

Arvind Rangaswamy, Jehoshua Eliashberg,
Raymond R. Burke, & Jerry Wind

Developing Marketing Expert Systems: An Application to International Negotiations

A large number of marketing decisions are based on "expert" judgments. In the emerging field of expert systems, techniques are being developed for systematically representing and using expert knowledge in computer systems. The computerization of marketing expertise will enhance decision support to marketing managers. The authors evaluate the opportunities and difficulties associated with building marketing expert systems by discussing the development of NEGOTEX (negotiations expert), a system that provides guidelines to individuals or teams preparing for international marketing negotiations. Possible benefits of this methodology in other areas of marketing are identified.

THE concepts and tools of artificial intelligence (AI) have been applied in many areas, including business-related disciplines (Sheil 1987). Businesses have shown particular interest in developing "expert systems" that can aid them in making decisions related to finance, manufacturing, and accounting. We evaluate the potential of expert systems for research, training, and decision support in marketing by describing our experiences in developing and testing NEGOTEX (negotiations expert), an expert system designed to help international marketing negotiators to prepare for a negotiation.

Expert systems are interactive computer programs that, within a specified domain (such as "forecasting severe thunderstorms" or "market segmentation"), can solve a problem with the expertise of an acknowl-

edged human expert. When their performance reflects knowledge from several sources rather than from a single expert, these systems are called "knowledge-based" systems (Luconi, Malone, and Scott Morton 1986). For convenience, we use the term "expert systems" to refer also to knowledge-based systems. The term "expert" is intended to imply narrow specialization and a high level of competence in the specified domain.

Several successful expert systems have been built. Among them are MYCIN, a system for diagnosing infectious diseases (Buchanan and Shortliffe 1984), XCON, a system developed for Digital Equipment Corporation for configuring computer systems (Kraft 1984), and PROSPECTOR, a system for evaluating geographic locations for possible ore-grade deposits (Duda, Gaschnig, and Hart 1979). More recently, successful business applications such as American Express' "Authorizer's Assistant" have been developed (Kupfer 1987). These experiences suggest that expert systems are a valuable tool for capturing and disseminating knowledge and skill, often to create a competitive advantage (Leonard-Barton and Sviokla 1988).

Negotiations play a key role in the formation of

Arvind Rangaswamy and Raymond R. Burke are Assistant Professors of Marketing, Jehoshua Eliashberg is Professor of Marketing, and Jerry Wind is The Lauder Professor of Marketing, The Wharton School, University of Pennsylvania. The assistance of Ritson Ferguson, Catherine Guillemet, Vincent Jackson, Terumi Laskowsky, Michael Thomas, Aamer Shahab, and Marianne White in the development of prototypes of the NEGOTEX system is appreciated. The authors thank two anonymous *JM* reviewers and the Editor for their helpful comments. The research was supported in part by an IBM MOIS grant.

exchange relationships in industrial (Reeder, Brierty, and Reeder 1987) and international marketing (Graham 1985). In preparing for a negotiation, a manager needs expertise to combine and process many related facts and concepts in order to identify an effective negotiation strategy. Good negotiators rely on experience, knowledge, and intuition to develop comprehensive negotiation strategies. Marketing managers engaged in international contract negotiations may not always have such expertise. Perhaps an expert system can aid in training novices and in preparing more experienced managers for international negotiations.

The development of an expert system for negotiation raises several interesting questions: Is it possible to represent expertise in an area such as negotiation in computer systems? What are the opportunities and difficulties associated with developing such a system? More generally, what steps are to be followed in developing marketing expert systems? What role, if any, can such systems have in the generation, transmission, and use of marketing knowledge? We examine these issues by reporting our own experiences in developing NEGOTEX.

After providing an overview of the NEGOTEX system, we describe the process by which the knowledge base for NEGOTEX was compiled. We then describe system development, validation, and refinements. Finally, we explore the possible contributions of expert systems to marketing research, modeling, and practice.

Overview of the NEGOTEX System

Objectives of NEGOTEX

In spite of the availability of a large body of theoretical (e.g., Pruitt 1981; Raiffa 1982; Roth 1979), empirical (e.g., Eliashberg et al. 1986; Neslin and Greenhalgh 1983), and anecdotal (e.g., Nierenberg 1973) knowledge on negotiations, very little of this knowledge is available in an "actionable" form to help managers prepare for negotiations. Yet, American managers have noted that preparation and planning are key factors in negotiating successfully (Graham and Sano 1984; Karass 1970). Consolidating knowledge and expertise about negotiations in an expert system is one way to aid managers in preparing for a negotiation. The development of the NEGOTEX system was undertaken with the primary objective of helping users to prepare for an ensuing international contract negotiation. The objective of the system is to stimulate a user's thinking by providing some expert tips in a systematic and organized way for the user's particular situation.

The international negotiation domain is a suitable

context for exploring expert systems for marketing applications. It has the typical features of "semistructured" domains generally considered appropriate for the application of expert system methodology. A large number of contextual as well as self- and opponent-based factors determine negotiation outcomes. Practitioners and researchers often use several "qualitative" rules of thumb for deciding on effective negotiation strategies. Conventional modeling techniques generally are inadequate for representing these heuristics, especially when the various factors interact in complex patterns. This knowledge could be modeled better by means of expert system methodology.

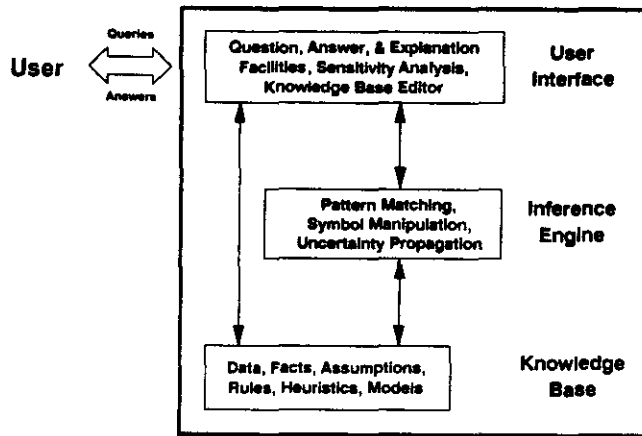
The necessary characteristics of an expert system for negotiations can be illustrated by considering an example of how human experts might help a manager to decide the level of the initial offer to be made during a negotiation. In making this judgment, experts apply their accumulated expertise in a selective and heuristic way. If they need additional information, they may ask the manager further questions, consult with others, refer to textbooks, or simulate the sequence of offers and counteroffers with quantitative models. Suppose the manager were to make this decision with real-time help from a computer system. What would be the basic requirements of such a system? First, it should be able to represent the accumulated knowledge and expertise about negotiations in a way that allows this knowledge to be accessed and used by a computer. Second, it should allow for the use of this knowledge in a variety of ways, tapping into particular elements of the knowledge base and requesting additional information that becomes essential for solving a problem. Finally, the system should be user-friendly to give the manager full access to the system's resources. In particular, like the human expert, the system should be able to clarify its questions (with a WHAT feature), provide justification for its questions (with a WHY feature), explain its reasoning (with a HOW feature), and allow the user to examine the impact of changes in his or her inputs (with a WHAT-IF feature).

