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## SIMULATING NEGOTIATIONS IN AN EDUCATIONAL CONTEXT

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### ABSTRACT

This paper reports a recently developed computer simulation specifically designed to familiarize users with major issues and successful techniques in bargaining. The behavior of the computer simulated opponent is governed by a model of bargaining based in large part on the theoretical works of Schelling, Zeuthen, Pen, Cross, Walton and McKersie.

NEGOTIATE is an interactive computer simulation of labor negotiations in the public sector. The purposes for its development were: 1) research 2) instruction and 3) decision analysis. It creates an experiential learning environment by simulating the behavior of a bargaining opponent where the strategic responses of the opponent are consistent with certain theories of bargaining.

### INTRODUCTION

Labor relations in education is in a rather immature evolutionary state, but its rapid expansion and pervasiveness are becoming apparent to all individuals concerned with the education industry. Yet most administrative personnel in education, many with significant labor relations responsibilities, have had no formal training in the dynamics of negotiations. This training is not widely available and not generally required of administrators in their career development programs.

#### Purpose of NEGOTIATE

Computer-assisted simulations provide one training alternative to formal coursework or apprenticeships. With this idea in mind a research team designed and developed NEGOTIATE, a direct-interaction computer simulation of collective bargaining in public education. It was specifically designed to familiarize users with major issues and successful techniques in bargaining. The purposes for its development were:

1) research 2) instruction and 3) decision analysis. An experiential learning environment is created by simulating the behavior of a bargaining opponent where the strategic responses of the opponent are consistent with certain theories of bargaining.

The focus of NEGOTIATE is primarily on the utilities of the parties involved in negotiations, the interactions of major bargaining components, and the dynamics of the bargaining process. The primary aim of NEGOTIATE is one of giving to the player experience in the bargaining process and providing through that experience some of the concepts, actions, and structural elements of negotiations. Thus, this simulation is directed at all persons interested in learning more about the negotiation process and in particular those persons who are engaged at present or who will be engaged in the future in the labor relations area--either in the negotiation or the administration of a contractual agreement.

### Framework

The structure of the model of "NEGOTIATE" is based on environmental, structural, procedural, and process variables in conjunction with their relationships to bargaining outcomes. It is assumed that the first three of the above mentioned factors essentially determine the nature of the bargaining process, which in turn determines the outcomes.

The basic environmental variables found in this model are an operative "cost-of-living" parameter, a negotiation budget, and trends of both local and national effect. The financial capability of a school district to afford a wage bill and benefits package depends on projected income which is partially a function of a cost-of-living index. In order to create a more realistic image of this measure, the inflation rate is systematically varied through the use of a random number generator and, in addition, three different projections of this figure are provided to eliminate source bias in economic data.

The bargainer is allowed \$50,000 annually to cover expenses incurred during the conduct of negotiations. He has total latitude in deciding how and where this sum will be spent.

Immediately following the introduction to the simulation, the player is informed of the occurrence of certain national trends, such as a dramatic development in the unemployment rate. National and local changes in social developments occur randomly and affect bargaining outcomes through modifications of a utility matrix which lies at the heart of the simulation. The strategy of the computer closely resembles both distributive and integrative bargaining.

The structural factors in its design are 1) the items available for bargaining 2) time constraints 3) method of making offers and 4) the reward system.

Fourteen items with 7 alternative positions for each item together with a "wage" item which does not have a fixed range are available for bargaining. A maximum of ten items per year can be the subject matter of negotiations.

Since the bargaining process is viewed as an interactive type of activity, the simulation was designed so that the player would continue through many rounds of bargaining before play ceases. The construction of NEGOTIATE permits a maximum of ten years of sequential contract negotiations while incorporating the cumulative effects of each previous settlement. Negotiations begin in March and consist of weekly sessions for 30 weeks or until a contractual settlement is reached. Any items still in dispute at the end of the 30th session are settled by arbitration. Each item on the agenda appears as a bargaining subject once during each session until it is settled. Items can be negotiated separately as "single offers" or simultaneously through "package deals".

The general performance of the player is described

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through the designation of earned game points which are indices measuring the relative change in attitude of the teacher constituent group between the new contract settlements and the previous ones. The role of the player, interest groups, and their respective utilities form the procedural factors of the model. The player assumes the role of a negotiator for the teachers' organization and tries to maximize his gains in the contractual agreement by developing and implementing effective strategies.

Although the negotiating teams representing the board of education or the teachers' organization form the two central groups involved in the process, two other sociopolitical groups exert pressures in the negotiations. The impact of these external parties, the public and the politicians, is embedded within the concession function which serves as one of the major determinants of the acceptability state of offers. Thus, the NEGOTIATE environment incorporates utility estimates for all four participant groups as a way of representing characteristic multilateral bargaining interests.

The utilities held by all four groups are located in a cross-impact matrix in which the importance rankings of each item are established. The elements of this matrix are modified as the player progresses through the simulation.

The agenda, the bargaining moves available to the player, and the decision variables are the process variables which determine outcomes. A compromise agenda is determined by merging a list of the items upon which the player wishes to bargain with a similar list formed by the school district negotiator. Throughout the negotiations the player has seven strategic moves which encompass behaviors consistent with alternative bargaining behaviors. The strategic moves available to the player throughout the course of bargaining are:

- 1) requesting information
- 2) performing a financial analysis
- 3) conducting a strategic campaign
- 4) breaking off negotiations
- 5) calling a strike
- 6) requesting binding arbitration, and
- 7) making, accepting, or rejecting an offer.

