTICAL MEDIATION) are operated by a single negotiator or a "chauffeur".

All of the NSS were designed to provide primarily analytical processing capabilities using the parties' preference data generated internally within the negotiation session. Three systems (MEDIATOR, NEGO [24], and RUNE) allow use of external data sets. A variety of analytical techniques based on regression analysis, or derived from multiple-criteria decision making and game theory models, are employed to identify high joint benefit solutions or viable negotiating strategies. (For a detailed discussion of NSS design issues and existing software, see [20]).

The primary shortcoming of the NSS discussed above is their lack of support for: 1) handling cognitive biases and social-emotional aspects of conflict situations; 2) structuring the negotiation process; and 3) facilitating direct interaction between the parties. However, these same issues have been stressed in the conflict resolution literature as the underpinnings of successful negotiations [3, 10, 26]. Generally, NSS developers have relegated these issues to treatment by a skilled mediator. In this paper, we suggest means by which NSS can effectively provide these types of support.

IV. A Design Framework for Computer-Supported Conflict Resolution

The NSS setting is the "Decision Room" (as shown in Figure 1). Each negotiator has a personal input and display device networked with each other's device. The seating arrangement provides each participant with a clear view of one another and of the public video display screen. The facilitator in this context acts as a mediator as well as a technical assistant for using the NSS; he is equipped with a printer and a workstation, also networked with the negotiators' personal computers.

General features supported by NSS are drawn from three areas of

research: negotiation, group process and communication, and analytical techniques. The NSS assists a mediator in: structuring the negotiation process, employing group process structuring techniques, adding electronic communication channels, supporting subjective preference analysis, and documenting agreements. The rationale behind these NSS features is to overcome the general types of obstacles to integrative bargaining as discussed in Section 3.3; i.e., overcoming cognitive biases, treating socio-emotional characteristics of conflict, and supporting analytical processing. Computer support for each of the above stated activities is now described.

1.0 Structuring the Negotiation Process

Negotiation process structuring is provided by software modules that can be linked in the sequence shown in Table 1. This "linkage" includes automatically passing control and data sets from one module to another. Some of the modules are mandatory, such as defining the problem and issues, generating and evaluating alternatives, and completing the agreement. Others are available if additional support is needed to improve the cooperative atmosphere (e.g., establishing rules, role reversal, paraphrasing) or to sort through specialized or complex analyses.

2.0 Employing Group Process Structuring Techniques

Three group process structuring techniques are proposed for item generation activities, based on Nominal Group (NG) processes [5] and the Process Centered Leadership (PCL) approach [33]. Using the PCL model, the mediator assumes a system input role to record the parties' discussion and generate consensus. This approach is employed, for example, for establishing rules for the session.

Two NG variations are used here; they are referred to as cooperative and noncooperative nominal group techniques. First, for cooperative activities, each negotiator individually inputs items. These are randomly merged into a single joint list and displayed on the public screen. The GDSS at the universities of Arizona and Minnesota, mentioned previously, use variations of the cooperative NG technique. An NSS would employ this approach, for example, in eliciting perceived advantages to resolving the conflict. The interactive item-by-item merging of inputs helps the development of a joint cooperative frame.

Second, for noncooperative activities, the individually-generated items are retained as separate lists. The column lists are renumbered on the public screen to match related items into pairs. Each pair is edited (by the mediator) during discussion to merge the two related statements into a single item which meaningfully integrates the pair. This non-cooperative nominal group approach is used especially in identifying aspects of the problem, the central issues, and generating alternative solutions.

3.0 Adding Communication Channels

An electronic communication channel for face-to-face discussion is provided through interactive input by the negotiators and public display of this input. The NSS provides an additional (not substitute) communication channel to spoken or written expression (e.g., on paper or blackboard). This electronic channel has certain characteristics which may affect the nature of the interaction. First, everyone has equal access to the channel to express their ideas and judgments. This prevents a single party from dominating the discussion, and enforces fairness. Second, spoken expression has been found to be more impulsive and emotional while writing is more elaborate and rational [13]. Assuming these findings hold for typed computer input, the electronic channel would contribute to reducing socio-emotional tensions and encouraging more substantive communications. What is not known is whether people can adequately express themselves once emotions have become heated.

Third, unambiguous and precise wording of issues is important to focus the group attention, to restrain the negotiators from resorting to vague generalities (that often distort differences), and to find more subtle semantic compromises on specific positions [17]. In a distributive bargaining situation, where deceit and maneuvering are expected, the "permanent record" implication of written expression may be resisted by negotiators. However, in integrative bargaining, it may reinforce the spirit of cooperative problem-solving.

4.0 Supporting Subjective Preference Elicitation and Analysis

Explicit techniques that can be used for preference/utility elicitation include direct rating/ranking of issues or possible solutions, distributing a fixed number of utility points among alternatives, pairwise

comparison, etc. Techniques for identifying implied preferences have been operationalized in several existing software packages such as POLICY-PC, DECISION ANALYSIS SYSTEM, PREFCALC [28]. Negotiators first assign preference values to randomly-generated contracts. Next, an algorithm derives, for each negotiator, the implied weight (or importance rate) for each specific issue or alternative varied in the contracts.

Whether explicitly or implicitly derived, the preferences are then available for automated evaluation methods. Generally some form of cross-matrix analysis is used to identify issues ripe for trade-off, alternatives with high joint utilities (also called "Nash solutions"), or mismatches between issues and alternatives. The ultimate objective for analysis is to identify integrative solutions that maximize the utility of both parties. When many issues or possible solutions exist, such calculation can be extremely difficult without computer assistance.