Components of NEGOTEX

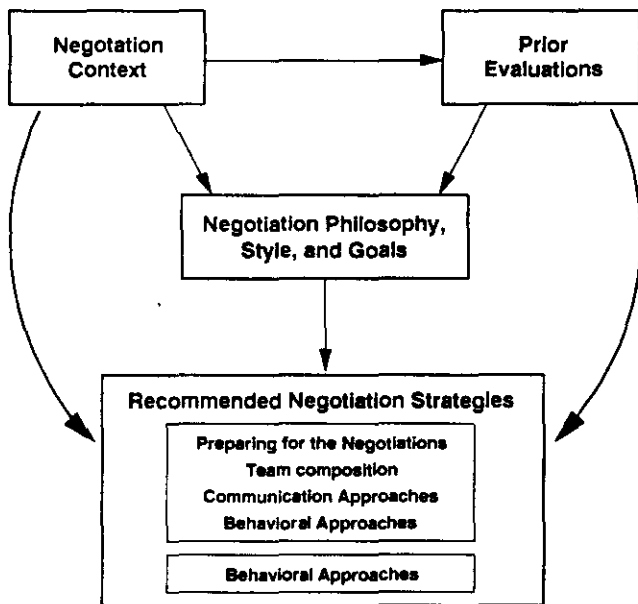
An expert system with these characteristics has two key components, shown in Figure 1A: the *knowledge base* and the *inference engine* (Luconi, Malone, and Scott Morton 1986). In conventional computer programs, data and the data manipulation techniques often are embedded together in a program. In contrast, in expert systems, the inference engine is separated, to the extent possible, from the knowledge base. This separation allows for the flexible use of knowledge and makes possible the development of systems that have greater explanatory facilities. By treating negotiation knowledge in the way traditional systems treat

FIGURE 1

A. Components of an Expert System



B. High Level Concepts in NEGOTEX



data, the NEGOTEX system can apply different inference processes to the same knowledge base in order to address related issues. In the next two sections, we describe how these two key components of NEGOTEX were developed.

Developing the Knowledge Base for NEGOTEX

The first major component of the NEGOTEX system, the knowledge base, consists of definitions of objects and variables pertinent to the international negotiation domain as well as the relationships between these ob-

jects and variables. Once the problem domain of an expert system is clearly defined, development of the knowledge base usually proceeds in two stages: (1) framework development and (2) acquisition and representation of relevant knowledge (i.e., coding facts and relationships).

Framework Development

Two broad approaches to system development can be identified: concept-driven and data-driven. In the concept-driven approach, system development is guided by an *a priori*, high-level abstraction of the domain of interest. In contrast, in the data-driven approach, the elements of knowledge gathered (from an expert or published sources) help define the scope of the system and the underlying concepts used. In the negotiation domain, a concept-driven approach might be based on a conceptual model of the negotiation process such as the win-win model (Fisher and Ury 1981) whereas a data-driven approach might use generalizations from observations of the success or failure of past negotiation strategies in specific situations (Nierenberg 1986). We chose to use primarily a concept-driven approach for the development of NEGOTEX because information about the actual processes and outcomes of negotiations generally are not released by participating negotiators. Further, the concept-driven approach provides focus to the knowledge acquisition process and illustrates knowledge acquisition methods more clearly. Our own familiarity with the negotiation domain also helped in this respect.

Four concepts were identified as being fundamental in formulating a managerially actionable framework: (1) context in which the negotiation takes place, (2) prior evaluations of self, other party, and the upcoming negotiation, (3) negotiation philosophy, style, and goals, and (4) recommended negotiating strategies including guidelines on preparing for a negotiation (e.g., whether to have an agenda, who should set the agenda, whether minor issues should be discussed before major issues, etc.), team composition (number of members, the skills of members, etc.), communication strategies, and behavioral responses during the negotiation. Figure 1B shows this high-level abstraction of the NEGOTEX system. The task of the system was defined as the generation of a list of recommended negotiating strategies based on the user's subjective assessments of the contextual factors and prior evaluations. The system would be designed to map the user inputs to recommended strategies by inferring the appropriate levels of the intermediary concepts of negotiation philosophy, style, and goals.

The next step is the specification of a source of knowledge about the relationships between the input, intermediate, and output variables. Unlike many ex-

pert systems developed in other areas that have relied on a single source, namely the domain expert, NEGOTEX uses a range of knowledge sources including academic and practitioner publications. The use of multiple sources of knowledge introduces additional challenges because these diverse knowledge elements must be "interpreted" into one coherent framework. If the only objective of the system were the "intellectual cloning" of an expert, a single source would be appropriate. However, when experts are likely to disagree on the knowledge elements, or when each expert might have expertise only along a few dimensions, it is important to consider multiple sources in order to identify the core knowledge in a domain. We chose the latter course, despite the difficulty involved in working with confusing and little-agreed-upon terminology, because the different knowledge sources in negotiation tend to have both common and distinct elements.

To ensure that the prototype is of a manageable size, NEGOTEX is restricted to make recommendations on only a few specified dimensions such as how to communicate effectively (e.g., summarize your position at the outset, do not put down your competition directly, use quantitative data, use visual evidence) and the composition of the negotiation team (e.g., include a bilingual team member, send your key decision maker, use lawyers and consultants).

Knowledge Acquisition

Definition of variables. The major challenge in building an expert system is the construction and refinement of the knowledge base. The first step in this process is the identification and definition of key variables. The inclusion of a complete set of relevant variables and values is necessary to enable the system to reason accurately about the problem. Careful knowledge representation also helps the system to justify the course and the outcome of the consultation in language familiar to the user.

A review of published materials uncovered a large number of potentially relevant variables fitting one of the four major concepts mentioned in the preceding section. However, these sources often used the same term to refer to different variables or different terms to refer to the same variable (e.g., "negotiation style" and "negotiation philosophy" were used interchangeably by some authors whereas others explicitly recognized them as different constructs). Variable names and their possible values were standardized for computer use. Table 1 lists examples of variables under each of the four central concepts.

