A Computer-based Role-Playing Game for Participatory Management of Protected Areas: The SimParc Project

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Abstract. *This paper shows an example of how role playing games can be used for two complementary purposes: to help at extracting the expertise of social actors, but also to support their participation in decision making. These two objectives correspond, respectively, to the 2nd grand challenge (computational modeling of complex systems) and to the 4th one (participatory access to knowledge). Our approach combines distributed role playing, geographic information systems, support for player negotiations and insertion of various types of artificial agents. We are exploring it in the context of participatory management of protected areas, for biodiversity conservation and social inclusion.*

1. Introduction

We believe that the 2nd grand challenge (computational modeling of complex systems, e.g., of interaction man-nature) and the 4th grand challenge (participatory access to knowledge) may actually not be independent, but rather complementary, specially in the case of modeling complex systems involving social actors. Our basic argument is as follows. In order to be able to capture and model a social process, an interesting way is to directly involve human social actors as elements of the computer supported simulation of this social process. In practice, we propose computer supported role playing games. They create simulated situations in which social actors can play their roles and expose their behaviors and strategies. At first, this leads to a more natural incremental modeling of the social process and of the behaviors of the social actors. Therefore, we then may gradually replace human actors by artificial agents, the human actors validating or amending the behaviors of artificial players. These artificial players may be designed at hand or inferred by semi-automated analysis of traces of the interactions and decisions of the human players. At second, such role playing games provide social actors with access to understanding of social phenomena and also support their participation in possible decision making, thus making a natural link to the 4th grand challenge. In other words, the 2 challenges could mutually reinforce each other, in some kind of "virtuous circle".

In order to further detail our argument, let us now consider the other way around and start by the 4th grand challenge. Its objective is not only to provide citizens with access to knowledge but also to improve their participation in the actual formation of knowledge and in decision making. We will consider here as example an important issue in Brazil, the management of protected areas for biodiversity conservation, with also a concern for social inclusion. Indeed, protected areas (e.g., national parks) usually undergo various pressures on resources, use and access, which results in many conflicts. This makes the issue of conflict resolution a key issue for their management. Traditional technocratic approaches, with typical top-down modeling and also top down decision process, have shown their limits in terms of acceptance by social actors and for their inability to exploit local knowledge and to well address conflicts. New methodologies intending to facilitate participation and conflict resolution are being addressed via bottom-up approaches that emphasize the role of local actors (stakeholders, e.g., environmentalist NGOs, communities, tourism operators, public agencies, and so on).

We believe that computers may provide significant support to address such challenges. More precisely, the idea is to help various stakeholders to collectively understand conflicts and negotiate strategies for handling them through a role playing game with computer support. The game is based on a negotiation process that takes place within the park council, about the desired level of conservation (from more restricted to more flexible) for each sector of the park. The game considers a certain number of players' roles, each one representing a certain stakeholder (see above). Conflicting objectives will lead players to negotiate and to explore collective strategies of management.

An interesting side effect of this approach is on the extraction of knowledge. Note that one of the key issue of the 2nd grand challenge (about computational modeling of complex phenomena) is about extracting knowledge about the phenomena, in this case social actors and social processes. This means the elicitation of models of representation, models of interaction and models of decision. Traditional approach used in social sciences and in computational modeling and simulation of social processes use observation and transcription of social actors behaviors in the real world, by using an ethnographic approach and also surveys based on interviews. With the proposed approach of role playing games, social actors are immersed within a simulated situation represented by the role playing game. Indeed, role-playing games are "social laboratories", because players can try many possibilities, without real consequences [Barreteau, 2003]. The fact that the role playing game is distributed and that players interact through computers allows the systematic memorization of all interactions and decisions taking place between players. This opens the way for some automated or semi-automated analysis of traces of interactions [Guyot and Honiden 2006] [Briot et al. 2007] in order to infer behavioral models. This means that elicitation (knowledge extraction) of human experts behavioral models (e.g., models of interaction, decision and negotiation) may be conducted via automatic monitoring of experts in (virtual/simulated) situation/action, as opposed to more traditional interview-based (off situation) elicitation. These models of behaviors may then be used to refine the modeling. They may also be used to construct artificial players representing human players. In summary, we believe that computer support for role playing games provides a dual way to improve the modeling of social processes (2nd grand challenge) and also the access of social actors to knowledge and participation in decision making (4th grand challenge). Thus, the 2 challenges could then be complementary and self reinforcing.