5.0 Documenting Agreements

Agreement documentation is a by-product of using the NSS to input, display, and refine negotiating rules, issues, and solutions. Standardized rules and contract formats stored in the NSS might be used to automatically draft the agreement document(s) following final resolution and wording. This feature facilitates reaching closure during or after the negotiation process by making it possible to sign the rules contract or final document immediately.

V. An Implementation Framework for Computer-Supported Conflict Resolution

1.0 Introduction

The previous sections of this paper have discussed the integrative bargaining model and raised the major obstacles to its implementation. General NSS features to counteract these obstacles were then outlined. This section illustrates a framework for implementing NSS through the IB process steps. The pre-negotiation stage is also treated, though as a separate activity.

Figure 2 is a flowchart of the NSS framework using the IB Process.

It outlines the negotiation stages and activities supported by the NSS. For each activity, the flowchart shows the mediator and individual negotiator inputs, and the corresponding NSS operations. Also, relevant existing software is noted.

For example, the first activity under Setting the Stage involves developing rules. The NSS first displays a template with general interaction rules (details are given below). Next, the mediator inputs items from a discussion of what additional rules specific to the parties' dispute should be added. Once complete, a final rules contract is printed for the parties' signatures to help generate trust in the process. The theoretical background and NSS implementation procedures for each step in the IB process are now described.

INSERT FIGURE 2 ABOUT HERE

PRE-NEGOTIATION:

2.0 Pre-Session

BACKGROUND: There are two pre-negotiation activities: 1) strategy formulation, which is undertaken individually by each party; and 2) agreement between the parties to engage in mediated negotiation. Three NSS (DECISION MAKER, RUNE, and COMPUTER DECISION TREE MODEL), support strategy formulation, i.e., the process of determining the conflict resolution approach a party wishes to pursue. Integrative bargaining may be among the possible strategies, which could also include doing nothing, taking unilateral actions, or using the court system. Each party should consider its own and its opponent's available alternatives (using, e.g., DECISION MAKER), goals (employing e.g., RUNE), its "Best Alternative To a Negotiated Agreement" [10], and estimates of gains, risks and probabilities (supported by, e.g., the COMPUTER DECISION TREE MODEL software package).

IMPLEMENTATION: One or more of the three existing pre-negotiation NSS are recommended for parties that desire support for pre-session strategy formulation. There is no need for tightly integrating the pre-session and

during-session NSS as these are very different processes. Should both parties decide to engage in negotiation, they would agree to schedule the session(s) via communication channels external to the NSS (e.g., via correspondence or through the mediator.)

DURING THE NEGOTIATION

3.0 Setting the Stage

Setting the stage for negotiation consists of establishing rules for interaction and creating positive negotiator frames.

3.1 Establishing Rules

BACKGROUND: Often the basic issues involved in an interpersonal conflict situation are shrouded in distrust, hostility, negativity, and tension. The session begins by developing a set of rules that governs interactions during the negotiation and actions taken outside the session which could undermine good faith efforts. Standard rules are reviewed and rules specific to the negotiators' situation are added. (See appendix for an example of a rules contract).

The primary objective here is to start the session off with agreement, reinforcing an atmosphere of cooperation. The rules are made explicit to allow their even-handed invocation during the session if tensions escalate. Also, process rules can help deter negotiators from undercutting the negotiation with actions taken outside the session.

IMPLEMENTATION: The NSS implementation for setting rules uses the process centered leadership approach. The NSS displays general interaction rules and the mediator inputs additional ones specific to the conflict, agreed to by the negotiators. This activity gives the parties time to become accustomed to the environment and enables the mediator to set a constructive tone to these initial interactions. Responses to rule violations may be addressed as needed and could be included in the rules statements. Finally, the rules contract is printed and signed by all participants.

3.2 Creating a Positive Frame

BACKGROUND: Generating commitment to the rules contributes to setting a positive opening tone. To further cement a positive frame for the negotiation, common goals are elicited. The basic question negotiators address is: "What are your interests in resolving our conflict?".

IMPLEMENTATION: Negotiators individually input statements of their interests in a negotiated settlement, using a cooperative nominal group approach. Inputs are displayed on the public screen as a single combined listing. The mediator is involved in facilitating the subsequent discussion of this listing, enforcing a neutral tone while organizing/restating/editing items, and supporting the negotiators in identifying commonalities between their individual needs and goals.

4.0 Formulating the Problem

BACKGROUND: The second phase of the negotiation is to define the problem and central issues. Here "definition" is the key word. Evaluation of the issues and their resolution follows in the third phase after a complete outline of the problem and issues has been developed. Initially, the negotiators clearly and objectively describe their own perspectives. Kessler [26] points out that in many disputes the mediation session is the first time the negotiators have sat face-to-face to hear the other party out. Even if they may have been arguing about the issues for some time, the rules stressing non-interruption may help the parties actually listen to one another.

Three key objectives for this stage are: developing a comprehensive problem representation, separating agreed facts from separate assumptions, and getting all of the issues on the table. The NSS partly accomplishes these objectives by separating problem from issue definition. The problem representation is the entire context of the conflict situation, whereas issues are specifically what can and must be negotiated between the parties. Both must be explored. However, while the parties may never fully agree on all facets of the problem, they must come to agreement on the specific issues for which negotiated solutions are required.