Assimilation of published materials. The next step is to establish relationships between the identified variables. Several different theoretical frameworks that

examine effective negotiation strategies were culled from the academic literature, including the "economic model" (Cross 1969), the "competitive-coordinative" model (Pruitt 1981), the "distributive versus integrative" bargaining model (Raiffa 1982), and the hard, soft, and principled approach of Fisher and Ury (1981). In addition, several practitioner sources such as Karass (1970), Nierenberg (1973, 1986), Cohen (1980), and Winkler (1984) provided further structure to the relationships between the variables. Finally, several authors provided knowledge about special factors operant in international negotiations: e.g., Hall (1960), Wells (1977), Gulliver (1979), Tung (1984), Graham and Herberger (1983), Graham (1985), and Ghauri (1986). These and other sources were scanned systematically to determine knowledge elements that establish relationships between the identified variables.¹ In some cases, this process necessitated revisions to the set of variables or to the values of the variables used in the system, especially when new variables had to be added to accommodate new conditions. At this point, except for substitution of variable names or values to maintain consistency, the knowledge elements taken from the published materials were retained in their original form. All knowledge sources were documented to provide the user with explanations of the recommendations in terms of the underlying theoretical concepts and models.

By modeling various intermediate relationships between variables, the system can reason about a broader range of situations than a system that directly associates negotiation strategies with input variables. This approach is consistent with recent trends in artificial intelligence research to develop expert systems using "deep knowledge" about the relationships between variables (Davis 1984; Michie 1982).

Knowledge Compilation

To ensure that knowledge representation issues do not confound the process of understanding the structure of knowledge in a domain, several researchers have recommended that knowledge acquisition and analysis be independent of system implementation decisions (Clancey 1985; Hayward, Bieling, and Breuker 1987). Accordingly, we did not address any representational concerns until the stage of compilation of the various knowledge elements identified from the literature.

Several schemas are available for representing knowledge for computer use. "Production rules" are the most commonly employed knowledge representation scheme in expert systems (Duda and Gaschnig 1981; Luconi, Malone, and Scott Morton 1986). Here,

¹Eliciting knowledge directly from experts raises a whole set of different issues not addressed here. See Wright and Ayton (1987) for further discussion of the techniques available for this purpose.

TABLE 1
Examples of Variables Used in NEGOTEX

The complete lexicon and glossary for NEGOTEX can be obtained by writing to the authors.

Contextual Factors

Existence of deadlines = [yes, no]
 Gender of party = [male, female]
 Outcome of past negotiations = [both won, we won, we lost]
 Nature of existing relationship = [normal, trusting, adversarial, strained]
 Complexity of negotiation = [high, low]

Prior Evaluations

Those marked with an asterisk (*) may be either asked of the user or inferred/recommended by the system depending on availability of internal knowledge.

*Agenda setter = [you, other party, optional]
 Authority level of parties = [decision maker, delegate]
 Environmental uncertainty = [highly uncertain, uncertain, certain]
 Experience level of parties = [high, moderate, low]
 Level of preparation (both parties) = [well prepared, not well prepared]
 Power differential = [extreme, moderate, slight]
 *Stronger party = [you, other party, neither]

Negotiation Philosophy, Style, and Goals

The system tries to determine the values of these variables internally by applying its knowledge base to the contextual factors and prior evaluations provided by the user. Only when it is unable to do this will it ask the user to provide values for these variables.

Negotiating philosophy (for both parties) = [competitive, problem solving, coercive, compromising]
 Negotiation style (for both parties) = [accommodative, firm but fair, accurate and objective, angry, assertive, confrontational/nonconfrontational, considerate, deceptive, delay/avoid delay, emotional, flattering, perseverance, pressure, self-effacing, subservience, threatening/nonthreatening, supportive, yielding/unyielding]
 Negotiation goals = [increase/decrease pressure on other party, get information, give information, establish rapport, have structured/unstructured negotiations]

Negotiating Strategies

For several of these variables, the values concluded are too numerous to be listed here. For some example values, see the sample consultation in the Appendix.

Preparing for the negotiation

Whether to have an agenda = [yes, no]
 Agenda setter = [you, other party]
 Order in which issues are to be discussed = [minor issues first, major issues first]

Team composition

Size of team = [small, medium, large]
 Authority level of team = [sign documents, cannot sign documents]

Communication strategies

Whether to discuss one's objectives and interests openly
 How to get more information from the other party

Behavioral response

Rate at which concessions should be made
 How to respond to a high demand made by the other party

General advice

General advice on various factors such as cultural sensitivity and cultivation of long-term relationships

knowledge is represented with a series of IF-THEN statements, also called "situation-action pairs." An example rule for negotiations is: If you are the weaker party, then you should delay discussion of difficult issues until the end of the negotiation (Winkler 1984, p. 83). Indeed, many of the actionable insights and relationships culled from the literature tended to be procedural heuristics of the form: "If you find yourself in situation X, do Y." Therefore, the natural choice

was to consider a rule-based representation for the acquired knowledge.² A set of rules about negotiations can be viewed as a collection of axioms against which hypotheses (e.g., "minor issues should be discussed first") posed to the system can be tested. In a pioneering article, Newell and Simon (1958) advanced

²An alternative representation scheme is the "frame." For more details about frames, see Minsky (1975) and Harmon and King (1985).

the idea that a system using production rules could model some types of human problem-solving.

Knowledge as expressed in published materials is often different from knowledge as embodied in computer programs. Very rarely is knowledge in published sources stated directly in terms of rules even when knowledge is of a heuristic nature. For example, Fisher and Ury (1981, p. 36) state, "To reduce the dominating and distracting effect that the press, home audiences and third parties may have, it is useful to establish private and confidential means of communication with the other side." Translating this statement into a rule might go something like this: "If third parties are interested in the outcome of the negotiations and they could have a distracting effect on the negotiations, then it is useful to establish private means of communication between the parties."

The initial set of rules derived in this way often requires substantial modification and refinement before it can be used in the knowledge base. A careful assessment must be made of whether individual rules capture the underlying knowledge they are supposed to represent. Many knowledge elements are universally stated, leaving to the reader the specification of the conditions under which they apply. For example, Coffin (1973, p. 138) states, "If this is the first meeting, avoid a breakfast meeting." The authors typically assume that the reader would have relevant world knowledge to "fill in the blanks" when assumptions are not stated explicitly. Most of the public sources of knowledge also do not state in any specific way the uncertainty (or confidence) associated with a knowledge element.