2. The SimParc Project

2.1. Project Motivation

The SimParc project focuses on participatory parks management. (The origin of the name SimParc stands in french for “Simulation Participative de Parcs”) [Irving et al. 2007]. It is based on the observation of several case studies in Brazil. Our first concrete case study has been the urban National Park of Tijuca, in Rio de Janeiro. It undergoes a real pressure, both by urban growth and illegal occupation. This makes the issue of conflict resolution a key issue for the park management. Examples of inherent conflicts connected with biodiversity protection in the area are: irregular occupation, inadequate tourism exploration, water pollution, environmental degradation and illegal use of natural resources. Examples of social actors involved in these conflicts are: park managers, local communities at the border area, tourism operators, public agencies and NGOs.

The design of our current role playing game has taken inspiration in real cases such as the National Park of Tijuca, although it is not the reproduction of a real case. Real cases are important, because they bring concrete elements to the game, which allows our proposal to be evaluated in more realistic and illustrative settings. However, we chose not to reproduce exactly a real case, in order to leave the door open for broader game possibilities [Irving et al. 2007].

2.2. Game Objectives

The SimParc game constitutes an innovative and playful approach to support negotiation procedures in national parks management. The current game has an epistemic objective, to help each participant discover and understand the various factors, conflicts, and the importance of dialogue for a more effective management of parks. Note that this game is not (or at least not yet) aimed at decision support (i.e., we do not expect the resulting decisions to be directly applied to a specific park). The targeted audience includes different actors such as: park managers, researchers, students, and all stakeholders willing to understand and explore the challenges, conflicts and negotiation process for participatory management of parks.

The game is based on a negotiation process that takes place within the park council. This council, of a consultative nature, includes representatives of various stakeholders (e.g., community, tourism operator, environmentalist, non governmental association, water public agency…). The actual game focuses on a discussion within the council about the “zoning” of the park, i.e. the decision about a desired level of conservation (and therefore, use) for every sub-area (also named “landscape unit”) of the park. We consider nine pre-defined potential levels (that we will consider as types) of conservation/use, from more restricted to more flexible use of natural resources, as defined by the law [Brazil 2000].

The game considers a certain number of players' roles, each one representing a certain stakeholder. Depending on its profile and the elements of concerns in each of the landscape units (e.g., tourism spot, people, endangered species…), each player will try to influence the decision about the type of conservation for each landscape unit. It is clear that conflicts of interest will quickly emerge, leading to various strategies of negotiation (e.g., coalition formation, trading mutual support for respective objectives, etc).

A special role in the game is the park manager. He is a participant of the game, but as an arbiter and not as a direct player. He observes the negotiation taking place between players and takes the final decision about the types of conservation for each landscape unit. His decision is based on the legal framework, on the negotiation process between the players, and on his personal profile (e.g., more conservationist or more open to social concerns) [Irving 2006]. He may also have to explain his decision, if the players so demand. We plan that the players and the park manager may be played by humans or by artificial agents (see Section 5).

2.3. Game Cycle

The game is structured along six steps, as illustrated in Figure 1. At the beginning (step 1), each participant is associated to a role. Then, an initial scenario is presented to each player, including the setting of the landscape units, the possible types of use and the general objective associated to his role. Then (step 2), each player decides a first proposal of types of use for each landscape unit, based on his/her understanding of the objective of his/her role and on the initial setting. Once all players have done so, each player's proposal is made public. In step 3, players start to interact and to negotiate on their proposals. This step is, in our opinion, the most important one, where players collectively build their knowledge by means of an argumentation process. In step 4, they revise their proposals and commit themselves to a final proposal for each landscape unit. In step 5, the park manager makes the final decision, considering the negotiation process, the final proposals and also his personal profile (e.g., more conservationist or more sensitive to social issues). Each player can then consult various indicators of his/her performance (e.g., closeness to his initial objective, degree of consensus, etc.). He/She can also ask for an explanation about the park manager decision rationales. The last step (step 6) "closes" the cycle by considering the possible effects of the decision. In the current game, the players provide a simple feedback on the decision by indicating their level of acceptance of the decision.[1]

A new negotiation cycle may then start (see Figure 1), thus creating a kind of learning cycle. The main objectives are indeed for participants: to understand the various factors and perspectives involved and how they are interrelated; to negotiate; to try to reach a group consensus; and to understand cause-effect relations based on the decisions.

[1] For a future version, we also plan to introduce some evaluation of the quality of the decision through computable indicators (e.g., on the economical or social feasibility) or/and through multi-agent simulation (of the evolution of resources).

