

An Automated Diplomacy Player

Sarit Kraus*

Institute for Advanced Computer Studies and
Department of Computer Science
University of Maryland
College Park, MD 20742

Daniel Lehmann Eithan Ephrati
Department of Computer Science
The Hebrew University
Jerusalem 91904 Israel

Abstract

A program that plays Diplomacy (named Diplomat) was developed. Playing Diplomacy involves a certain amount of technical skills as in other board games, but the capacity to negotiate, explain, convince, promise, keep promises or choose not to keep them, is an essential ingredient of good play. To enable Diplomat to compete on equal terms with human player a diplomatic language was defined and all players were required to use only this language in their negotiations. In this paper we concentrate on problems that arise while evaluating suggestions during a Diplomacy game. Diplomat was evaluated and consistently played better than well experienced players, and in games that were held, many players did not guess which player Diplomat was playing.

*This work was partly done while the author was at Hebrew University

1 Introduction

The process of negotiating an attempt to reach a settlement process of interactions and in all aspects of his way up to superpower are the same regardless development of models many important forms

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Diplomacy is a board game just prior to World War I. The moves of the game and a Fall move, beginning privately writes down to do only one thing a fleet may be also ordered other. The power that a good player one needs the board according to above all, one needs other players, to make to break these agreements he says. Deciding when Details of the rules of

2 Comparison

Diplomacy is very different artificial intelligence

1 Introduction

The process of negotiation is one in which two or more parties to a dispute attempt to reach a settlement acceptable to all sides. It is in fact a central process of interactions in any social grouping, and takes place at all levels and in all aspects of human interaction, from children and parents all the way up to superpowers. Many of the processes involved in negotiation are the same regardless of what level we are dealing with, and hence the development of models of the negotiation process can be useful in analyzing many important forms of human interaction.

Also, an automated agent that will act in a multi-agent environment, especially, in an environment where conflicts between the agents exist, but cooperation is beneficial, needs the capability to negotiate.

Such an environment is a game named Diplomacy, marketed by Avalon Hill Company. Diplomacy is an environment of intense negotiating situation where we could really fit an automated agent against humans without the later knowing. We built an automated Diplomacy player called Diplomat (see general description in [7], [4] and [9]).

Diplomacy is a board game played on a map of Europe during the years just prior to World War I. Each player plays one of seven European powers. The moves of the game are figured as two moves each year: a Spring move and a Fall move, beginning in year 1901. After negotiation, each player privately writes down the orders for all of his units. A unit may be ordered to do only one thing on each season: to hold, move, or to give support. A fleet may be also ordered to convoy another army from one coast to the other. The power that gains control over Europe wins the game. To be a good player one needs some technical skills in moving military units on the board according to the reasonable but complex rules of the game, but above all, one needs the ability to communicate and negotiate with the other players, to make agreements with the others and possibly to decide to break these agreements, since the rules do not bind a player to anything he says. Deciding whom to trust as situations arise is part of the game. Details of the rules of the game can be found in [1].

2 Comparison with Other Work

Diplomacy is very different from other games that were considered in the artificial intelligence community. For example, one may compare Diplo-

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macy with Chess. The best programs that play Chess use search methods. Those methods are not applicable to Diplomacy for several reasons.

First of all, in Diplomacy, the number of possible moves is much larger since in every move every player gives orders to all of his units simultaneously. There are usually 34 units on the board and the average number of possible orders for each unit is 8, so the average number of possible moves in a season in Diplomacy is 8^{34} . Note that in chess the average number of possible moves for each player is 80 and for a round, 80^2 . In fact, since the basic actions of a player involve negotiations, every possible step in a negotiation should be considered a basic move. The number of such possible moves is overwhelming.