IMPLEMENTATION FOR DEFINING THE PROBLEM: Individual input of problem statements using the noncooperative nominal group approach gives each negotiator the opportunity to "tell their story" without distraction from the other's verbal interruptions or non-verbal cues. The subsequent discussion provides each with the opportunity to verbally clarify their perceptions. Each party's problem statement inputs are displayed side by side on the public screen. To separate facts from assumptions, the negotiators together (with the mediator's technical assistance) organize statements into matching pairs. Then they select, edit or merge one representation from each pair to construct a jointly-understood "fact". If single statements cannot be agreed upon, they are moved to the bottom of the list to represent individually-held "assumptions".

IMPLEMENTATION FOR DEFINING THE ISSUES: Defining issues follows the same procedure as defining the problem, with two exceptions. First, all items must be agreed upon in the joint issues list. Second, the agreed list of problem statements is available for reference while developing issue statements. As the negotiators separately generate issues, they may display the problem statements to pull in and reword those that may apply. This can speed input and help relate issues to problems.

The Arizona PLEXSYS software has an Issue Identification module which may be useful for this purpose. The previously generated joint problem list is displayed on each individual screen. Participants scroll through this list while generating issues, and electronically attach relevant problems to issue statements.

5.0 Processing the Issues

BACKGROUND: The issue processing phase is a continuation of issue definition, emphasizing deeper understanding of the other party's interests, needs, and perspectives of the problem and issues. Goals for this stage include [26]: managing the emotional climate, encouraging empathy and maintaining equality. This phase usually involves extensive verbal and non-verbal interactions between the negotiators. Mediator intervention is crucial to successfully guide the parties' discussion.

Many of the techniques described by Kessler to accomplish this (such as using carefully worded questions to diffuse tensions, or monitoring

verbal and non-verbal cues for hidden messages) do not easily lend themselves to computer support. However, there are a few techniques which may, such as tracking time deadlines, focusing attention, enacting role reversal or paraphrasing, and maintaining the equal footing of both parties. These techniques are discussed below.

IMPLEMENTATION FOR TRACKING TIME: Deadlines for completing the negotiation, or for separate sessions can help negotiators focus on resolution. The NSS could track and post reminders of session time to enforce agreed upon deadlines.

IMPLEMENTATION FOR FOCUSING ATTENTION: Topic wandering or snowballing abstraction can quickly destroy a rational approach to investigating issues. The public display can be used to focus the negotiators' attention on one specific item at-a-time. The mediator could control sequencing through all the issues or problem statements, or just display that specific point under discussion. Discussion time limits and automatic sequencing through the issues could be used to facilitate consideration of all the issues.

IMPLEMENTATION FOR ROLE REVERSAL: Role reversal is one means of encouraging empathy, tolerance and understanding for the other's position. Negotiators could be encouraged to "place themselves in the other's shoes" by using several NSS techniques. One is to display the issues list (or other listing they have generated) on each of the negotiators' private screens. Each person then assigns preference ratings to the issues based on what they believe to be the other party's values. The two sorted lists would then be displayed on the public screen for discussion, or automated analysis could be performed to highlight those issues with the greatest misunderstanding. A second means of implementing role reversal would be for each negotiator to enter comments that reflect the content, antecedents, or criteria which he/she believes to be the other's perception of each issue.

IMPLEMENTATION FOR PARAPHRASING: Another means of encouraging empathy is through active listening and paraphrasing. This can take the form of a rule that one must restate what the other has just said before stating one's own side. Paraphrasing may also be used as a tool for slowing the pace of interaction, concluding a given discussion, or refocusing back

on the issue at hand.

The NSS might be used to support occasional paraphrasing. A paraphrase module would be either:

- A simple electronic notepad for each negotiator to restate the other's position, needs, orientation, communication style, assumptions, etc; or
- A more sophisticated notepad with prompts (entered by the mediator or dynamically generated by the system) to paraphrase specific information related to the other party.

In either case, the paraphrase statements could be publicly displayed for discussion or privately exchanged to allow time for thinking them over.

IMPLEMENTATION FOR MAINTAINING EQUALITY: In most cases, personal, positional or financial inequalities will exist between the parties. These inequalities can be especially significant if they affect a negotiator's ability to articulate their own interests. In the event that one individual begins to dominate the interaction, the electronic communication channel could be used to help equalize participation. In an extreme case, the mediator may choose to channel all communication through the electronic medium for a period of time. This would give both parties equal access to the communication channel. Alternatively, the NSS may be used as a time keeper, tracking agreed upon time allotments for each side to use in verbal discussion.

6.0 Resolving the Issues

BACKGROUND: The final phase is resolving the conflict issues with integrative solutions, and completing the final agreement contract. The IB approach includes four techniques that are incorporated here. First, delaying negotiators' commitment to positions until after the problem and issues have been completely specified and discussed. This is important to prevent the negotiators from committing their egos or narrowing their thinking to fixed positions before having heard out the other side. Second, generating a wide range of alternative solutions. Third, broadening the boundaries of the solution domain as far as is creatively and realistically possible to include potential settlements. Fourth, specifying plans for implementing the agreement, once a solution to the full range of issues has been accepted.

IMPLEMENTATION: The NSS implementation for a specific negotiation may be more or less sophisticated depending on the extent of differences remaining between the parties. A less sophisticated approach would use the NSS for alternatives generation and public display of these alternatives for verbal evaluation. If an agreement is easily reached on a comprehensive solution, the parties may begin detailing implementation plans. If impediments to an immediate agreement exist (such as numerous or complex issues/alternatives, or unclear preferences), then the NSS could also provide support for further analysis and/or evaluation.