To encode the knowledge from published sources in computer systems, conditions may have to be added to many of the rules to take into account the implied contextual characteristics and degree of confidence. Ideally, each rule must be self-contained; that is, if the premises of a rule are satisfied, the resulting conclusion must be accepted (at least for further processing) irrespective of whether any other conditions are satisfied or not. In modifying the rules to satisfy this requirement, we relied on the *a priori* conceptual model and our own familiarity with the domain to add contextual conditions and levels of intermediate variables where we thought they were appropriate. In a sense, we played the role of intermediate experts who mapped the published insights and heuristics of other experts into a coherent framework. Thus, NEGOTEX is to be viewed as representing our own expertise as influenced by the writings of other researchers. We defer discussion of whether the knowledge embodied in NEGOTEX is valid to the sections on evaluation and validation of expert systems.

The refined set of rules generally fits into one of three categories. "Procedural rules" are used to spec-

ify the appropriate negotiation strategies to consider or subgoals to establish when a certain objective and set of conditions exist. "Declarative rules" are used to impose semantics on the knowledge elements and maintain consistency by specifying relationships between facts (world knowledge). "Processing rules" are used to guide the inference process. An example of each type of rule from NEGOTEX is given in Table 2.

The rules in NEGOTEX also can be characterized in terms of the negotiation domain to which they apply. Some rules apply to all negotiations. Other rules apply depending on the nationalities of the parties to the negotiation. Currently, the country-specific rules in the system apply primarily to American, Japanese, and Chinese negotiators. The system is being updated continuously to include knowledge about negotiating practices in Russia, European countries, and South American countries.

System Development, Validation, and Refinement

Choice of Inference Engine

The inference engine manipulates the elements in the knowledge base, along with information supplied by the user, in a way that solves a particular problem. The most common inference procedure is to link the knowledge elements together logically through a combination of "unification" (i.e., finding a rule in the knowledge base whose premise supports a selected hypothesis) and "resolution" (i.e., attempting to verify the premise by searching the knowledge base for relevant facts) (Charniak and McDermott 1985).

In rule-based systems, this linkage process can proceed with forward chaining, from known input conditions to possible solutions (recommendations), or can proceed with backward chaining, from hypothesized solutions to necessary conditions (Luconi, Malone, and Scott Morton 1986). For example, in the negotiation domain, forward chaining would require the user to supply at the outset all known inputs about the negotiation context and prior evaluations. The system matches these inputs with the premises of the various rules in the knowledge base to draw inferences which, in turn, may satisfy the premises of other rules. The system then selects all the recommendations whose premises are satisfied. In contrast, in the backward chaining process, the system first scans and selects the rules whose conclusion satisfies a prespecified goal. For example, the chosen conclusion may be that the "negotiation should be held at the other party's location." This conclusion is considered to be a "hypothesis" to be tested. Next, the system attempts to verify whether the premises of the selected rules can

TABLE 2
Examples of Rules from NEGOTEX

Procedural Rule

If the place is not already set and
you are the stronger party and
the power differential is extreme and
other party's facility is viable
then recommend that the negotiation be held at their location.

Explanation: If intimidated, the other party may not open up. Therefore, as the stronger party, you may have to deliberately reduce your power by agreeing to meet at the other party's location in order to get the other party to relax and open up (Winkler 1984, p. 58)

Declarative Rule

If nationality of the other party is Russian and
authority level of the other party is unknown and
the negotiation is to take place at their location
then the other party may be assumed to be a delegate.

Explanation: Soviet commercial negotiators bargaining at home tend to have lower relative rank and stiff demeanor, because the game plan has usually been approved in detail in advance by higher authorities (Nite 1985, p. 28)

Processing Rule

If whether to have agenda is sought and
the recommended agenda setter is sought and
the recommended negotiation time is sought and
the possible length of negotiation is sought and
the recommended order to discuss issues is sought and
the recommended agenda for the negotiation is sought
then module agenda is complete.

Explanation: This rule describes the subtasks, namely, the values for various recommendations that need to be sought by the system, in order to provide the user some recommendations on setting the agenda for the negotiations.

be deduced from other rules in the system. If so, the premises of these rules become new subhypotheses to be established. The program chains backward through the rules in this way until no further deductions can be made. At this point, it asks the user whether the subhypothesis it is working on (e.g., "the power differential between the two parties is extreme") is true. This process continues as long as there are goals remaining for the system to seek. In backward chaining, the user will be asked only questions that are relevant given the previous answers.

Increasingly, rule-based systems employ both forward and backward chaining, depending on the particular subproblem being solved. Though a particular inference mechanism may afford some advantages in a specific domain, experience suggests that the quality of the recommendations of an expert system is influenced more by the content and structure of the knowledge base than by the particular inference engine used (Feigenbaum 1977). The inference engine is more likely to influence the system's speed of operation.

There are essentially two choices for an inference engine for NEGOTEX. The first alternative is to construct an inference engine using a high-level AI language such as PROLOG or LISP. The other alternative is to use commercially available "shells" to speed

prototype development (Kinnucan 1985; Waterman and Hayes-Roth 1983).³ Use of shells obviates the need to develop a custom inference engine using a high-level AI language and enables the researcher to focus on knowledge engineering issues rather than programming issues. Commercially available software programs tend to vary widely in terms of such features as how they handle uncertain knowledge, how well they interface with various types of traditional software, whether they handle mathematical relationships, and the type of computer/operating system on which the programs run. For comparative details of specific systems, refer to Kinnucan (1985), Tello (1985a,b), and Ruby (1986).

In selecting software for NEGOTEX, we evaluated several commercially available shells to ensure that the built-in knowledge structure and inference engine were appropriate for achieving our objectives. Because most of the knowledge is in the form of facts and rules, the chosen shell should provide tools for representing rules. In addition, the shell had to allow

³A shell is an expert system whose domain-specific knowledge has been discarded, leaving only the knowledge representation mechanism, inference engine, and the user interface. Shells from several well-known expert systems such as MYCIN are now commercially available.

for variables with non-numeric values (e.g., "negotiation philosophy" = competitive, problem-solving, coercive, or compromising) or numeric (e.g., "value of the contract"). Variables could be either single- or multivalued. Single-valued variables can take only one value (e.g., "name of the other party") whereas multivalued variables can take on any number of values (e.g., "objectives of the negotiation" = apply pressure, get information, give information, create new options). Because of inadequacies in the rule set and insufficient and/or unreliable data on input variables, the system should allow for uncertainty in the validity of facts and in the recommendations of the system. After evaluating several shells on these dimensions, we identified M.1 (*M.1 Reference Manual* 1986) as being suitable for this problem domain. It is primarily a rule-based system allowing symbolic and numeric variables, uncertainty, multiple goals, and a hybrid reasoning approach. The shell also allows for both forward and backward chaining and provides a built-in WHY feature to justify why a particular question is asked during a consultation. Another important feature is that M.1 runs on IBM personal computers, which are widely available in the business world.