But the problem is much deeper. To use search for game-playing, one needs a good evaluation function. In a game, such as Diplomacy, in which some moves may have only long-range purposes (e.g. to help an ally in order to get something from him in return later on), it is very difficult to find such a satisfactory evaluation function. In Diplomacy, such a function would have to include the state of mind of the other players, but this is very hard to quantify. Indeed, the uncertainty of each player regarding the state of mind of other players (including their evaluation of the value of possible intermediate goals) and the consequences of his actions on their states of mind makes Diplomacy, in fact, a game of incomplete information.

As Shubik says ([13]): "A major difficulty in applying game theory to the study of bargaining or negotiation is that the theory is not designed to deal with words and gestures-especially when they are deliberately ambiguous moves".

For all those reasons our methods are mainly heuristic and knowledge-oriented instead of search-oriented. This approach is similar to the approach of the chess program PARADISE, written by D. Wilkins ([15]).

There is a Diplomacy program, "Computer Diplomacy", marketed by Microcomputer Games, a division of Avalon Hill Co., that runs on the IBM-PC. It plays but cannot negotiate. It can only order its units around the board according to the rules. Since Diplomacy is mainly a game of negotiations, the interest of this program is limited. The tactical skills displayed by this program are also of limited value, and our strategic procedure (without diplomacy) beat this program in all of the games they played against each other.

In prior works Rosenschein and Genesereth [11], used certain game-theoretic techniques to model communication and promises in multi agents interaction. There, the process of negotiation was severely restricted (the

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3 Diploma

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agents could only make single, simultaneous offers), and it assumes that each agent knows the complete payoff matrix associated with the interaction. Also, for large games involving many agents and outcomes, the kind of environments in which we are interested, the size of a payoff matrix may quickly become intractable.

Davis and Smith [3] proposed an approach to cooperation using a contract-bid metaphor to model the assignment of tasks to processors. They used negotiation to match idle problem solvers to outstanding tasks as a basis for the transfer of control and as a way of viewing invocation as the matching of knowledge sources to tasks.

Sathi, Morton and Roth [12] considered the problem of project management. In this approach the agents negotiate by relaxations so as to achieve a compromise. The constraints and their relaxation are statically known. No attempt is made to influence other agents' relaxation.

Sycara [14] presented a model of negotiation that combines case-based reasoning and optimization of the multi-attribute utilities of the agents. She implemented her ideas in a computer program called the PERSUADER, that resolved adversarial conflicts in the domain of labor relations, and tested her system using simulations of such domains.

Comparing this to our work, our system acts and negotiates successfully with human partners in a more complex environment where a mediator is not available. The agents may break their promises, close cooperation between different agents is needed, and possible coalitions between other agents must be taken into account.

3 Diplomat General Description

The external general structure of Diplomat can be described as a government: the Manager is the Prime Minister, the Planner is the Ministry of Defense, the Negotiator is the Foreign Office, and the Military Headquarters is the Executive. Diplomat also consists of a Strategies Finder.

1. *The Prime Minister* directs Diplomat's activities. Diplomat's KBB includes the following parts (see [9]).
 - Diplomacy's rules (including general information about the board).
 - The situation of the game.
 - Agreements table.
 - Information about the other powers and their relations.

2. The *Ministry of Defense* is responsible for the planning and analysis. It consists of departments that deal with the various fronts. New departments are established by the general director of the office, at the beginning of every season and during a season by a request of a 'Desk' at the Foreign Office. Every department looks for strategies for its front. It keeps close contact with the corresponding Desk at the Foreign Office.
3. The *Foreign Office* directs the communications of Diplomat with other powers. It includes different departments ('Desks') that are responsible for the relations with the different powers. Each Desk conducts negotiations according to strategies received from the relative departments of the Ministry of Defense. The Desks also apply to relative departments of the Ministry of Defense to evaluate suggestions received from other powers. During the negotiations it decides whether to sign agreements, and if so whether to keep or to break them. After signing an agreement, it announces the details to the Prime Minister, who updates the agreements table.
4. The *Military Headquarters* gives Diplomat's orders at the end of each season, taking into account the agreements signed during the negotiations period. It also tries to estimate the relations between the powers, checks whether Diplomat's allies kept their promises, and reports its conclusions to the Prime Minister. This module is also responsible for retreating, building or disbanding units when needed. After this it reassesses the relations between the powers.
5. The *Strategies Finder* gets a front and a configuration of the board as an input and finds the possible strategies for this front. The Ministry of Defense and the Headquarters that use this module can influence the strategies that are output by changing certain parameters.