Whether or not an offer is acceptable to the school district is based on several algorithms which utilize mathematical expressions of certain decision variables determining 'Loss' and 'Concession'. An offer by the player is accepted if 'Loss' is less than the maximum allowable concession. For example, position A on any given item may have a numerical utility weight of 10; position B, a weight of 7. Since the 'Loss' would be 3 if position B were accepted, the value of 'Concession' would have to equal a number greater than 3. 'Loss' is defined as the magnitude of the difference in the utilities between the position most desirable to the district and the position offered by the player. The computer determines the maximum concession allowable on an item by defining 'Concession' in terms of certain time variables, economic factors, priorities and strategic movements of the parties. One time variable has an exponential effect on the concession function, while another time variable is a measure of serious commitment to achieving a settlement. Strategy variables focus on successive utility changes as bargaining progresses. The differences between initial offers and offers currently on the table, average

concession by each party, and proximity of an offer to a settlement point are examples of strategy variables. The economic factor deals with the ratio of the sum of salaries and benefits to district revenue.

In response to any offer made by the player the computer will counter with either tentative acceptance or a rejection and a corresponding offer. After all issues have been presented for bargaining the computer proceeds to the next session until all items are settled or arbitration is chosen by the player. After all items have been settled, the tentative settlement is presented for ratification. If the contract is ratified, the player is presented with a summary of data pertinent to the analysis of his performance and strategy.

### Analysis of the Model

Identification of the key elements of a theoretical model of collective bargaining was the first step in the design of NEGOTIATE. The medium of computer language was chosen as the means by which the structure, procedural rules, and game strategies were represented. The development of this new model of negotiations which integrates the significant interrelationships in collective bargaining was possible only through the ability to quantitatively express these relationships among the critical variables. The interactions of the independent variables of the model are defined by mathematical functions, and the impact of certain elements are interpreted in functional terms.

Some of the central factors included in the model focus on costs of bargaining, importance of information within the system, and utilities. There are numerous costs built into this model of bargaining. Each strategic move contains a hidden time cost associated with it. In addition, some moves also have associated with them certain economic costs. Some of the costs of disagreement can be avoided by the player if he can successfully modify the utilities of others to be more compatible with those of the teachers. Other costs of disagreement are located in the areas of arbitration and breaking off negotiations. A settlement derived from arbitration usually favors the district, while a break in negotiations reduces the district's concession function.

Information plays an essential part in the operation of the model. The outcomes of each strategy are generated from the information processing methodologies of each strategy. The exchange of information between parties is necessary so that accurate estimates of certain variables can be made. One of the major tasks of the player is to acquire enough relevant information to be able to make wise decisions during the bargaining.

The major premise of the bargaining model of NEGOTIATE is that outcomes are primarily a function of utilities, where utilities have two dimensions--value and resolve. When the player makes a decision, he should be concerned with a range of possible offers, the selection of an offer in this range, and the feasibility of obtaining a modification in the utilities of the various interest groups. Thus, the bargainer needs to methodically weigh the rewards and costs of each alternative and choose the one yielding the largest profit. In resolving the dilemma of whether to retain or lower his position during negotiations the player must compare expected payoffs of his course of action.

The importance of utilities in the model is evidenced by the ability of the parties to influence each other through utility changes. The essence of bargaining

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power in this simulation is derived from the ability to manipulate the behavior of the opponent vis-à-vis utility changes. The effects of structural, cognitive, and political influences on utilities is given considerable attention in NEGOTIATE.

From the beginning of the development of NEGOTIATE it was recognized that many dimensions of collective bargaining were being excluded. Although the model is primarily one of distributive bargaining and this type is most commonly used in labor negotiations, the inclusion of certain integrative features would definitely enhance the model. Since simulations are abstractions of reality, the model suffers from the loss of some personal and interpersonal dimensions in real bargaining.

### Data Routine

The designers of NEGOTIATE recognized the need for a way to collect data about the particular behaviors of the participants and the information generated by the simulation. As a result a computer-assisted system was designed and developed for the collection, analysis, and output of data related to the operation of the simulation. The system serves as a device for researching the dimensions of bargaining presented in the model of NEGOTIATE, for assessing its instructional utility as a teaching simulation, and for supplying feedback information about the effects of the simulation experience upon the players.

The analytical data collection and output system is composed of several functions which display data in a variety of ways. The formats of the information generated and supplied by the system are; (a) a profile of strategic bargaining moves implemented by the player; (b) a report of four personal characteristics of the player; (c) a profile of the concession behavior of the player; (d) a profile of the punitive actions used by the player; (e) a profile of issue formulation; and (f) a report of data related to the strategy of the player.

The data collected, analyzed, and supplied by this system connect the bargaining behaviors of the involved parties to the outcomes of the bargaining process. It is the logical link which relates a quasi-experimental research device, NEGOTIATE, with descriptive, theoretical, and empirical accounts of the interactions of the key elements of the bargaining process and its outcomes. This system with its capacity to collect data on the important variables which impact bargaining outcomes can provide a systematic perspective of the nature of the bargaining process in addition to providing experiences in which the player learns to estimate interests and formulate strategies consistent with effective bargaining. It also gives an instructor certain diagnostic capabilities related to the student player's techniques and skills in bargaining.

The designers feel that this computer simulation represents an improvement in the campaign to better understand and to teach the various dimensions of collective bargaining. Although one can use NEGOTIATE as an aid in acquiring a systematic perspective of the process and its component parts, they also acknowledge that considerable work still remains before a comprehensive understanding of the bargaining process can be achieved.