Putting Together a Prototype

Once the shell was selected, a prototype system was developed by inputting the knowledge elements into the shell according to its conventions and syntax. At this stage, the primary design criterion was the simplification of the user's access to the knowledge and interaction with the system.

NEGOTEX starts a consultation by asking a few preliminary questions such as the names of the two parties, their titles, sex, nationalities, the object of the negotiation, and authority level of the parties. It then uses the set of more than 350 rules in its knowledge base in a primarily goal-driven (i.e., backward-chaining) way to search from alternative negotiation strategies, to the underlying negotiation philosophy, style, and goals, to contextual factors and prior evaluations to be asked of the user. For single-valued recommendations, the system will stop searching for a value when it accumulates sufficient support for a single hypothesis. In the case of recommendations that can have multiple values, the program evaluates the acceptability of each alternative. At the end of the consultation, it presents its recommendations.

To enhance the value of the system to the user, we have added three explanatory features: (1) WHAT, to give users a detailed definition of terminology used in the system's questions and recommendations, (2) HOW, to report in detail how the system arrived at a certain recommendation, and (3) WHATIF, to enable users to test the sensitivity of the system's recommendations to changes in input scenarios.

A sample consultation with the current version of NEGOTEX is given in the Appendix. Note that when the user requests explanations for any of the recommendations, the rationale is provided in a sequence of levels. At the first level, the most immediate set of conditions that led to a recommendation is reported. If the user requests the next level of explanation, the system reports on the conditions that led it to infer values for premises used in the previous level. The user also can conduct a sensitivity analysis by reviewing and revising the input information and examining its impact on the recommendations. When the WHATIF feature is initiated, the system first presents a list of values of the variables that were provided by the user. The user can change any of these values. The variables whose values are inferred by the system then are sought once again and a new set of recommendations is displayed. Additional questions that were not asked in the original consultation might be triggered during the WHATIF analysis.

It is interesting to note some differences between NEGOTEX and two commercially available negotiation systems⁴ that are based on conventional computer modeling techniques. Making a direct comparison by providing identical test situations to the systems is not possible because of the very different orientations of each of these systems. Nevertheless, some important differences are evident. Neither of the commercial systems provides much in the way of explanatory facilities. Further, these systems use conventional sequential programming techniques. As a result, they generally ask the same questions in the same sequence regardless of the inputs provided by the user. NEGOTEX, in contrast, asks a question only when it becomes necessary for solving the current problem. Consequently, the questions asked and the sequence in which questions are asked are likely to vary from one consultation to another. Almost every user who has experimented with NEGOTEX finds its explanatory facilities to be the most useful and distinguishing feature in comparison with conventional systems.

Validation

The next stage in the development of an expert system involves validating the prototype system and the representational forms used to implement it (see, e.g., Buchanan et al. 1983). This stage is followed by further revisions to the prototype.

For a comprehensive validation of expert systems, several different criteria such as content validity, criterion validity, and construct validity have been proposed (O'Leary 1987). Sheil (1987) notes, somewhat

⁴"Art of Negotiating" by Experiences in Software, Inc., Berkeley, CA and "Negotiating Edge" by Human Edge Software Corp., Palo Alto, CA.

more pragmatically, that the manager who is considering using artificial intelligence technology essentially wants to know whether the system is reliable. Will it perform to specifications? Will its answers always be right or, at the very least, defensible? Interestingly, Sheil observes, "There is no way to check that all knowledge is 'correct' and no way to prove that the system has no significant gaps in its coverage."

Our approach to validating NEGOTEX represents a compromise between the two viewpoints. As a first step, we focus on one type of validation that we simply term "evaluation." The basic objectives of the evaluation are to determine the extent to which relevant user populations (1) find the system actionable and managerially relevant, (2) consider the conceptual framework to be sound, (3) consider the interaction with NEGOTEX helpful, (4) appreciate the various explanatory features of NEGOTEX, and (5) are likely to use NEGOTEX.

For a preliminary assessment of its utility, the NEGOTEX system and/or two sample consultations, one with a Japanese counterpart and the other with a Chinese counterpart, were reviewed by (1) seven leading academicians in the areas of negotiations and international marketing, (2) a marketing strategy class of 33 MBA students at The Wharton School, (3) executives who participated in an executive education program conducted at The Wharton School, and (4) several practitioners. A questionnaire designed to evaluate the accomplishment of the basic objectives of NEGOTEX was administered to the first two groups.⁵ The last two groups were surveyed informally.

The following major conclusions can be drawn at this stage from the evaluation of NEGOTEX. The version evaluated was found to be interesting, thought provoking, and more useful for training inexperienced negotiators than for use as a full-fledged expert system that can provide insights for experienced negotiators. On the average, NEGOTEX was rated on 1-to-5 scales as 4.5 and 4.1 in asking managerially relevant questions by the academicians and the MBA students, respectively. The soundness of its conceptual framework averaged 4.0 and 3.9 for these two groups. Its helpfulness as a general training tool was rated 8.5 and 7.5 on 1-to-10 scales. The ratings for the perceived importance of its various explanatory features (WHAT, WHY, WHATIF, and HOW) ranged from 7.3 to 8.5, again on 1-to-10 scales. Four of the six academicians who answered the question and 70% of the students indicated on 1-to-4 "intention to use" scales that they would either definitely or probably

use NEGOTEX in the context of a real international negotiation. The informal responses from the practitioners were generally similar. From an analysis of the critical comments, the major concerns appear to be (1) the incompleteness of the evaluated version of the system, (2) the simplicity of some of the recommendations, and (3) the relative insensitivity of the recommendations to alternative business and cross-cultural situations. On the positive side, the evaluators liked (1) the "customized checklist" feature, which contributes to introspection, (2) the pulling together of diverse perspectives as part of the recommendations and explanations, (3) the logical structure the system imposes on thinking about negotiations, and (4) the ability to perform sensitivity analysis.