We define a strategy, in the Diplomacy game, to include a list of orders and the expected loss or profit from them. Each order includes the active unit, the type of the activity (Move, Support, Convoy, Valid and Hold), and the locations on the board that are related to this activity. The purpose indicates whether the action is part of a plan to attack a specific area or part of a plan to defend a specific area. The structure of each order is as follows:

$(loc_1 op_1 loc_2 loc_3 op_2 spa)$

where loc_i are locations on the board of Diplomacy where units are located,

and spa is a space
 $op_1 \in \{MOVE, S$
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and *spa* is a space on the board (see [1]).

$op_1 \in \{MOVE, SUPP, CON, HOLD, VALID\}$

$op_2 \in \{DEFEND, ATTACK\}$.

The meaning of such an order is that the unit that is in loc_1 will perform the operation op_1 related to loc_2 and loc_3 , in order to defend or to attack *spa*. For example the meaning of the order: (*ruml SUPP bull serl ATTACK Serbia*)¹ is that the army in Rumania will support the move of the army in Bulgaria into Serbia, in order to attack Serbia.

The strategy also includes the expected average profit from performing the strategy for each power that participates in the strategy (i.e., at least one of its units is active in the strategy), and the global expected profit for all of the powers. The global expected profit is calculated according to three criteria: the minimal expected profit, the maximal expected profit, and the average expected profit. The profit's expectation may be negative, meaning loss. For an example see the strategy given in Figure 4.

To enable Diplomat to compete on equal terms with human players a diplomatic language was defined and all players were required to use only this language in their negotiations. The language that we developed includes four kind of messages: declarations, questions, suggestions and answers.

Declarations are used to convey information (correct or incorrect) and they generally do not require an answer.

A declarative sentence is used to make the receiver believe in the content of the sentence.

Questions are essentially declarations in the interrogative form and they are used to get information and to ask for clarifications concerning a previous suggestion. They require an answer.

Suggestions are used as preliminary steps towards agreements. They focus the negotiations on specific plans. These plans may be detailed or only general sketches. They require an answer or a counter-suggestion.

Answers are used to finalize agreements after a suggestion, to answer questions or to wait for another suggestion from the other party. Answers may be positive or negative, and they contain a level of strength.

The building stones for the messages are simple sentences that are specific to the subject of the negotiations. Using those simple sentences with

¹We denote spaces on the board by their first three letters, (see [1]), and add "l" for an army in the land of this space, "c" for a fleet in the coast of this space and "s" for a fleet in a sea.

conjunctions such as and, or, if-then-else, since and because, one may compose the suggestions, declarations, questions and answers.

After observing many Diplomacy games and analyzing the messages that were exchanged between the human players, we decided on the simple sentences on which the negotiation language for Diplomacy is built. Those simple sentences are:

- Sentences that describe the orders a Diplomacy player may give:
Move, Hold, Support, Convoy, Valid, Build, Retreat, Dislodge.
- Sentences that describe general activities on the board:
Attack, Defend, Enter, Help and Leave.
- Sentences that describing the personality of the players, their strength and their relations:
Character, Units, Control, Allies, Enemies.
- Sentences that can be used to discuss the negotiation itself:
Talk, Transmit.
- Sentences that concern agreements and wars:
Agreement, War.

In order to use our language and the tools we have developed in another environment where negotiations are needed, one may replace our simple sentences by new sentences fitting the new environment. One can use the special editor that was developed by Arie Schlesinger, and our decoder and encoder of messages.

Examples of messages written in the Diplomacy Language, appear in Figures 1, 3.