IMPLEMENTATION FOR GENERATING ALTERNATIVES: A cooperative nominal group approach could be used to generate a joint listing of alternatives. Each party inputs numerous possible alternatives, which are exchanged as they are entered to stimulate creativity. The mediator encourages negotiating parties to broaden the boundaries of their solution domain to encompass multi-issue and single-issue solutions.

IMPLEMENTATION FOR ANALYZING ALTERNATIVES: Analysis support would take the form of individually matching issues with relevant alternatives (e.g., as performed by the Minnesota GDSS). These inputs could then be displayed in a cross matrix format showing the coverage of issues by alternatives. Overlapping or irrelevant alternatives and untreated issues become apparent through the matrix display and are immediately handled.

IMPLEMENTATION FOR EVALUATING ISSUES: The evaluation module would support eliciting issue preferences from the parties (e.g., through POLICY-PC, DECISION ANALYSIS, or MEDIATOR) and automatically calculating and displaying preference differences for specific issues (by using, e.g., the ANALYTICAL MEDIATION software). Wide differences mark issues ripe for trade-offs. The negotiator with a high relative preference for one issue could be given his/her favorite solution in exchange for an issue for which he/she has a low relative preference.

IMPLEMENTATION FOR DEVELOPING SOLUTIONS: The mediator plays an important role in assisting the parties develop solutions to the issues set from among the generated alternatives. Alternatives and issues lists, the analysis matrix, and the differences in issue preferences could be alternatively displayed on the public and private screens to focus the negotiators' discussion. The mediator could edit the wording of selected

alternatives to shape them into acceptable solutions. Multiple rounds of preference elicitation and evaluation could move the parties gradually together.

IMPLEMENTATION FOR COMPLETING THE AGREEMENT: Once agreement has been developed covering the entire issue set, plans to implement the agreement (including time tables, specific resource transfers, and follow-up evaluations) are jointly developed. The mediator acts as leader to input the negotiators' conditions. Finally, copies are printed for the parties' signatures. Whether or not the agreement is binding, the act of signing a document tends to cement a person's felt commitment, and hence improve the chances for successful implementation.

7.0 Summary

The NSS implementation described above supports the integrative bargaining approach to negotiation that uses the following process: 1) setting the stage; 2) formulating the problem; 3) processing the issues; and 4) resolving the issues. The objective of the NSS features is to assist a mediator in overcoming the cognitive, socio-emotional and analytical obstacles to successful application of IB techniques. Existing NSS and GDSS were found to support isolated activities within the overall IB process, addressing primarily the analytical obstacles. However, a number of additional activities that could be supported in a more comprehensive and integrated fashion were identified.

V. Directions for Future Research

Numerous research opportunities remain to be investigated in order to develop practical NSS for use in real-world negotiations. First, the NSS described in this paper provides a conceptual framework for supporting the IB approach to conflict resolution. Although detailed design and implementation guidelines for the development of such NSS are given, an elaboration of a prototype and experimentation with it are required to evaluate the system effectiveness. As suggested in Section III, existing GDSS may provide an excellent starting point to make modifications needed for effective negotiation support.

Second, there is a large number of variables involved in categorizing

conflicts and determining how best to support their contingent resolution. Important variables include conflict intensity, issue complexity, number of parties, use of negotiating teams, constituency involvement, ratification requirements, third-party intervention, characteristics of the relationship, and incompatibility of interests. (For more in-depth discussion of these factors see [18, 23, 36, 37]). A great deal of work is required in order to understand the effects such factors have on negotiation as well as how NSS should be adapted to support these contingencies.

Third, the roles played by a human versus the computer as third-party intervenors need to be further explored. The human third-party role discussed in this paper was that of a mediator who contributed process facilitation and substantive assistance in exploring issues and identifying solutions. In fact there is a wide variety of roles this person could play, from no involvement to nonsubstantive discussion leader, to arbitrator with the power of imposing a binding solution on the parties. Support for different roles would pose different requirements for NSS design.

Fourth, the applicability of GDSS research in cooperative situations to conflict situations needs to be further investigated. Specifically, how does conflict change the nature of group interaction, and what implications does this have for NSS design? An understanding of differences between single and mixed-motive situations would assist in the "transfer" of design features and research findings between the two types of systems. Specifically, some GDSS findings that could have significance for NSS include:

1. GDSS have been found to heighten conflict within a group "as members become more blunt and assertive in their comments." [43];
2. GDSS tend to help focus attention on substantive issues leading to more in-depth consideration of ideas and minimizing "topic wandering" and "social chatter" [43] and
3. GDSS tend to encourage equality of participation and reduction of individual power and influence [7].

Fifth, considerable research has been carried out regarding effective user-interface characteristics (e.g., data input and display), but little formal work has gone into the special characteristics needed in a group

setting. Vogel et al. [43] used the term "user seductiveness" in place of "user friendliness" to emphasize this point. In a conflict situation, however, research is needed to determine the reaction of people to the electronic channel when they are in emotionally charged states.

Sixth, the eight existing NSS examined in Section III have suggested a wide variety of analytical techniques, yet only one is known to have been subject to experimentation in a real-world conflict setting. More work is needed to compare the effectiveness of different techniques for different types of issues or conflicts. Of special importance is examining how best to present these techniques and their outputs to negotiators to enhance the legitimacy of their analyses.

Seventh, the NSS framework presented in this paper assists with process structuring, communication, analysis, and documentation. This represents an intermediate level of negotiation intervention. However, many variations of system involvement also are possible. The NSS could play a very passive role as a backroom analytical processor e.g., [34]; or, a very active role employing expert system techniques [19]. The rule base could be used to analyze conflict contingencies, to suggest appropriate process structuring formats or analytical models, to enforce norms for interaction by monitoring the semantic content of electronic communications, or to suggest high joint-benefit contracts. One question is the extent to which NSS could be developed with sufficient sophistication so as to effectively perform the activities of a human mediator in high conflict situations.