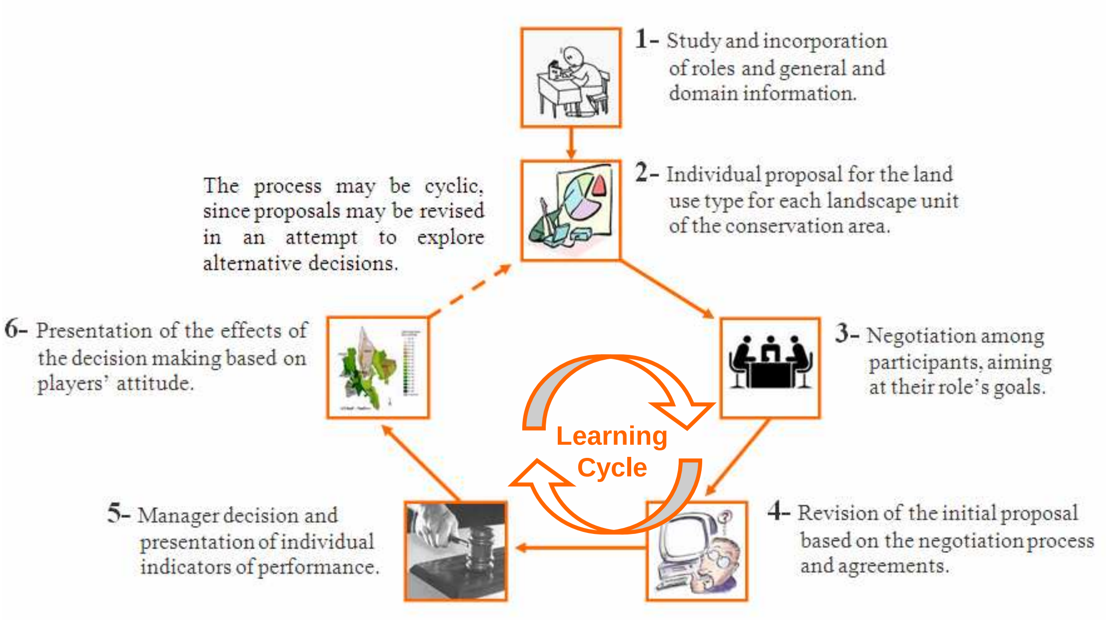

Figure 1. The six steps of SimParc game

2.4. Experiments

The initial game design was developed in 2007 [Briot et al. 2007]. It was tested, in its first version, without any computer support, through a game session conducted by researchers and students specialized in biodiversity participatory management: the GAPIS (Grupo de pesquisa Áreas Protegidas e Inclusão Social) research group at UFRJ (Rio de Janeiro). There were seven roles in the scenario: six stakeholders/players (environmentalist, community, hotel owner...) and the park manager. Each role was played by a team of two participants. In parallel to this initial design and test, a first computational prototype for the game was built (see Section 3.3). Based on some careful analysis of the first version of the game,[2] we then designed a second version of the game, with a new computer support prototype currently under development. We will now, at first, discuss general computer support of role playing games for participatory management, and then describe the design of our prototype for the SimParc game.

3. Computer Support for Role Playing Games

3.1. Motivation

Role-Playing Games (RPGs) are games where players perform characters. A character is situated inside a particular scene (environment). It follows a system of rules that serves to organize its actions, determining the limits of what can or cannot be done. Thus, RPGs are games where each player plays a role and makes decisions to reach its objectives. In fact, players use RPG like a "social laboratory", because they can try many possibilities, without real consequences [Barreteau, 2003]. In fact, RPG is an old technique that has been used in computer science from the eighties, mostly in games

[2] Our analysis and evaluation was based on: the analysis of the game session conducted at UFRJ, the evaluation of our first computer-support prototype (see Section 3.3), and the discussions which took place within an interdisciplinary workshop gathering researchers in our area, that we organized in Rio in November 2007.

[Costikyan 1994]. It is also being increasingly used in training and learning, because players can be inserted in real decision-making situations. Moreover, big companies have used RPG during technical courses, since the training and/or learning can be facilitated due to the game's amusing factor [Barreteau 2003] [Silva et al. 2006].

3.2. RPG & MAS techniques

The integration between Role-Playing Games (RPG) and Multi-Agent-based Simulation (MAS) started with the ComMod (Companion Modeling) approach, which is about participatory methods to support negotiation and decision-making for participatory management of renewable resources. Their method, called MAS/RPG, consists in coupling multi-agent simulation (MAS) of the environment resources and role-playing games (RPG) by the stakeholders [Barreteau 2003].

