A User Interface to Support Dialogue and Negotiation in Participatory Simulations

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Abstract. In this paper, we discuss the process of analysis and design of a user interface to support dialogue and negotiation between players of participatory simulations. The underlying context is an interdisciplinary project, named SimParc [1], about participatory management of protected areas for biodiversity conservation and social inclusion. This project is inspired by the ComMod MAS/RPG approach [2] and by recent proposals for software support for distributed role playing games, such as those by Guyot [3] and by Adamatti [4]. In this paper, we focus on the analysis and design of a user interface to ease and structure dialogue and negotiation between players, using a methodology based on semiotic engineering. Our main objective is to try to find a good balance between the necessary structuring and the spontaneity of dialog and negotiation.

Keywords: role playing games, multi-agent simulation, participatory simulation, negotiation, human computer interfaces, communication-centered design, semiotic engineering, biodiversity conservation.

1 Introduction

One of the principles of the Convention on Biological Diversity [5] refers to a participative process of social actors in the management of the biodiversity. Methodologies and computer-supported tools intending to facilitate this process have been addressed via bottom-up approaches that emphasize the role of local actors (stakeholders) and communities. Such bottom-up approaches echo the research conducted by members of the "ComMod" (for Companion Modeling) movement on participatory methods to support negotiation and decision-making for collective

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management of natural renewable resources. Their method, called MAS/RPG, consists in coupling multi-agent simulations (MAS) of the environment resources and role-playing games (RPG) by the stakeholders [2].

Our project inherits from this tradition. It is named "SimParc" (which stands for "*Simulation Participative de Parcs*") and gathers French and Brazilian researchers in an inter-disciplinary approach. It constitutes an innovative and playful approach to explore and learn about negotiation procedures in national park management, based on the recognition of conflicts involving different interests, roles, and strategies. SimParc explores the use of advanced accompaniment methodologies based on MAS/RPG. More precisely, it follows recent proposals of integration of role playing into simulation, and of inserting artificial agents, as players or as assistants [3], [4]. In this paper, we focus on the user interface support for dialogue and negotiation between game players, and on the process of its analysis and design, by using a methodology for designing human computer interfaces based on a HCI theory named semiotic engineering.

2 The SimParc Project

2.1 Motivation

The SimParc project focuses on participatory management of parks and protected areas.[2] Our first concrete case study has been the urban National Park of Tijuca, in Rio de Janeiro, Brazil. It undergoes a real pressure, by urban growth and illegal occupation. This makes the question of the conflict resolution one of the key issues for the management of the park. Examples of inherent conflicts are: irregular occupation, inadequate tourist exploration, water pollution, degradation of the environment and illegal use of natural resources. Examples of social actors involved are: park managers, researchers, traditional or non traditional community representatives, tourist operators and agencies.

The design of our current role playing game has taken inspiration in real cases such as the National Park of Tijuca, in order to bring concrete elements to the game, which confers greater applicability to our proposal. However, we chose not to reproduce a real case but to simulate emblematic and illustrative real situations in national parks.

2.2 Objective

The SimParc game constitutes an innovative and playful approach to support negotiation procedures in national parks management. Current game has a

[2] Parks are one among the different types of protected areas, as defined by Brazilian legislation. Other examples of types are, e.g., biosphere reserves or ecological stations [4].

pedagogical objective and is not (or at least not yet) aimed at decision support.[3] The targeted public includes managers of parks and protected areas, researchers, students, and all stakeholders and people willing to understand and explore the challenges, conflicts and process of negotiation for participative management of parks and protected areas.

The game is based on the process taking place within the council of the park. This council, consultative, includes representatives of various stakeholders (e.g., traditional community, tourism operator, environmentalist non governmental association, water public agency…). The actual game focuses on a discussion within the council about the demarcation ("zoning") of the park. More precisely, it is about the decision to associate a type of conservation (and therefore, use) to every sub-area[4] (named "landscape unit") of the park. We consider nine pre-defined potential types of conservation/use, from more restricted to more flexible, as defined by the law.

The game considers a certain number of players' roles, each one representing a certain stakeholder. Depending on its profile and the presence of elements of concerns in some 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 influence and negotiation (e.g., coalition formation, trading mutual support for respective objectives…).

The manager of the park observes the negotiation taking place and takes the final decision for types of conservation for each landscape unit, based on the legal framework, on the process of negotiation between players, and on his personal profile (e.g., more conservationist or more open to social concerns) [5]. He also may have to explain his decision, on demand from the players. The park manager may be played by a human, or by an artificial agent.[5]

In summary, the objective of the project is thus to propose an epistemic process to help each participant discover and understand the various factors, conflicts, and the importance of dialogue for a good management of protected spaces.

