

# dipGame: a Testbed for Multiagent Systems

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## ABSTRACT

There is a chronic lack of shared application domains to test the research models and agent architectures on areas like negotiation, argumentation, trust and reputation. In this demonstration we introduce such a friendly testbed called dipGame that can be used for all such purposes. The testbed is based on the Diplomacy Game due to its lack of random moves and because of the essential role that negotiation and the relationships between the players play in the game. The testbed may also profit from the existence of a community of bot (player software agent) developers and a large number of human players that would provide data for experiments. We offer the infrastructure, including a bot, and make it freely available to the MAS community.

## Categories and Subject Descriptors

I.2.11 [Distributed Artificial Intelligence]: Multiagent systems

## General Terms

Experimentation

## Keywords

application, testbed, diplomacy game

## 1. DIPLOMACY

The game was created in 1954 and is quite popular. Each player is in charge of the armed forces of a major European power and must decide which movements on a map of Europe the various units should execute. The game ends when someone has an army powerful enough to control Europe. What makes Diplomacy so compelling for our purposes is the relevance that negotiating abilities have in this game. Players negotiate deciding allies, selecting whom to ask for help, arguing with other players to get information about their objectives or to find out what they know, building trust and reputation, maintaining relationships, and so on.

Diplomacy is often played on the Internet. Interestingly, playing online makes it easier to secretly meet with other players to negotiate and keep conspiracies under wraps. There

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is a large online community of players that meets around <http://www.diplom.org>. And there is also an important community of bot developers that has defined a standard communication protocol<sup>1</sup>. Up to now, the bot development efforts have focused mostly on the strategy and tactics of the no-press variant of the game (i.e., without dialectic communication between players). We follow the next natural step enriching the bots by adding negotiation capabilities.

## 2. DIPLOMACY FOR RESEARCH

From the point of view of AI research, Diplomacy is a multiagent system environment where competitive self interested agents need to cooperate to obtain better outcomes. This is done by the signature of agreements where agents involved commit to do a plan of action. Agreements in such environments are reached as the result of successful negotiation processes in which agents dialogue exchanging proposals and information with the aim of convincing the other agent to accept a deal, sometimes arguing. As time goes by, agents can observe how their counterparts honour up the agreements they sign and build a model of agents' beliefs, desires and intentions. This model will help in future negotiations, even to decide which agent should we negotiate with. Concepts like trust, honour, or sincerity can summarise the perception of the behaviour of an agent. Also the reputation of an agent can be modelled because agents may talk about other agents performance, promises, intentions, ...

By means of this testbed, we join together research and entertainment with the aim of providing an infrastructure to play Diplomacy comfortably, where and when the player wants to play, using a common language and all for free. At the same time, the testbed will permit the gathering of valuable information that is useful to support experimental research in MAS. As described in [1], Diplomacy is the perfect domain for a testbed for multiagent systems. [3] was the first work that pointed it out.

## 3. TESTBED ARCHITECTURE

The testbed infrastructure is composed by a framework for bot development and some software components that allow to check and analyse the correct behaviour of those agents. It also includes a library for chatting with other players using the language levels defined in [2] –see in Figure 1 a graphical representation of such language levels. With

<sup>1</sup>[5] and [4] can be considered a standard for Diplomacy bot communication, specially the level 0 syntax, as the other levels are almost never used.

this testbed, the researcher can build a player agent and get relieved from the painful programming of the communication between agents and concentrate on the interesting decisions from a MAS research perspective: what to do and whom to say what, that is, *reasoning*.

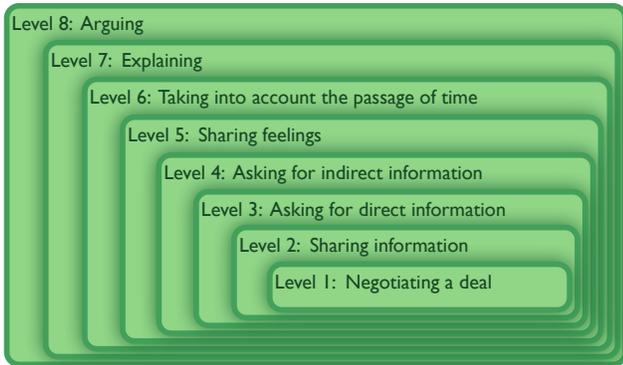


Figure 1: Language level representation.

The framework assists on the development of four different types of components, listed in Figure 2. To complete a component the programmer is required to add code to implement the functionality that appears on the last column of the figure. (The already provided functionality appears on the third column.) The actions are the movements on the map. Bot selects the best action to perform by means of a search process that uses the programmer’s defined action evaluation function. The chatting bot permits to talk to other agents using the programmer’s defined negotiation strategy to select what to say to whom. The testbed also provides complete components built on top of this framework with an implementation of a web-based visualization (see Figure 3), and with basic implementations of action selection and negotiation strategy.

This testbed facilitates the construction of agents capable of playing Diplomacy using negotiation. In addition, through the testbed web site <http://www.dipgame.org> anyone can play against our complete player agents. The same site also provides all the necessary infrastructure and documentation to build player agents. Anyone interested can quickly start building their own agent.

#### 4. DISCUSSION AND RESULTS

Diplomacy is an ideal environment for testing MAS because players must constantly confer, sign agreements and decide whether to honour them or not, decide whom to cooperate with, etc. There is also a large group of human

| Component type | Plays? | Provided                               | Required                                |
|----------------|--------|--|---|
| observer       | no     | game state                             | vizualization                           |
| player         | yes    | game state                             | action selection                        |
| bot            | yes    | game state, best action                | action evaluation                       |
| chatting bot   | yes    | game state, best action, communication | action evaluation, negotiation strategy |

Figure 2: Bot development framework.

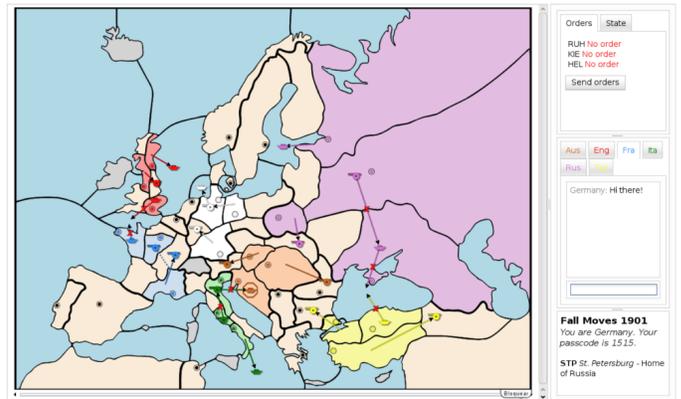


Figure 3: Screenshot of the component that provides web-based visualization.

players ready to go head to head with software agents and accustomed to play online.

In this demonstrator we introduce dipGame, a complete testbed for MAS experimentation and a framework for agent development based on Diplomacy. It is already available online at <http://www.dipgame.org>. At this web site, anyone can play Diplomacy against our software agents or build their own agents and make them compete. Moreover, the testbed provides facilities for monitoring and data gathering of the games played to simplify the data analysis process of the experimenters. A video demonstration is available at <http://www.dipgame.org/media/AAMAS2010demo>.

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