Recent works propose further integration of role-playing into simulation, and the insertion of artificial agents, as players or as assistants. Participatory simulation, and one its incarnation, the Simulación framework [Guyot and Honiden 2006], focuses on a distributed support for role-playing and negotiation between human players. All interactions are recorded for further analysis (thus opening the way to automated acquisition of behavioral models) and assistant agents are provided to assist and suggest strategies to the players. The Games and Multi-Agent-based Simulation (GMABS) methodology focuses on the integration of the game cycle with the simulation cycle [Adamatti et al. 2007]. It also innovates in the possible replacement of human players by artificial players (see Section 5.1). Based on these two experiences (by members of our project), one of our objective is to try to combine their respective merits and to further explore possibilities of computer support, as will be discussed in Sections 4 and 5.

3.3. A First Computer Support Prototype

In order to help us to validate and assess our model, a first rapid prototype was proposed to collect feedbacks from participants, domain experts, and designers. It was based on the Simulación framework [Guyot and Honiden 2006] and it proposed three main tasks for the players: (a) communication via a chat system; (b) the delimitation of landscape units;[3] (c) the definition of the conservation policy for every landscape unit. In this prototype, each player is also provided with an assistant agent (with a face avatar), welcoming the player and providing some simple information about the steps of the game.

To represent the imaginary park and its elements, a map with small icons is available in the main window of the game. Several tabs are also available to: show various types of information (profile of each role, resources of each landscape unit) or to select decisions (delimit each landscape unit, choose conservation policy for each landscape unit). This prototype has benefited from Simulación framework features [Briot et al. 2007]. Meanwhile, experiments also revealed some limitations, such as: (1) communication limited to plain text; (2) communication is stored in an unstructured log file, which makes difficult later analysis; (3) scarcity of representation and visualization of resources.

[3] This task was abandoned in the second (current) version of the game, in order to focus on the main question of conservation policy decisions.

3.4. A Second Computer Support Prototype

The second prototype did not have the same exploratory character of the first one. With the higher maturity of the project, the current prototype could be proposed, based on a detailed design process. All steps described in the game process (Figure 1) were carefully studied and the system requirements were elicited. The experiences learned with the first prototype helped us to prevent diverse problems faced in this first version. Some steps of the design process are described in Section 4.

Based on the system requirements, we adopted Web-based technologies that support the distributed and interactive character of the game as well as an easy deployment. More specifically, we chose the J2EE software development platform and the Web framework Java Server Faces (JSF). Figure 2 shows the general architecture and communication structure of SimParc prototype version 2. In this second prototype, distributed users (the players and the park manager) interact with the system mediated internally by communication broker agents (CBA). The function of a CBA is to abstract the fact that each role may be played by a human or by an artificial agent. A CBA also translates user messages in http format into multi-agent KQML format and vice versa. For each human player, there is also an assistant agent offering assistance during the game session (see Section 5.4).

During the negotiation phase, players (human or artificial) negotiate among themselves to try to reach an agreement about the type of use for each landscape unit (sub-area) of the park. A Geographical Information System (GIS) offers to users different layers of information (such as flora, fauna, land characteristics) about the park geographical area. All the information exchanged during negotiation phase, namely users' logs, game configurations, game results and general management information are recorded and read from a PostgreSql database. As we already mentioned, the general structure of the SimParc Web system, steps, data processing, user interfaces and database access are based on JSF framework. In the next two sections, we will focus on two ongoing research directions: the design of interface support for negotiation and the insertion of artificial agents.