Eighth, the negotiator cognitive limitation issues raised by Bazerman [3] provide a potentially fruitful area for further exploration. Bazerman notes that "future research and training programs need to pursue the potential of improving judgment as a step in providing better prescriptions to negotiators" (p. 226). Significant opportunities exist for "improving judgment" through the use of NSS. These need to be pursued within the framework of Lewin's change model [30] to enhance the instruction and refreezing stages.

Ninth, we note that evolutionary systems design (ESD) developed by Shakun [39] may be viewed as a formalized OR/AI Framework complementary to the IB Framework developed here. Shakun discusses formally how an NSS can

support evolution of the group problem representation -- a process of consensus seeking (through information sharing) subject to problem adaptation and restructuring within which compromise is possible. ESD is IB-oriented and its relationship to the NSS development framework presented here should be explored.

VI. Concluding Remarks

The Integrative Bargaining process offers an effective structure for negotiations which can produce high joint-benefits for the parties involved, as well as contribute to a more positive future relationship. However, important practical obstacles to using IB techniques exist, such as cognitive biases of the negotiators, socio-emotional, factors and analytical difficulties. This paper provided a framework for developing an NSS that can assist in overcoming these obstacles and realizing the potential of Integrative Bargaining.

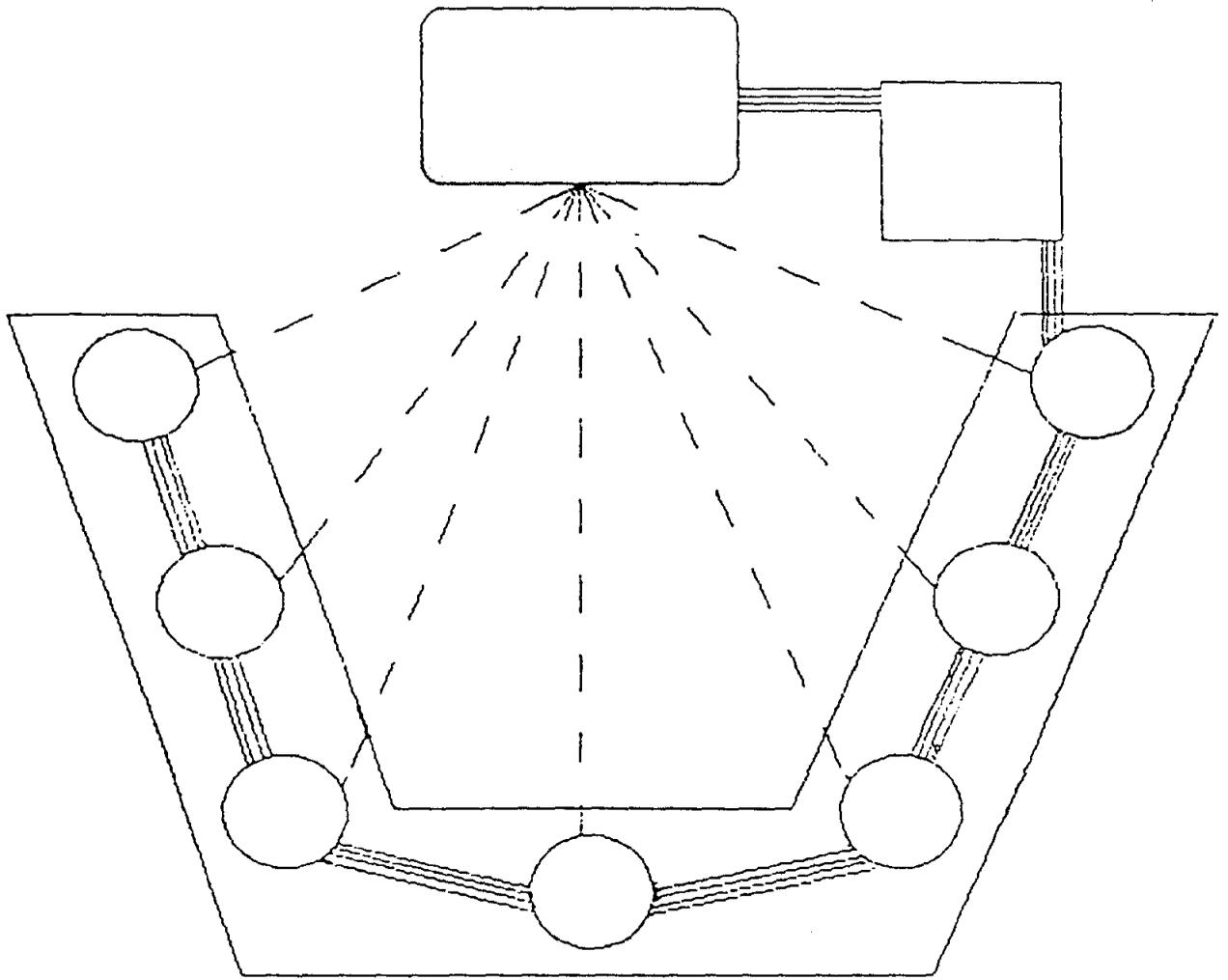
We have noted a shortcoming in existing NSS software which focus almost exclusively on single-user and analytical support for negotiation. Little attention has been given to applying computer support to the entire negotiation session, or to addressing socio-emotional and cognitive impediments. This paper addressed these deficiencies by describing design and implementation features of a more comprehensive NSS. It also illustrated where existing NSS and GDSS applications fit into this larger framework of negotiation support. Moreover, it is quite obvious from the research agenda proposed in the previous section that the short history of investigating computer support for negotiation creates extensive opportunities for future studies in this area.