Diplomat is implemented in Ylisp [10] (a dialect of Franz-Lisp) on a Vax 11/785 running Unix, Berkeley 4.3. The current version is the product of three years work by three programmers. It includes over 10,000 lines of Ylisp code.

4 Suggestions Evaluation — General Description

In this paper, we concentrate only on problems that arise while evaluating suggestions during a Diplomacy game. Sending a suggestion is the way to

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*<MESSAGE 1 FROM England TO France> :
 I would like to suggest to you a Cooperation Agreement
 between England and France against Germany now.
 END OF MESSAGE.*

Figure 1: Spring 1901: General Suggestion

propose a plan for acceptance or rejection. Actually, it is the main method used to try to convince another player to perform actions, and it is the way to promise to the other player, which actions sender will perform. One of the main technical problem in evaluating suggestions by Diplomat is the large number of possible suggestions and the fact that different kinds of suggestions need to be evaluated in different ways.

In order to be able to solve this problem and to make the negotiations more modular Diplomat distinguishes mainly between two kinds of suggestions: general suggestions and detailed suggestions. A general suggestion discusses the general purpose of the negotiations, as where a detailed suggestion discusses the specific common activities and the ways to achieve those common activities. A general suggestion can include the kind of agreement to be achieved: a cooperation or non-aggression agreement, possible common enemies, or the directions of possible common attacks. For an example see the message in Figure 1 which provides an example of a general suggestion. The detailed suggestions can also be divided as follows:

1. Suggestions concerning general purposes of an agreement: spaces on the board to attack, spaces to defend, areas to leave or to enter. For example, see sentences (2) and (3) in Figure 3.
2. Suggestions about the specific movements in order to achieve the purposes of 1: which unit has to attack or to give support, which fleet can convoy, and which unit has to move in order to cut support. For example, see sentence (4) in Figure 3.

We have developed different methods for evaluating different kind of suggestions. The General Suggestion Evaluator (GSE) evaluates general suggestions using very fast heuristics. The Detailed Suggestion Evaluator (DSE) evaluates detailed suggestions by finding fitted strategies to them.

The Detailed Suggestion Evaluator uses a Strategies Finder (SF) module, to find strategies under several constraints, given by the DSE (see [6]

for more details).

Before sending the suggestion to one of the above modules, we move it through a Pre Analyzer (PA) that will fill in gaps of missing information. The GSE, DSE and the PA are part of the Foreign Office.

5 Diplomat's General Suggestions Evaluator

Suppose Diplomat gets a general suggestion. It has to decide whether to accept the suggestion and to continue the negotiations or to put the suggestion aside. Diplomat can also decide that it does not want to accept the suggestion, but to pretend that it does.

In order to decide whether to accept a general suggestion, Diplomat uses the General Suggestions Evaluator (GSE) (see Figure 7). The GSE has to use fast methods, because it is not worthwhile to spend a lot of time searching for good detailed strategies in this step of the negotiations. The principle directing the GSE is that if there is some hope of profiting from the suggested agreement, it is worth continuing the negotiations.

The GSE distinguishes between two cases: when the general suggestion fits a general plan which Diplomat has already considered and when the suggestion introduces an agreement that it has not considered at all. In the first case the GSE can decide quickly by searching the Diplomat's memory. (Details of ways to decide with whom to start negotiations can be found in [4] and [9].)

In the second case, Diplomat's GSE uses the following methods.

1. Find the internal relations among the allies of the suggested agreement and their relations with the enemies of the agreement (if enemies exist). The parameters that weigh in favor of the agreement are: If the allies of the suggested agreement are friends (according to Diplomat's KBB) or if the enemies of the agreements are among the enemies of Diplomat, or if common friends or common enemies exist for the allies of the agreement.
The parameters that weigh against the agreement are: If the allies of the agreement are enemies according to Diplomat's KBB, or if the enemies of the agreement are friends of Diplomat and Diplomat's enemies are friends of the allies of the agreements.
2. Make a general evaluation of the expected profit and loss for Diplomat from the suggested agreement. (See the algorithm below). The

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estimation that the agreement is profitable for the allies is necessary for Diplomat's GSE to decide that the agreement is worthwhile.