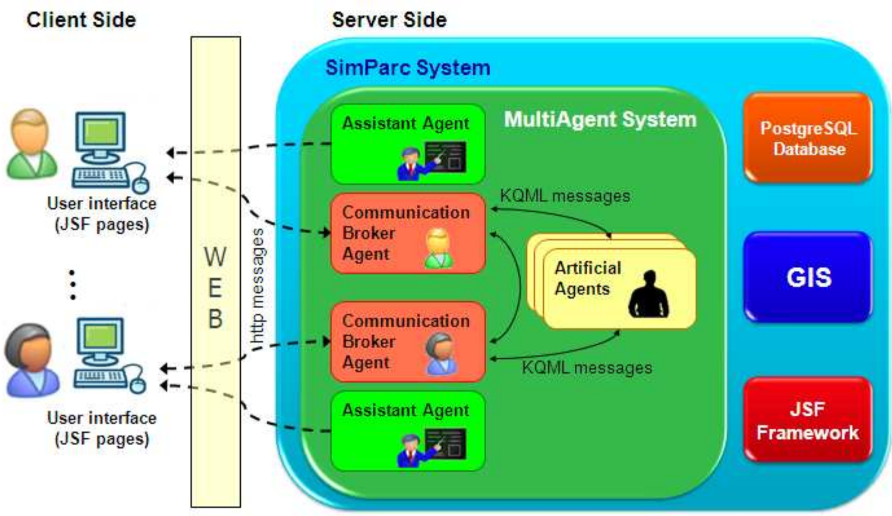

Figure 2. SimParc version 2 general architecture

4. An Interface Language for Negotiation Support

4.1. Analysis and Design Process for the User Interface

The process of design of the user interface of SimParc prototype version 2 has been based on communication-centered design, and its more agile version, eXtreme Communication-Centered Design [Aureliano et al. 2006], both based on the semiotic engineering theory of human-computer interaction.[4] We adapted the methodology to the characteristics of the SimParc project. Three phases were considered: analysis, design and prototyping.

The output products of the analysis phase are the logs from interviews with experts and users, scenarios (use cases), goals diagram and tasks model. The scenarios were constructed based on interviews, in a narrative form, to help identifying contextualized types of usages. The goals diagram, modeled in the MoLIC language, was constructed from the scenarios and interviews, with the aim of representing the goals (identified a priori) of the users. We believe that the task model represents an intermediary step, easing a conceptual transition from the analysis phase (what, why and by whom) to the design (how). Note that task models are also widely used and accepted in human-computer interaction (HCI). Overall, the goal of the diagrammatic representation of task models is to provide an overview of the design process for each goal and how these goals are decomposed into tasks and sub-tasks. This diagram provides a new set of information about the process, presenting the hierarchy and flow of tasks, preparing designers and users to an outline of the interaction. We used an adaptation of the Hierarchical Task Analysis (HTA) [Annett & Duncan 1967] for modeling tasks identified from the goals diagram and the scenarios. More details about the SimParc models can be found in [Vasconcelos et al. 2008].

4.2. User Interface Design - Structuring Dialogue and Negotiation

We consider negotiation as a particular form of communication process between two or more parties, focused on mutual agreement(s) on a given conflict of interest or opinions [Putnam & Roloff 1992]. We further believe that the adoption of an interface language, based on argumentation models and linguistics theory, can offer different ways of supporting a computer-mediated negotiation process. The main objective of such interface language is to find the inflection point between the necessary “framing” and the maintenance of fluidity and naturalness of the dialogue.

The structure of the dialogue is an important factor, because it helps to better manage the history of the negotiations. It facilitates the inclusion of artificial agents in the process and increases the focus on the process, on issues negotiated and on the clarity of dialogue. Many interaction protocols for negotiation between agents have been proposed (e.g., via the FIPA-ACL effort), but they privilege the agent-agent communication at the expense of human communication. Note also that computer mediated communication suffers from various types of impoverishment of the dialogue, particularly in relation to non-verbal communication, considering the body language

[4] According to the theory, both designers and users are interlocutors in an overall communication process that takes place through the interface of the system. Designers must tell users what they mean by the artifact they have created, and users must try to respond to what they are being told [de Souza 2005].

[Ekman 2003] and the vocal intonation. Thus, we are looking for an intermediate and simple way to promote both human-human and human-agent communication.

We considered many proposals of notation for structuring and visualizing argumentation, e.g., in [Kirschner et al. 2003]. Among them we cite: the Toulmin model, a reference for the majority of the posterior models; the Issue-Based Information System (IBIS), an informal model based on a grammar that defines the basic elements present in dialogues about decision-making; and the "Questions, Options and Criteria" (QOC) [Kirschner et al. 2003]. Based on this analysis, we believe that it is possible to offer a pre-structure, adding to the informal and interpretative characteristic of prose, while maintaining the fluidity of dialogue. Our main inspiration for rhetorical markers is IBIS, as well as theories of negotiation, such as [Raiffa 1982] and Speech Act Theory [Searle 1969]. The proposed markers are basically composed of: rhetorical identifiers of intention (e.g., propose, agree, justify, see Figure 3); the focus of the intention; and a free form text (see Figures 4.3 and 4.4). These elements give the tone of the dialogue, making clear the illocution, and thus facilitating the expression of the desired perlocution [Searle 1969].

We therefore provide the structure by inserting threading on the dialogue, to minimize risks of losing context, common in computer-mediated communication (via chat). See [Vasconcelos et al. 2008] for more details. To complement this structure applied to the text, we propose to model each players' message as an object. This object has the following attributes: identifier, sender, receiver(s), marker, focus, and a free form text. This modeling makes it easier for both the system and the user to manage and index the dialogues. For instance, filters may be applied to analyze the history of a dialogue, e.g., messages posted by a given speaker, or tagged with a specific type of marker. And it also opens the way for possible processing of the dialogue by software agents (off line for after-game analysis/debriefing and for inferring behavioral models [Briot et al. 2007], or even on line, e.g., by assistants).