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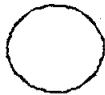
LEGEND:



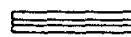
Video Screen



Server



Terminal



Local Area Network
Cables



Virtual paths

The GDSS Room

Figure 1: The Decision Room Setting
(from Jelassi & Beauclair, 1987)

FIGURE 2: Flowchart of NSS Framework and IB Process Stages

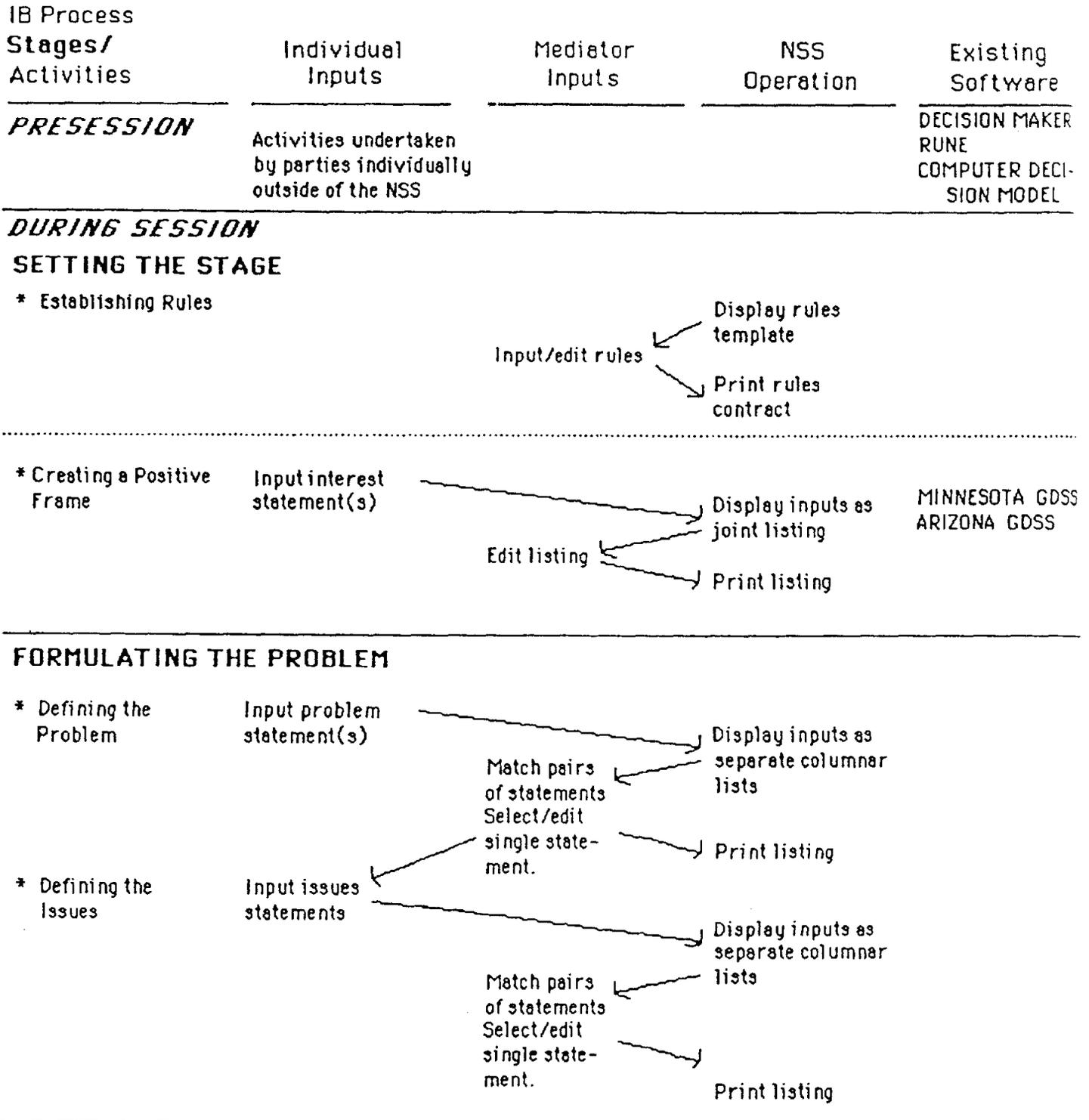


FIGURE 2: (page 2)