Further Refinements

System refinement and validation is an iterative process. On the basis of the initial evaluation, as well as our own experiences in providing the system with different test situations and judging the face validity of the recommendations, some rules were modified in two major ways. First, the structure of the knowledge base was revised by deleting rules that were either inconsistent or infrequently used. Second, the certainties associated with rule conclusions were modified to give individual rules more or less weight in the reasoning process. The knowledge base also was modified by adding new rules or new conditions to existing rules to resolve discrepancies. This refinement of the knowledge base focused specifically on how the rules interact with each other. The extensive use of the HOW facility helps in identifying knowledge elements that require further modification.

As the knowledge base of NEGOTEX is expanded, the system can take into account an increasing number of relevant variables. However, such expansion can cause the system to ask the user a very long series of questions before reaching a conclusion. This problem can be partially mitigated by linking the system to online data. Some of the system variables then can be defined operationally in terms of data or computations on data. For example, instead of asking the user detailed questions about Japanese negotiators, the system might infer values for some variables from a "country" database containing facts about typical negotiating practices in various countries.

Our validation is admittedly a simple first step. Proper validation of NEGOTEX requires the use of at least three criteria. The first criterion is the validation of the substantive contents of the knowledge base. The relationships specified in the rule set should be supported empirically and qualified properly in light of the range of situations to which the system will be applied. To validate the contents of the knowledge base in NEGOTEX, we propose to submit the refined set

⁵The complete details of the evaluations, including the profile of the respondents and the questionnaire, can be obtained by writing to the authors.

of rules to a sample of international marketing negotiators to assess their confidence in, and the relevance of, each of the knowledge elements.

The second criterion is validation of the system's recommendations against expert judgments. For a broad set of problems, the system's recommendations can be compared with those of real-world experts in international negotiations (a restricted form of the "Turing test"). A high correspondence would suggest that the system can emulate the problem-solving behavior of experts.

Third, one can test whether the use of the NEGOTEX system results in better decisions or higher payoffs. One form of this test is the validation-in-use procedure whereby the quality of system users' decisions is compared with that of nonusers' decisions. Plans are underway to validate NEGOTEX in a controlled experiment in which subjects will negotiate according to a structured exercise that has been developed. Test groups will have access to NEGOTEX as a consultant but the control group will not. This approach is similar to that used by Fudge and Lodish (1977) in evaluating CALLPLAN (Lodish 1971).

Discussion

Within the last few years, several researchers in marketing have initiated projects to develop marketing expert systems (Bayer and Lawrence 1986; Mitchell 1986; Rangaswamy et al. 1987; McCann and Reibstein 1987). To the best of our knowledge, no significant marketing expert system has been put into actual operation, possibly because of the long lead time needed to develop useful systems. However, we expect many marketing expert systems to become available in the next two to three years for both pedagogical and commercial use in a variety of marketing domains. In this section, we examine the impact such systems might have on research, modeling, and practice in marketing.

Expert Systems and Research Modeling in Marketing

The process of developing NEGOTEX involved a careful consideration of the interaction of many different variables, empirical findings, and theoretical propositions. A detailed analysis of these "interactive" components in addition to the "main" effects may require new forms of meta-analysis of past research. As one leading marketing scholar put it, "When I write a research article, it is pretty much self-contained. So are chapters of the textbooks I write. However, if I were to develop an expert system to represent my knowledge, I would have to really understand the intersections between my chapters and the relationship of my research findings to the many marketing vari-

ables of interest." The mere process of building NEGOTEX, by operationally defining the diverse constructs and variables and putting together more than 350 rules representing the current knowledge in the area, contributes to the marketing discipline regardless of whether the final system is used by decision makers. For example, the conceptualization of the key constructs in negotiations in Figure 1B provides a useful benchmark for further research.

As a research tool, NEGOTEX can have a role akin to that of numerical analysis of complicated dynamic models. The latter provides insights into the existence, uniqueness, and patterns of solutions. The NEGOTEX system can be employed in sensitivity analyses designed to identify a parsimonious representation of available knowledge about negotiations. Likewise, an intriguing possibility along these lines is the testing of consumer information processing models by explicitly representing hypothesized knowledge structures and the processing mechanisms in expert systems (Currim, Meyer, and Le 1988).

Expert system techniques also have the potential to extend model building into new areas of marketing. These techniques are most applicable to such domains as international negotiations, in which variables are categorical rather than continuous and the relationships between variables are logical rather than computational. Our experiences in developing NEGOTEX suggest that these techniques can be employed to build useful models in areas of marketing for which conventional modeling techniques have not been totally satisfactory. In determining whether a particular domain is suited for this methodology, the following checklist is useful.

- *Are the key relationships in the domain logical rather than computational?* In practical terms, the answer requires an assessment of whether the decision area is knowledge-intensive (e.g., generating new product ideas) or data-intensive (e.g., allocating an ad budget across media). Expert systems are generally better suited to knowledge-intensive problems, though they can, in principle, handle data-intensive problems.
- *Is the problem domain semistructured rather than structured or unstructured?* If the problem is well structured, a traditional approach using sequential procedures will be more efficient than an expert system approach. This would be true, for example, when the entire problem-solving sequence can be enumerated in advance. Moreover, for highly unstructured domains, expert system performance may be disappointing because the available problem-solving strategies may be inadequate.
- *Is knowledge in the domain incomplete?* In other words, is it difficult to identify all of the important variables or to specify fully their interrelationships? Expert systems are particularly applicable in domains with incomplete knowledge. Such domains often necessitate the use of problem-solving heuristics and facilities for reasoning under uncertainty. In addition, because expert

system knowledge is coded in the form of modular rules, adding new knowledge as it becomes available is relatively simple.

- *Will problem solving in the domain require a direct interface between the manager and the computer system?* A direct interface may be necessary in situations calling for online decision support. Such situations generally are characterized by a high level of decision urgency (e.g., buying and selling stocks) or complexity (e.g., retail site selection). Expert systems are particularly useful in these contexts because of their flexible and "friendly" user-interaction facilities coupled with their ability to explain their reasoning.

Table 3 illustrates how some familiar marketing decision problems might be positioned on the preceding characteristics. The closer a domain comes to satisfying the four conditions, the more likely it is to be

appropriate for this methodology. For commercial applications, it is also important to select problem areas that require frequent decisions (selection between promotional alternatives; interpretation of sales data) or ones that have long-term impact (product positioning strategies).