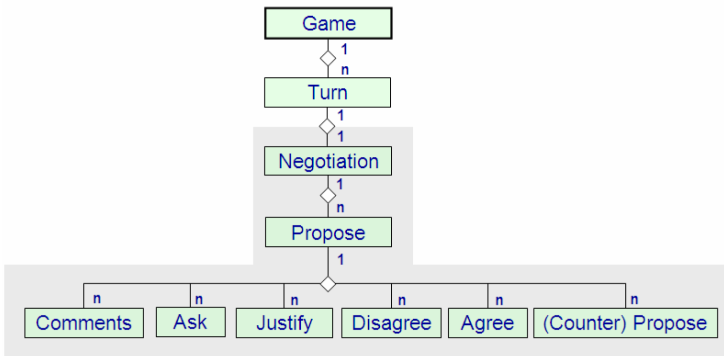

Figure 3. Messages structure based on rhetorical markers

4.3. A Simple Prototype

Based on SimParc game version 2 design phase outputs [Vasconcelos et al. 2008], we then created a simple prototype in order to evaluate the user interface appearance and prototype usage. In the following, we focus on the prototype user interface for step 3 of the game, i.e., negotiation between players. It is indeed a central part of the game, when the knowledge is built, shared and jointly negotiated. We would like to emphasize that we have tried to balance between some dialog structure and sufficient fluidity.

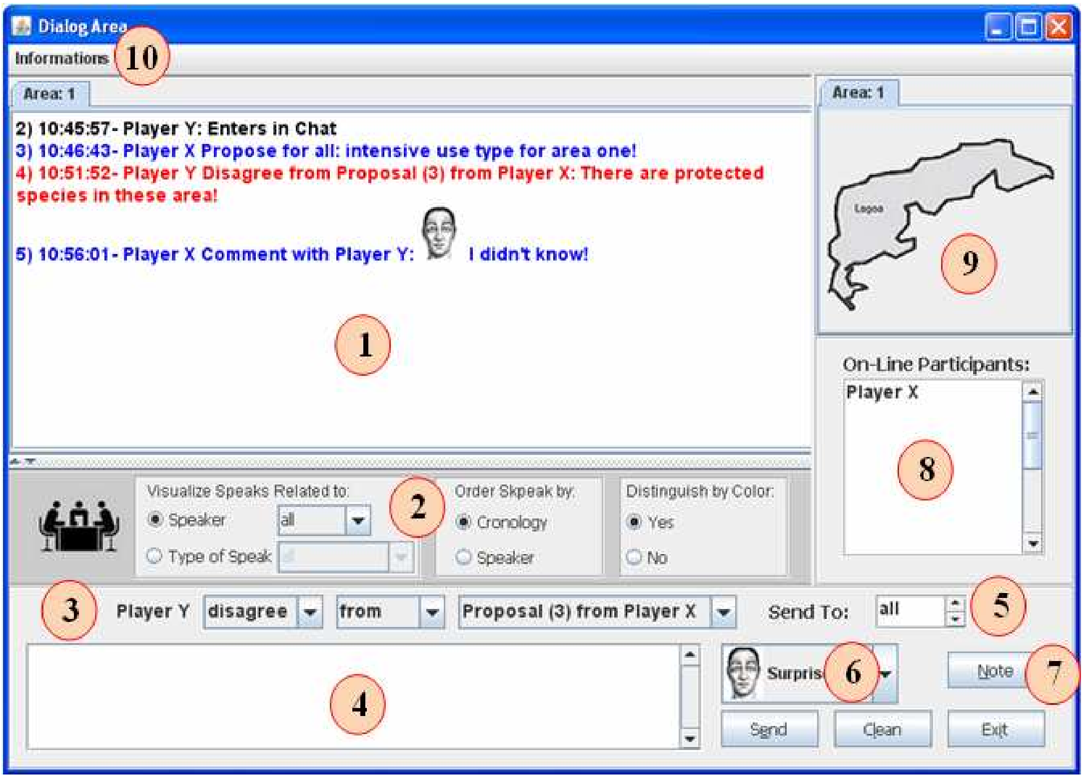

Figure 4. Prototype interface for the negotiation phase

The prototype user interface (see Figure 4) includes an area (1) for displaying the history of the exchanged messages. The area (2), for managing the history of messages, offers different ways of selecting and ordering the information and includes a simple way to better identify speakers (discrimination by color). The area (3) contains options for (semi) structure of messages via rhetorical markers for intention (e.g., disagree). The area (4) is for writing the actual contents (text) of the message. The area (5) allows selecting the recipients (unique or multiple) of the message to be sent. The area (6) provides the selection of iconic expressions to offer an alternative way for the user to express his emotional context during the negotiations, as an alternative way of minimizing the loss of communication modalities. The “facecons” were produced from the tool Artnatomia [Flores 2005], which generates iconic facial expressions of emotional states from the virtual manipulation of the muscles of the face.