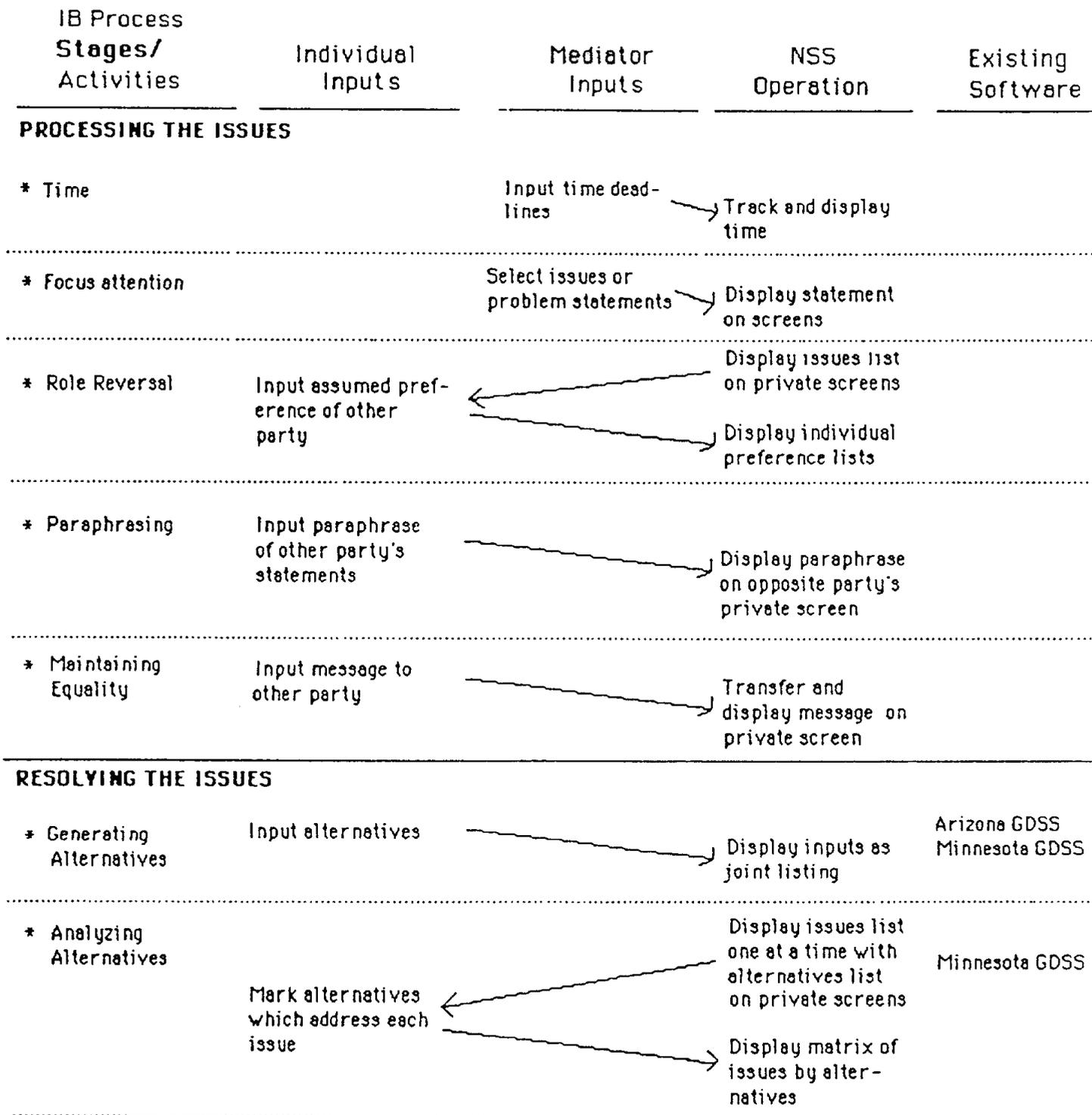
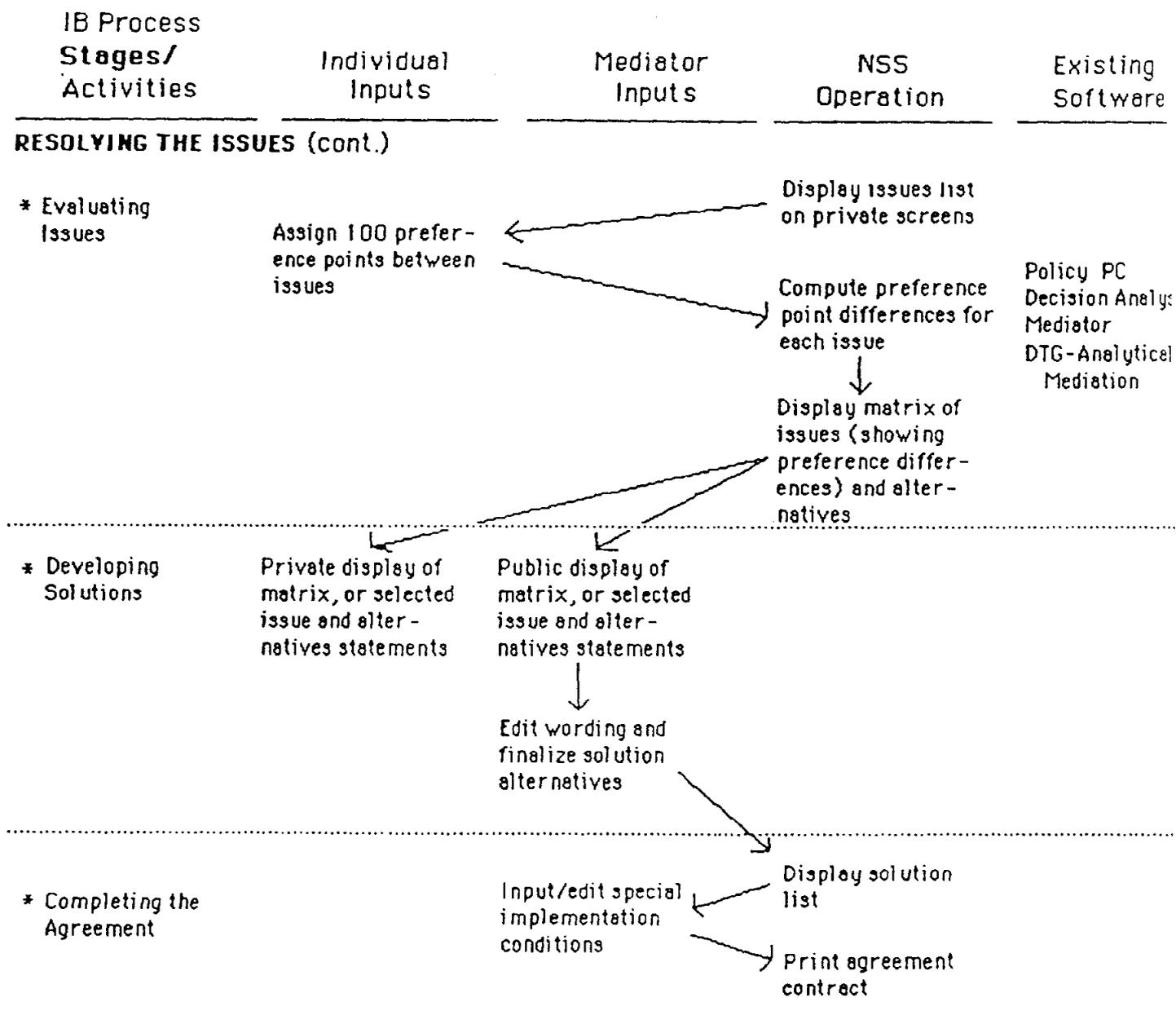


