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COLLECTIVE MEMORY SUPPORT FOR BUYER-SUPPLIER NEGOTIATION ON MULTIPLE ISSUES: DESIGN OF A WEB-BASED SYSTEM

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Abstract

Negotiation memory is a form of collective memory that can be used in repetitive negotiation on multiple issues. The use of negotiation memory can help negotiators to overcome various systematic judgmental limitations that they may have and enable them to rely less on mental short cuts or heuristics. This paper discusses how a web based negotiation memory support system can be developed to support buyer supplier negotiation on multiple issues. The use of the memory system may result in a win-win solution for the buyer-supplier negotiation.

Introduction

Negotiation is a process in which two or more parties (individuals, groups, or organizations) attempt to resolve incompatible goals and arrive at agreeable outcome(s). Negotiations may involve single issue, such as selling or buying a car when the final price of the transaction is the only critical issue. Sometimes, negotiations involve multiple issues, such as selling or buying a car when the dealer tries to link the price of the car with the additional accessories installed in the car. Negotiations can be one-shot (e.g. bargaining on the price of home) or repetitive (e.g. working out purchase price with suppliers of a product). Although Raiffa (1982) proposed various prescriptive approaches for negotiation, negotiators may not be able to implement these approaches because of the various systematic judgmental limitations that they may have. Negotiators may have limited attention, limited capacity to store, retrieve and process information (Pruitt and Carnevale, 1997). As a result they rely on heuristics or schemas and fail to generate optimal outcomes in negotiation. Paul (2001) proposed the use of negotiation memory support to address this lacuna. Negotiation memory is a form of collective memory that can be used in repetitive negotiations. Following on the definition of organizational memory by Stein and Zwass (1995), we consider the collective memory as the means by which information and/or knowledge is gleaned from previous negotiation sessions to influence the negotiation efficiency and effectiveness. An information system implementation of this memory is termed as negotiation memory support system (NMSS). A macro-level framework of NMSS is discussed in Paul (2000). A typical NMSS may contain various relevant data/information on prior negotiations, such as acceptance regions, locations, movements, agreement regions, and final solutions of the participants. Holsapple, Lai, and Whinston (1998) provide a detailed discussion on these parameters.

A typical application area for NMSS is the buyer supplier negotiation that involves various issues, such as price, lead-time, shipping time, and quality. Both buyer and supplier can be business organizations; for example, a grocery store or a departmental store that may negotiate with the suppliers or purchaser on the price, lead-time, shipping time, and quality of the products in consideration. These negotiations are often repetitive in nature and may involve the same set of negotiators. In a traditional negotiation between a buyer and a supplier the participants only know the organizational information about each other, the issues to be negotiated at a specific negotiation session, and their own acceptance regions. But in this traditional system none of the participants has any idea about the opponents’ acceptance region. As a result the participants in such negotiation session tend to move their demand (location) just by intuition. As these intuitions may not always be correct or may not always lead to the right direction, conflicts may occur, sometimes even when the acceptance regions of the participants are quite close, thereby eluding a potential agreement. Sometimes due to the lack of information on the opponent’s past negotiation pattern, negotiators may become locked into a specific location or into a specific position. In the traditional one to one negotiation session the participants
take time to get familiarized with the other party’s attitude and make a sense of the offer that the opponent may put on the table, as one has no information on the other’s negotiation pattern.

With the proliferation of electronic business, it is likely that a significant number of these negotiations will take place on the web. A NMSS that provides a repository of negotiation history may play a critical role in the web-based negotiations where parties cannot meet face-to-face to discuss various issues of conflict.

The objective of this paper is to discuss an effort that has been undertaken to build a Web based NMSS to help support a buyer-supplier combination engaged in multiple-issue negotiation on a repetitive basis.

**Conceptual Model of Buyer-Supplier Negotiation**

A simple flow of buyer supplier negotiation process is presented in figure 1. Both buyer and supplier enter into a negotiation process with an objective to negotiate over various issues, such as price, lead-time, shipping time, quality. Each negotiator has an acceptance region, which is a collection of the acceptable values of price, lead-time, shipping time, and quality. Each set of acceptable value on the issues is a location. Negotiators also have preference structures for the issues that can be expressed in terms of weights. During the process of negotiation, negotiators move over various locations till they reach an agreeable solution or they abandon the negotiation process. Tradeoffs and concessions over various issues are inherent characteristics of these negotiations. There exist various approaches to evaluate tradeoffs. Raiffa (1982) discusses an additive scoring system approach that can be used if the tradeoffs between the levels of any two issues are preferentially independent of the remaining issues. In this system, if \( x_j \) is the generic value of the \( j \)th issue with an acceptance region \([a_j, b_j]\) (for \( j=1,2,\ldots, J \)) and if \( V_i(x_j) \) denotes the component score of negotiator \( i \) (for \( i=1,2 \)) on an issue \( j \), the negotiator \( i \)'s total score for contract \( x=(x_1, x_2, \ldots, x_j) \) is given by (Raiffa, 1982):