There is an area (7) for personal annotations, allowing the user to make and record personal notes during the negotiation, which are not shared with the other players. The area (8) displays the list of participants and their roles, as a basic support for coordination. The area (9) visualizes the object negotiated via its geo-processed representation. Last, menus (10) provide access to different types of information about the domain, the system and the context of the game, such as the legal types of land use, the roles, the game objective and steps, the system use, and finally help.

5. Towards Inserting Artificial Agents in the SimParc Game

In SimParc game version 2, we are planning to insert three types of artificial agents: the artificial players, the park manager and the assistants, as will be discussed in next sections.

5.1. Previous Experiences on Artificial Players in the ViP-JogoMan Game

Our previous experience in inserting artificial players in a RPG is the ViP-JogoMan game [Adamatti et al. 2007]. It is an instance of the GMABS methodology (see Section 3.2) and the game domain is water resources management. It involves four different roles: mayor(s), land owner(s), water company administrator and migrants representative. They must share a same physical space and just one water reservoir. The specific objective of the game is to determine water quality and quantity in a peri-urban catchment. This game has been designed as a Web-based application, meaning that players could be in different places at a same time [Adamatti et al. 2007].

In this game, it is possible to replace some of the human players by artificial players (artificial agents). The two main motivations are: (1) the possible absence of sufficient number of human players for a game session and (2) the need for testing in a systematic way specific configurations of players profiles. The artificial players were developed along BDI (Belief, Desire and Intention) architecture [Rao 1996] and implemented in Jason [Bordini and Hubner 2007]. For each possible role of the game, different behavior profiles were defined, and each profile had a specific objective. In this game, there were two different types of negotiation, based on Raiffa negotiation protocol [Raiffa, 1982]: bilateral and collective negotiations. In the first one, just two players interact about a specific subject, as buy/sell a plot. In the second one, all players negotiate about general situations of the game, as water reservoir pollution. Many sessions were conducted with different configurations (all human, all artificial, hybrid). The experiments were quite promising: all players interacted a lot with each other, as witnessed by the high number of messages exchanged. However, the negotiation process was defined as a close set of possible messages (this was not a free speech), thus restricting excessively the communication process and making the negotiation process too artificial. An interesting finding was that the artificial players were not easily discovered by the human players.

5.2. Towards Artificial Players for SimParc

In order to describe the rationales for the design of artificial players agents in SimParc game, we will follow Buttner's reference classification structure for automated negotiation [Buttner 2006], based on structure, process and theoretical foundations. As for the structure, the SimParc negotiation process can be classified as a double-sided multilateral negotiation (many buyers and many sellers). It follows an integrated model distribution type, whose target is to maximize the collective utility of all partners (win-win approach), with a multi-issue (more than one independent negotiated object) and multi-attribute negotiation, having more than one characteristic evaluated on the negotiated issues (objects). Last, it is a non-mediated and closed session negotiation. Regarding the process, the level of automation can be seen as a hybrid model trying to allow the participation of autonomous agents and to facilitate the negotiation among humans by supporting the communicative process (communication-oriented). The negotiation is goal-oriented, where negotiators act on the basis of their expressed goals and objectives. The theoretic foundation that we are currently choosing to design the artificial player's negotiation model is the argumentation-based negotiation approach (ABN) [Sierra et al. 1998]. In ABN, it is possible for the agents to exchange additional information besides the proposals. They have to support their positions in negotiation. This automated negotiation approach appears specially interesting for our purpose, because it is the closest proposal to the way that humans negotiate. At the moment a logic-based argumentation structure [Besnard and Hunter 2000] is being chosen to support the SimParc agent negotiation strategy. The argumentation structure will also be related and based on the interface language proposed on Section 4.

We also propose for the artificial player's negotiation model some important predefinitions, based on Kersten and Noronha [1999] negotiation life cycle. In the pre-negotiation, considered for many authors the most important phase, the agent must have defined in its model: its interests and objectives, a BATNA (Best Alternative To a Negotiated Agreement) and a reserve price; what are the interests of other negotiators; its priorities; a boarding strategy; and an agenda. Based on the structure of negotiation in SimParc, for the negotiation phase, we will adopt, as in [Adamatti et al. 2007], the Raifa's bilateral and collective negotiations proposals [Raiffa, 1982].