FIGURE 2: (page 3)



PROCESS STAGES	ACTIVITIES
PRE-SESSION	<ul style="list-style-type: none"> A. Pre-negotiation strategy formulation B. Agreement to engage in negotiation
SESSION:	
1. Setting the Stage	<ul style="list-style-type: none"> A. Establishing Rules B. Developing Positive Frames
2. Formulating the Problem	<ul style="list-style-type: none"> A. Defining the Problem B. Defining the Issues
3. Processing the Issues	<ul style="list-style-type: none"> A. Tracking Time Deadlines B. Focusing on Specific Issues C. Role Reversal D. Paraphrasing E. Maintaining Equality
4. Resolving the Issues	<ul style="list-style-type: none"> A. Generating Alternatives B. Analyzing Alternatives C. Evaluating Issues D. Developing Solutions E. Completing the Agreement

Table 1: IB Process Stages and Activities

Activities Supported	Arizona GDSS	Minnesota GDSS
Problem Definition	X	X
Items Generation	X	X
Items Organization/ Consolidation	X	
Alternatives Evaluation	X	X
Voting	X	X
Other (e.g., Policy Formulation, Agenda Development)	X	
Facilitator Intervention	X	

Table 2: Comparison of Arizona and Minnesota GDSS

Table 3: Review of Existing NSS Designs

NSS Software Package	Negotiation Stage Supported	System Input Interaction	Group Process Support	Principal Data used for Analysis	Principal Data Analysis Techniques	Status of System
COMPUTER DECISION TREE MODEL (Winter, 1985)	Prerenegotiat strategy formulation	Single party or chauffeur	None	Subjective estimates of gains, risks and probabilities	Decision Tree Analysis	Single real-life application
DECISION ANALYSIS (Executive Software Inc. 1983)	Evaluation of alternatives	Single party	None	Subjective multi-issue contract preferences	Regression Analysis	Commercial software package
DECISION MAKER (Fraser, Hipel, 1981,1985)	Prerenegotiation strategy formulation	Single party or chauffeur	None	Subjective alternative strategies Strategy preferences	Metagame Analysis Method	Commercial software package
DTG-ANALYTICAL MEDIATION (Mumpower, et al, 1986) *	Evaluation and selection of alternatives	Single chauffeur	Group discussion	Subjective issue preferences	Game Theory (Nash Solution) Optimization (Goal Programming)	Single real-life application
MEDIATOR (Jarke, Jelassi, Shakun, 1987) (Shakun, 1988)	Evaluation and selection of alternatives	Multi-party	Group discussion	Subjective solution and attribute preferences Objective alternative attribute data	MCDM (Additive Utility functions, the UTA Method)	Conceptual Model (includes PREFCALC)
NEGO (Kersten, 1985)	Compromise evaluation	Single party or chauffeur	None	Subjective, goals, demands Alternative objective functions	Optimization (Multi Objective Linear Programming)	Prototype used for teaching
POLICY PC (Executive Decision Services)	Evaluation of alternatives	Multi-party sequential	None	Subjective multi-issue contract preferences	Regression Analysis	Commercial software package
RUNE (Kersten, et al., 1986)	Prerenegotiation strategy formulation	Single party or chauffeur	None	Subjective goals, subgoals Binary facts	Rule Based Processing	Prototype in testing

* Based on Multi-Attribute Utility Model (Barclay, Peterson, 1976)

APPENDICES

MEDIATION RULES

In order for mediation work, the process rules must be clear to both parties. Both people need to agree to abide by the same rules, otherwise mediation may not be worth the risk of opening up. The following represent some basic rules. The parties and mediator may choose to delete, amend or add on to these rules.

1. I agree to share all of the information pertinent to the issue(s).
2. I agree to put my anger aside and deal with the issues in a fair manner.
3. I agree to not use outside audiences to sway the other person.
4. I agree to abide by the final agreement made.
5. I agree to have all of the persons who are involved in the conflict be a part of the mediation, if that is agreeable to the other person and necessary to the solution.
6. I agree to not use the information gained in the mediation against the other person.
7. I agree that what happens in mediation is fully confidential.
8. I agree to the use of a tape recorder within the mediation so that we may recheck the information and facts at a later date.

RULES DESIRED BY THE PARTIES

- 9.
- 10.
- 11.
- 12.

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