3. If a very strong agreement exists between the enemies of the agreement (if enemies exist) and Diplomat, then the GSE will conclude that the suggested agreement is not worthwhile.

The general evaluation algorithm of the expected profit and loss is as follows:

- For each power of the allies of the suggested agreement, compute the difference between the number of units between this power that are adjoined with the units or the supply centers of Diplomat and the number of Diplomat's units that adjoined with the partner. The danger for Diplomat from the agreement increases with this number, and the expected profit decreases with it. The reason is that it increases the willingness of the allies to attack Diplomat and decreases their willingness to help it.
- Find all the powers that border both Diplomat and the suggested allies. Those powers can be possible common enemies for an agreement. The expected profit for Diplomat from an agreement against such a power increases monotonically with the difference between the number of Diplomat's units that adjoin this power and the number of the this power's units that adjoin Diplomat.

If the GSE concludes that the suggested agreement is worthwhile, then Diplomat sends a positive answer to the sender. It also searches for a good strategy which fits the agreement by applying to the Strategies Finder and may add more details to its answer. If it can not find a good strategy, it asks the other partner for more details. If the GSE concludes that the suggested agreement is not worthwhile, Diplomat will decide whether to pretend to accept the suggestion or to send a negative answer. (See [4], [8] for more details.)

We examined 77 cases and in 55 (71%) of them the evaluation of the GSE was similar to the evaluation of the more complex evaluator, Detailed Suggestion Evaluator, (i.e., the one that requires much more time to make its decisions).

6 Diplomat's Detailed Suggestion Evaluator

Suppose Diplomat gets a message which includes a detailed suggestion and must decide how to respond. After passing the message through the PA and filling in the gaps, the next step is to try to evaluate the expected profit (or losses) for Diplomat and its partners from this suggestion. The DSE translates any suggestion into a set of strategies that *fit* the given suggestion, taking into account the current situation and the beliefs of Diplomat about the other players and the game. This translation changes each suggestion received or sent by Diplomat into a unique strategy format, which allows it to be compared with other suggestions or strategies. The translation is done using Diplomat's Strategies Finder, and the strategy found is used as a basis for further negotiations when needed. The next step is to examine the expected profit from the fitted strategy and compare it with the expected profits from other possible strategies.

A strategy *fits* a suggestion when all the specific activities such as Move and Support that are precisely mentioned in the suggestion appear in the strategy and the strategy does not include activities whose negations appear in the suggestion. If general activities such as Attack and Defend are mentioned in the suggestion, the strategy must include at least one order that implements every such general activity.

If the parties had agreed upon some details during the previous seasons, and the current suggestion does not contradict those details, then the *fitted* strategy has to fit those details too. So, Diplomat assumes that a detail of an agreement is valid until the other party says the opposite or does something that contradicts this assumption. We found out from human players that they make the same assumption, and an automated Diplomat player that negotiates with humans should make it, too.

Usually a suggestion does not include all the possible activities of the involved player. Even the activities that are mentioned are usually just sketched. Only general activities are described, especially at the beginning of negotiations. When Diplomat receives such a suggestion, it has to try to extrapolate the missing details, when possible, like a human player. Only when it fails to find any strategy that fits the suggestion may it ask for more details. One can notice that there is a possibility that Diplomat will ask for more details whenever they are missing, but such questions reduce the reliability of the agent, especially when there is only one implementation for the suggestion.