\[
V_i(x) = \sum w_{ij} V_i(x_j)
\]

where \( w_{ij} \) is \( i \)'s importance weight on issue \( j \) where \( \sum w_{ij} = 1 \) (for \( i=1,2 \)). While this is a viable scoring system that the negotiators can employ to evaluate their own tradeoffs on various issues, they are unable to ascertain how the concessions will be valued by the opponent (because they are unaware of the opponent’s preference structure on various issues). Although not a substitute for the additive scoring system, the use of NMSS can enable a buyer or a seller to collect information about the other participants’ acceptance regions and hence consider only those concessions that are of value to the other party. Negotiators can analyze negotiation memory data to discover the pattern of movements of the opponents that resulted in agreements and hence become familiarized with opponent’s preferences (but not preference structures). Additionally, the use of this memory system is expected to facilitate win-win negotiations and shorten negotiation time (Paul, 2001). Moreover, as this buyer-supplier negotiation memory support system will be on the web, it will be accessible from anywhere. Participants can gather information on any specific organization’s negotiation data and analyze the prior negotiation patterns before participating in a negotiation session. According to the information, the participants can form their own locations and plan their movement during the negotiation sessions.
The System

The system is composed of two subsystems: data acquisition subsystem and data analysis subsystem (Figure 2). Each subsystem may be located on the same or different web servers. The data acquisition subsystem captures every location of each negotiator and the final outcome of the session. This is a web-based application that collects data from each negotiator’s client station and stores it in a server database. The data analysis subsystem can analyze both the participant’s historical data that has been stored in the database to develop a pattern and present the result on the client terminals. This is particularly useful when a new member (i.e. a new purchase personnel for buyer or a new sales personnel for supplier) gets involved in the negotiation. The analysis of the historical data enables the new members to become familiar with the acceptance regions and preference structures employed by their predecessors. The clients can access negotiation data by using ASP (active server pages). The system can use different ASP pages to access different sets of data (i.e. own and opponent). This may improve the security of data as well as reduce the data volume of a query. A similar approach has been followed by Sugumaran and Tanniru (2000) in their design of a web-based customer support system.

Table 1 presents the possible data entities of the negotiation database. The system can be accessed through the web, but the client will not have the authority to modify data. The possible types of data analyses that the data analysis module will perform on the past negotiation data are listed in table 2.

Table 1. Possible Data Entities of the Negotiation Database

<table>
<thead>
<tr>
<th>Possible Entities</th>
<th>Major Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>Name, business, size, address, product it buys or supplies</td>
</tr>
<tr>
<td>Session</td>
<td>Data, time, topic, final outcome, acceptance regions</td>
</tr>
<tr>
<td>Locations</td>
<td>Participant #, session#, time, values chosen on each issue (e.g., price, lead time, shipping time)</td>
</tr>
<tr>
<td>Acceptance region</td>
<td>Participant #, session#, acceptable ranges of values for each issue (e.g., lead time, shipping time)</td>
</tr>
</tbody>
</table>

Table 2. Possible Analyses of Negotiation Data

<table>
<thead>
<tr>
<th>Type of Data Analysis</th>
<th>Source of Data</th>
<th>Nature of Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Locus of movement of each participant in a session</td>
<td>Own</td>
<td>Graph</td>
</tr>
<tr>
<td>2. Acceptance regions of each participant in a session</td>
<td>Own</td>
<td>Graph</td>
</tr>
<tr>
<td>3. Widely visited locations across sessions</td>
<td>Own</td>
<td>Table</td>
</tr>
<tr>
<td>4. Sequences of locations widely visited by each participant across sessions</td>
<td>Own</td>
<td>Graph</td>
</tr>
<tr>
<td>5. Associations of locations widely visited by each participant across sessions</td>
<td>Own</td>
<td>Table</td>
</tr>
<tr>
<td>6. Dominant preference structure on issues across sessions</td>
<td>Own</td>
<td>Table</td>
</tr>
</tbody>
</table>
Conclusion

The negotiation memory support system discussed in this paper is currently under development and many of the features discussed above will be implemented before the conference. The memory-supported negotiation is expected to improve joint gains, negotiation time, negotiators’ confidence on negotiation outcome, and reduce the instances of exploitation (Paul 2001). Empirical validation of these issues remains an agenda for future research.

References