In order to implement our artificial players agents, we have chosen the BDI architecture, because of its underlying logical model, and more specifically the AgentSpeak(L) language [Rao 1996] and the Jason implementation [Bordini and Hubner 2007], all already experienced for ViP-JogoMan implementation. For the communication protocol, we have chosen the KQML language, because it is already integrated into Jason. We are currently designing the first versions of the artificial players agents, based on profiles models identified by our domain experts and with a generic negotiation model as introduced above. In a next stage, we also plan to use automated analysis of recorded traces of interaction between human players in order to infer models of artificial players. In some previous work, genetic programming had been used [Guyot and Honiden, 2006] as a technique to infer interaction models, but we will also explore alternative induction and machine learning techniques, e.g., inductive logic programming.

5.3. Towards a Park Manager Agent

According to the SimParc game, the Park Manager (PM) observes all negotiation process among the players, without participating in it. The PM agent acts as an arbitrator, making a final decision for types of conservation for each landscape unit and explains its decision to all players. To make these final decisions, we have identified two main criteria:

- Analysis of initial and final proposals of all players: the PM agent analyzes each player's choice and their changes (if they have changed between the initial and final proposals), based on the history of negotiation.
- Specific behavioral profiles: 5 basic possible profiles of park manager have been identified (farmer, preservationist, legalist, conservationist and environmentalist), capturing various background training and openness, e.g., to social issues.

According to these criteria, we are currently modeling decision rules for the PM agent, based on the experience and guidelines of our domain experts. An additional objective is for the PM agent to be capable of explaining its decision to the players in natural language, inspired by [Furtado and Vasconcelos 2007]. The basic idea is that each decision step (activation of some decision rule of the PM) is recorded in a Proof Markup Language (PML) format. At the end of the decision process, the tree containing all steps can be visualized and analyzed from the user interface, making it possible to review and explain the decision-making process.

5.4. Towards Intelligent Assistant Agents

This last type of artificial agent planned for SimParc version 2 is an intelligent assistant agent. This agent is been designed to assist a player by performing two main tasks:

- To help participants in playing the game, e.g.: the assistant agent tells the player where he/she can find a certain functionality and how to use it; when the player should make decisions; what are the phases of the game; what should be done in each phase; etc.
- To help participants during the negotiations.

Meanwhile, for this second task, we would like to avoid intrusive support, which may interfere in the player decision making cognitive process. We experienced the use of assistants agents in SimBar3 and SimCommod experiments [Guyot and Honiden 2006], also based on Simulación. In these experiments, assistant agents suggest decisions to the human players (based on a model of the game or/and history of player decisions). We believe that such intrusive situations do not favor the educational and training goals, because the cognitive process of some participants is driven to follow or refuse agents' suggestions. Instead of any kind of intrusive support, we have identified some actions, e.g., to identify other players' roles with similar or dissimilar goals, which may help the human player to identify possible coalitions or conflicts. The general main idea for an assistance for negotiation is thus to combine and classify important information to help participants to make analysis and do it faster than they would do alone, while keeping their focus on the game proposal.

6. Conclusion

This paper introduced a role-playing game computer support for participatory management of protected areas and discussed some of its features and prospects (notably, an interface for supporting negotiation and the use of artificial agents). We plan the completion of our second prototype before the end of 2008. To evaluate our proposal, in addition to conducting game sessions, we plan to use semiotic engineering epistemic tools [de Souza 2005] to evaluate the acceptance and usability by (human) users.

Considering the 2nd grand challenge, we think that our project participates in a better understanding and tentative modeling of some real and non trivial case of natural-social interaction. Note that our computational modeling explores also human-artificial interaction. Note also that the recording of semi-structured interactions between human players opens the way for some automated analysis of traces and therefore inference of models. Therefore, elicitation of human experts models may be conducted with experts immersed into a virtual/simulated situation, as opposed to more traditional off-situation (e.g., interview-based) elicitation. Meanwhile, computer supported distributed role playing games also provide social actors with access to the understanding of social phenomena and they also support their participation in possible decision making, thus making a natural link to the 4th grand challenge. In summary, although our project is more specific, we hope that the proposed approach and that some of the techniques being explored can help at both modeling and participation of social actors in social processes, thus contributing to mutually reinforce possible approaches towards 2nd and 4th grand challenges.

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