Since the set of strategies in Diplomacy is too big to be computed and

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stored, Diplomat must use heuristic methods to find strategies that fit a suggestion. Also, strategies that were found in previous seasons are no longer useful. On the other hand, strategies that were found during the current seasons can be stored and used. In order to be used effectively, the kept strategies have to be saved according to some criteria. We found during the development of Diplomat that a good method is to divide the strategies according to the players for whom they can be a basis for negotiations. So, Diplomat keeps all the strategy for cooperation with a specific power together. A secondary sort is done according to the enemies that this strategy is planned against. Diplomat removes the strategies at the end of each season after the situation on the board changes.

Diplomat's PA first finds the powers that are involved in a suggestion. Then Diplomat's DSE uses this information to find the set of strategies to consider. Diplomat's DSE looks for a strategy that includes all the Move, Hold, Support, Convoy and Valid orders that appear in the suggestion and does not include orders whose negations appear.

When Diplomat receives more general suggestions such as Attack, Defend, Enter, Leave or Help (see for example Figure 3), it is more difficult to check whether a strategy fits the suggestions. The Attack, Leave, and Defend sentences include the following information: the active powers, the places and possible directions from which to perform the activity (see [4]). The Leave sentence includes the active powers and the site that must be left. The Help sentence includes details about the active power and the kind of help that will be given: attack, defend and enter. It also includes all the details for these actions.

Diplomat passed through each strategy looking for at least one order that will fit each sentence as follows:

for an Attack and for a Defend sentence, it looks for an order that has an attack purpose or a defend purpose correspondingly; for example, the 'spa' field of this order (see Section 3) is one of the places mentioned in the sentence, and the active power of the order is among the powers of the sentence. If the 'directions' field of the suggested sentence is not empty, the active units must be located in one of them. The Enter sentence is treated like the Attack sentence.

In the case of a Leave sentence, the fitted order can be a Move order or a Valid order which moves from the site of the Leave sentence and is owned by one of the specified powers. In case of a Help sentence it looks for an order of the active powers whose details fit the Attack, Defend, or Leave sentence. For example see the message in Figure 3.

Power	Supply centers	Unit
Russia	Warsaw Sevastopol	warl ruml
Diplomat	Sweden Rumania Budapest Moscow St. Petesbourg	swec stpl most budl sevc
Austria	Trieste Serbia Greece Viena	tyrl serl tril grec
England	London Edinburgh Liverpool Norway	echş picl lonc norc
France	Brest Marceilles Paris Spain	spal brec parl burl
Germany	Kiel Berlin Munich Denmark Holland Belgium	munl holc kiec berc bell denl
Italy	Rome Naples Venice Tunis	napc tyss tunl piel
Turkey	Ankara Constatinople Smyrna Bulgaria	aegs smyc bull conl

Figure 2: The situation on Spring 1902: Diplomat plays Russia. Supply centers are places that produces supplies sufficient to keep an army or a fleet being. Units are armies or fleets. We denote spaces on the board by their first three letters, and add "l" for an army in the land of this space, "c" for a fleet in the coast of this space and "s" for a fleet in a sea.

< MESSAGE 2 FROM Turkey TO Russia > :

I would like you to know the following facts:

Russia seems to be strong, (1)

and Turkey will attack Serbia now, (2)

and Russia will help Turkey's attempt to enter Serbia, (3)

and Russia will move from Warsaw (inland) to Galicia (inland). (4)

END OF MESSAGE.

Figure 3: Spring 1902: Detailed Suggestion

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((Russia . 1496) (

Figure 4:

< MESSAGE 3 FROM
*I would like to
Germany will
and Russia wil
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and Russia an
END OF MESSAGE*

Figure

((swec MOVE swec :
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List of places that I
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Figure 6: The compi
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(((bull MOVE bull serl ATTACK Serbia)
 (sevc SUPP ruml ruml DEFEND Rumania)
 (ruml SUPP bull serl ATTACK Serbia)
 (budl SUPP bull serl ATTACK Serbia)
 (aegs SUPP conl bull DEFEND Bulgaria)
 (conl MOVE conl bull DEFEND Bulgaria)
 (smyc MOVE smyc conc ATTACK Constantinople)
 (warl MOVE warl gall ATTACK Galicia))
(10388 2135 11567
((Russia . 1496) (Turkey . 12030))))
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Figure 4: Strategy that fits the suggestion in Figure 6

< MESSAGE 3 FROM Germany TO Russia > :

I would like to suggest to you the following facts:
Germany will enter Sweden from Denmark now, (1)
and Russia will move from the coast of Sweden to the coast
of Norway now, (2)
and Russia and Germany can attack London in the year 1903. (3)

END OF MESSAGE.