Expert Systems and the Marketing Manager

Expert systems such as NEGOTEX could serve a number of important functions for marketing managers. First, they stimulate managers to consider factors that they may otherwise overlook and encourage them to explore new options, challenge assumptions, play "what if" games, and critically assess their own negotiation expertise, all of which could improve the quality and outcomes of their negotiations. Second,

TABLE 3
Illustrative Areas of Application in Marketing

Problem Domain	Characteristics			Will Problem Solving Require Direct Interface Between Manager and Computer System?
	Are Key Relationships Logical or Computational?	Is Problem Solving Structured, Semistructured, or Unstructured?	Is Knowledge in the Domain Incomplete?	
Product				
Product positioning	Both logical and computational	Semistructured	Somewhat incomplete	Not usually
New product development	Both logical and computational	Semistructured	Incomplete	Not usually
Distribution and Sales				
Site selection	Both logical and computational	Structured	Incomplete	Sometimes
Choice of distribution partner	Both logical and computational	Semistructured	Incomplete	Not usually
Negotiation strategies	Mostly logical	Relatively unstructured	Incomplete	Often
Price				
Setting price of product	Both logical and computational	Semistructured	Somewhat incomplete	Not usually
Advertising and Promotion				
Effective sales techniques	Mostly logical	Semistructured	Incomplete	Often
Generation of ad appeals	Mostly logical	Relatively unstructured	Incomplete	Sometimes
Choice of promotional technique	Both logical and computational	Relatively structured	Incomplete	Sometimes
Marketing Research				
Selecting market segments	Both logical and computational	Semistructured	Somewhat incomplete	Not usually
Predicting brand choice	Both logical and computational	Relatively structured	Incomplete at individual level, more complete at the aggregate level	Not usually
Selecting a data analysis technique	Both logical and computational	Semistructured	Relatively complete	Sometimes
Interpreting scanner data	Mostly computational	Semistructured	Relatively complete	Often

these systems provide a mechanism for bridging the gap between academicians and practitioners, as well as transferring negotiation expertise available at one level in the organization to other levels. This capability could minimize the costly duplication of scarce expertise and also allow for uniform implementation of policies. When deciding on the appropriate negotiation strategies to employ, managers would be able to combine their expertise with that of other experts and with the accumulated empirical and theoretical knowledge about negotiations. Third, expert systems can serve as a vehicle for accumulating organizational knowledge in a systematic way, enabling future managers to avoid "reinventing the wheel." Finally, NEGOTEX-like systems can be used as training tools for new employees as well as for novices in certain specialized areas of marketing.

Appendix

A Sample Consultation With NEGOTEX

Note: User input is underlined.

```
*****
* Welcome to NEGOTEX! *
*****
```

The NEGOTEX system is designed to assist you in developing a priori strategies for international business negotiations involving two parties. It is not intended for use concerning problems of arbitration or negotiations involving more than two parties.

During the course of a consultation, the system will ask you a series of questions regarding the context of the negotiation, your philosophical approach to negotiating, and the nature of the other party to the negotiation. NEGOTEX will then make recommendations concerning several aspects of the negotiation. If you are unsure of an answer, you may associate a confidence factor on a scale of 1 to 100 using the syntax shown in this example:

Will you be setting the agenda for this negotiation?
 ➤ yes cf 75

What is your name (please enclose your answer in quotes)?
 ➤ 'John'

What is your title?
 1. Mr.
 2. Mrs.
 3. Ms.
 4. Dr.
 ➤ 4

Are you male or female?
 ➤ male

What is your level of authority?
 1. decision maker
 2. delegate
 ➤ 1

What part of the world are you from?
 1. America 2. Europe
 3. Asia 4. Soviet Union
 5. South America 6. Central America
 ➤ america

What is the major object of the negotiation?

1. sales contract
2. distribution agreement
3. licensing agreement
4. joint venture

➤ 1

Will you be negotiating with:

1. an individual
2. a team
3. don't know

➤ 1

What is the name of the other party (please enclose your answer in quotes)?

➤ 'Hiroataka'

What is the title of the other party?

1. Mr.
2. Mrs.
3. Ms.
4. Dr.

➤ 1

What is Mr. Hiroataka's level of authority?

1. decision maker
2. delegate

➤ 1

What part of the world is Mr. Hiroataka from?

- | | |
|------------------|--------------------|
| 1. America | 2. Europe |
| 3. Asia | 4. Soviet Union |
| 5. South America | 6. Central America |

➤ why

The origin of a party to a negotiation can affect their behavior, philosophy, and expectations.

What part of the world is Mr. Hiroataka from?

- | | |
|------------------|--------------------|
| 1. America | 2. Europe |
| 3. Asia | 4. Soviet Union |
| 5. South America | 6. Central America |

➤ 3

What country in asia is Mr. Hiroataka from?

1. Japan
2. China

➤ 1

Have you negotiated with Mr. Hiroataka or their firm before?

1. yes
2. no

➤ 1

How would you describe the outcome of your most recent negotiations with this party?

1. mutually beneficial (both winners)
2. we won—they lost
3. they won—we lost

➤ 1

Is it likely that you will negotiate with this party again?

1. yes
2. no
3. maybe

➤ 1

How would be describe the type of relationship you have with the Mr. Hiroataka?

1. personal
2. professional
3. nonexistent

➤ 2

How committed is Mr. Hiroataka to their initial position?

1. committed

2. flexible
 > 1
- Which party has more to lose if an agreement is not reached?
1. you
 2. other party
 3. neither party

- > 1
- Does Mr. Hirotaka appear eager to reach an agreement with you?
1. yes
 2. no
- > why

Trying to determine whether you will be in a strong position during the negotiations.

- Does Mr. Hirotaka appear eager to reach an agreement with you?
1. yes
 2. no
- > 1

- How important is it to Mr. Hirotaka to reach an agreement?
1. very important (high)
 2. unimportant (low)
- > 1

- How would you characterize the current stage of the negotiations?
1. early
 2. middle
 3. late
- > 1

- Is Mr. Hirotaka oriented toward quantitative goals?
1. yes
 2. no
- > 1

- Is Mr. Hirotaka open to persuasion?
1. yes
 2. no
- > 1

- Do you expect a single meeting or several meetings with the other party during this negotiation
1. single
 2. several
- > 2

- What is Mr. Hirotaka's level of experience with this type of negotiation?
1. high
 2. moderate
 3. low
- > 1

- Does Mr. Hirotaka perceive his basic human needs (e.g., security, economic well-being, sense of belonging, recognition, and control over one's life) are threatened?
1. yes
 2. no
- > what

Every individual has certain basic needs which include security, economic well-being, sense of belonging, recognition, and control over one's life. If these needs are threatened by an individual's circumstances or the circumstances of the negotiation, then the negotiation is not likely to make much progress. (Fisher and Ury 1981, p. 50)

- Does Mr. Hirotaka perceive his basic needs (e.g., security, economic well-being, sense of belonging, recognition, and