Figure 5: Spring 1902: Detailed Suggestion

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((swec MOVE swec norc ATTACK Norway)
 (denl MOVE denl swel ATTACK Sweden))
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List of places that Russia and Turkey decided not to enter: (Black Sea, Armenia)

Figure 6: The compilation of message 3 together with the previous agreement

rs Russia. Supply
 eep an army or a
 s on the board by
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 et in a sea.

rbia, (3)
 alicia (inland). (4)

on

If Diplomat's DSE does not find any strategy among the stored ones, it compiles the suggestion into a format of a strategy and sends it to the Strategies Finder to get other strategies that do fit the suggestion.

Diplomat's DSE has to supply the Strategies Finder a set of allies and a set of enemies. Part of this information is supplied by the PA by analyzing the suggestion. Part was discussed in previous stages of the negotiation and kept in Diplomat's memory.

The DSE also goes through all the sentences of the suggestion in order to find out which places the sender suggested not to enter. It compiles the other sentences of the suggestion into a strategy format according to the rules to find fitted strategies among the kept strategies that were described above.

After finding a set of strategies that fit the detailed suggestion, the DSE has to choose the most profitable among them. The DSE also has to compare the chosen strategy that fits the suggestion, with the other strategies for cooperation with the other party that does not fit the suggestion. Finally the DSE decides how to react to the suggestion.

7 Results and Conclusions

In order to check the success of Diplomat's DSE, we examined 114 detailed suggestions that were received by Diplomat during negotiation periods. In 13 (11.4%) cases, Diplomat asked for more details from its opponent because it couldn't find a strategy that would enable it to decide. We also examined 90 suggestions that were received by human players. We found out that in 7 (7.7%) cases they asked for more details.

Also, in its other missions, Diplomat performs well. For example, we examined 63 agreements that were signed between Diplomat and another power, and Diplomat predicted successfully the ally's intention to keep an agreement in 92% of all the agreements it had signed. The human players predicted successfully Diplomat's intention to keep an agreement in 86% of all the agreements they had signed with Diplomat. We actually tested Diplomat in 100 Diplomacy seasons and, determined that Diplomat plays better than a well experienced player in a way that is difficult to distinguish from a human player. This is because Diplomat negotiates like human players, break agreements as they do and shows good strategic skills.

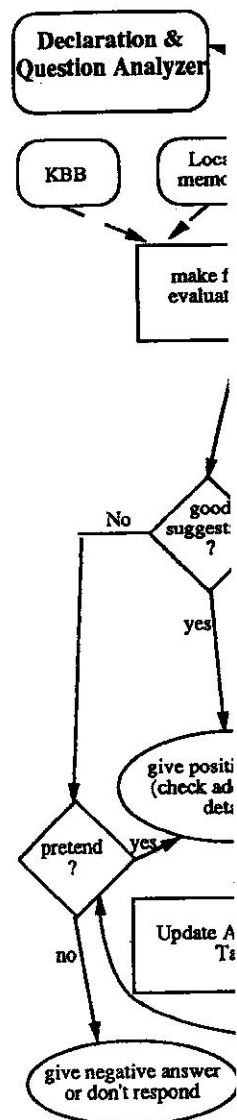


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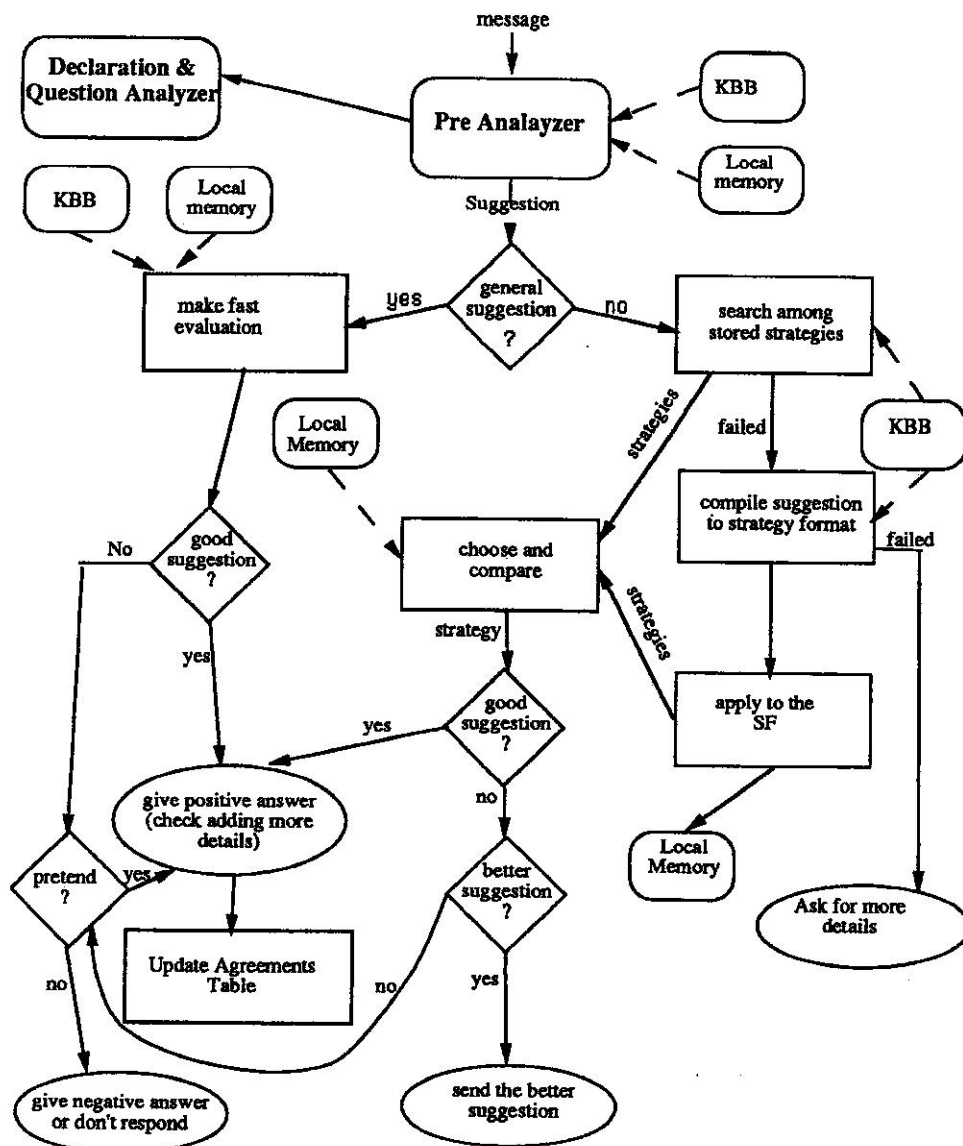
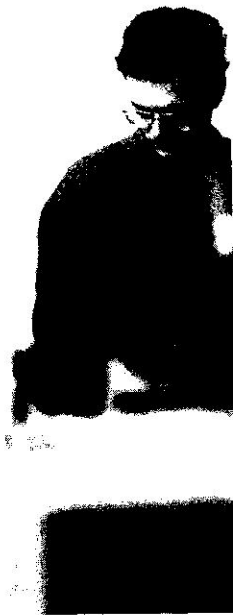


Figure 7: General Description of the Suggestion's Evaluation

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