- control over one's life) are threatened?
1. yes
 2. no
- > 2

- Are there any third parties that are very interested in the outcome of the negotiation?
1. yes
 2. no
- > 2

- Which role best describes you?
1. buyer
 2. seller
 3. other
- > 1

- How much time can you afford to spend reaching an agreement?
1. long
 2. short
- > 2

- Is the negotiation complex?
1. yes
 2. no
- > 1

- How would you describe the difference in power which exists between the two parties? Is it slight or extreme?
1. extreme
 2. moderate
 3. slight
- > 3

- How uncertain are the factors that could affect the profits that you will obtain from this negotiation?
1. highly uncertain
 2. uncertain
 3. mostly certain
- > 2

- How would you characterize your preparation for this negotiation?
1. well prepared
 2. not well prepared
- > 1

- Has the site for the negotiation already been selected?
1. yes
 2. no
- > 1

- Where will the negotiation be held?
1. your place
 2. other party's place
 3. neutral location
- > 2

- What time of day is best for Mr. Hirotaka in terms of mental acuity?
- | | |
|------------|----------------|
| 1. morning | 2. afternoon |
| 3. evening | 4. indifferent |
- > 1

- What is your level of experience with this type of negotiation?
1. high
 2. moderate
 3. low
- > 2

- Do you anticipate that you might have to retreat from your initial position?
- > y

What is your primary language?

➤ english

What is Mr. Hirotaka's primary language?

➤ japanese

Can you support your position with quantitative (as opposed to qualitative) information?

➤ yes

Is your intended presentation lengthy?

1. yes
2. no

➤ 1

Who will prepare the final documents if an agreement is reached?

1. you
2. other party
3. optional

➤ 1

Recommendations for Preparing for the Negotiations

1. Let Mr. Hirotaka set the agenda for the meeting.
2. Focus agenda on discussing issues of mutual interest.
3. Have your meetings in the morning.
4. Expect the negotiation to take up to six times as long as it may take with an American negotiator.
5. Let the other party make the opening offer.
6. Be prepared for a high initial demand from Mr. Hirotaka.
7. Your first offer can be conditional.
8. Discuss minor issues before discussing major issues.

If you would like explanation for any of these recommendations, type the sequence numbers (Separate by space or comma):

8

Explanation at level 1:

Perceived common ground encourages problem solving. Therefore, it is best to establish an agenda that begins with easier issues that involve less divergence of interest unless there is an explicit reason to do otherwise (Winkler 1984, p. 169).

Explanation at level 2:

When the relationship between the parties is an on-going one, the relationship tends to become entangled with the discussion of the issues. A positional approach to the negotiation will aggravate the entangling process. To minimize the conflict of the relationship and to focus on the substantive issues, we recommend a principled problem solving approach. (Fisher and Ury 1981, p. 20-21).

Recommendations for Team Composition

1. Send a team but include as few members as possible in the negotiation team.
2. The team leader should have high integrity and strong analytical and technical skills.
3. Include someone to record the discussions.
4. Have your own interpreter or send at least one bilingual member.

If you would like explanation for any of these recommendations, type the sequence numbers (Separate by space or comma):

1

Explanation at level 1:

There are two reasons to use a team when negotiating with the Japanese. First, the image of the principal negotiator is boosted if an assistant accompanies him or handles minor details. Second, it will almost always be advantageous to establish an informal channel of communication between executives at lower

levels (Graham and Sano, "Smart Bargaining: Doing Business in Japan").

When negotiating with the Japanese, it is recommended that you minimize the size of the negotiating team. If more than one party is involved (e.g., consultants) then we recommend a nemowahi approach which includes meeting with the separate parties individually and calling everyone together only at the conclusion of the negotiation (Graham and Sano, "Smart Bargaining: Doing Business in Japan").

Recommendations for Communication Approaches

1. Discuss your objectives and interests openly if Mr. Hirotaka does the same.
2. Use quantitative data to support your position.
3. Summarize key issues initially for the benefit of both parties.
4. In initial meetings, encourage informal discussions to gain information.
5. Provide no more than three to five facts at a time. Use visual evidence and take frequent breaks.
6. Do not be disturbed by long periods of silence from Mr. Hirotaka.
7. Try asking the same questions in several different ways.

If you would like explanation for any of these recommendations, type the sequence numbers (Separate by space or comma):

Recommendations for Behavioral Response

1. Expect concessions only toward the end.
2. Be prepared to concede on current issues for long-term gain.
3. Be ready to use silence, delays and "intentional mistakes."
4. Respond with silence if Mr. Hirotaka makes a high initial demand. The alternative is to make a lower counteroffer.
5. Persevere until Mr. Hirotaka provides clear answers for your questions.
6. Be gracious, and if required, allow Mr. Hirotaka to save face.
7. At the end, set an agenda for the next meeting.

If you would like explanation for any of these recommendations, type the sequence numbers (Separate by space or comma):

3

Explanation at level 1:

When the other party puts on the pressure, take time to think. Use silence and resort to asking questions to clarify their motives. Delay will reduce pressure. During a heated debate, one useful technique is to summarize the situation incorrectly. This invites the other party to correct you and explain themselves, which shifts the pressure. (Winkler 1984, p. 113).

Explanation at level 2:

Expect a competitive negotiator to be confrontational, argumentative, and to put pressure. (Murray 1986).

Explanation at level 3:

The potential for conflict bargaining (i.e., a zero-sum game) is increased when both parties have a high need for an agreement and, as a result, are forced to deal with one another (e.g., many industrial disputes, commercial disputes, or a monopoly buyer and seller relationship). Therefore, expect the other party to behave in a competitive manner. (Winkler 1984, p. 63).

Explanation at level 4:

The party with more to lose if an agreement is not reached has

a greater need for reaching agreement, less power, and a weaker bargaining position (Winkler, p. 32).

Recommendations in General

1. Let them appear to win.
2. Do not appear to be overeager.
3. Concentrate on common goals of the two parties.
4. If you need to break off the negotiations, do so by adding new issues or by introducing new information.
5. Study the cultural aspects (history and customs) of Japan.
6. Try to develop a personal relationship with Mr. Hiro-taka.

7. Attempt to cultivate a long-term relationship.
8. Be sensitive to status differences among members of Mr. Hiro-taka's party.

If you would like explanation for any of these recommendations, type the sequence numbers (Separate by space or comma):
Would you like an explanation for any other recommendation?

➤ n

Would you like to rerun this consultation with a different input scenario?

➤ n

The WHATIF analysis was not requested in order to conserve space.

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