2.3 Steps

The game is structured along six steps, as illustrated at Figure 1. At the beginning (step 1), each player 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

[3] Current game is aimed at helping participants to discover and explore conflicts as well as negotiation strategies to address them. But we do not expect the resulting decisions to be directly applied to a specific park. This would require, e.g., a precise calibration and a predictive model for park viability. This is left for future work.

[4] We suppose that the process of identification of (or, decomposition into) the landscape units of the park has already taken place before. Actually, the two processes were considered simultaneously in an initial version of the game, but this proved too complex. Moreover, deciding the type of conservation alone is sufficiently effective to capture conflicts and negotiation between stakeholders.

[5] This artificial agent version is under current construction, see Sections 2.4 and 2.5.

proposal of types of use for each landscape unit, based on his understanding of the objective of his role and on the initial setting. Once all done, proposals by players are made public to all. In step 3, players start interacting and negotiating about their proposals. This step is, for us, the most important, where players will collectively build their knowledge by means of argumentation process. In step 4, they revise and commit to their proposals. In step 5, the park manager makes the final decision, considering the process of negotiation, 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 can also ask for explanation of the park manager decision rationales. The last step (step 6), "closes" the cycle and provides a feedback on the decision, both by the players (indicating their level of acceptance of the decision) and some evaluation of the quality and of the decision through indicators (e.g., on the economical or social feasibility) or simulation.

A new cycle of negotiations may then possibly start (see Figure 1), thus creating a cycle similar to a learning cycle [6]. The main objective is indeed for participants to: understand the various factors and perspectives involved and how they are interrelated, negotiate to try to reach a group consensus, and understand cause-effect relations based on decisions.

The process may be cyclic, since proposals may be revised in an attempt to explore alternative (hopefully better) decisions.

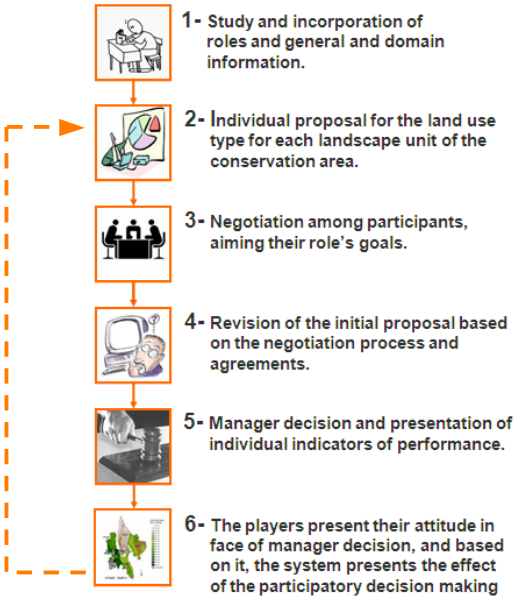

Fig. 1. The 6 steps of SimParc game.

2.4 Game Computer Support

A computer support is proposed for the game, allowing distributed role playing, where each player acts and interacts via a computer interface, as has been pioneered by Simulación [3] and ViP-GMABS [4]. In SimParc, the role playing game is completely distributed and the master of the game will be automated, in part or completely. Because all interactions, decisions and actions are mediated by the computer, they can be formatted as objects, recorded and processed on-line or off-line to allow the management of the history of the negotiations (different ways of visualization of exchanged messages) and to evaluate and analyze the players and the negotiation process. We also plan to introduce artificial agents in the game: (1) to represent the park manager, (2) as artificial players [4],[6] (3) as assistants to the players [3]. In section 5, we will discuss the support for the negotiation process.

2.5 Versions and Experiments

The initial design of the game (version 1) was conducted during year 2007 (see Figure 2). It was tested, without any computer support, through a game session conducted in September 2007 (see Figure 2). There were six roles in the scenario. Each role was played by a team of two players. Players were researchers and students of the APIS[7] research group, at UFRJ (Rio de Janeiro), led by Marta Irving, and specialized in biodiversity participatory management.

Fig. 2. Test of the SimParc game version 1.

In parallel, a fist computer support prototype, based on the framework Simulación [3] was designed and built (see Figure 3).

[6] Although we are not discussing the issue of artificial agents in this paper, it is important to mention that our design of a user interface for negotiation support – the real focus of this paper – already considers the future incorporation of various types of artificial agents, i.e., human-human but also human-agent interaction.

[7] APIS research group stands for "Áreas Protegidas e Inclusão Social", which means "Protected Spaces and Social Inclusion".

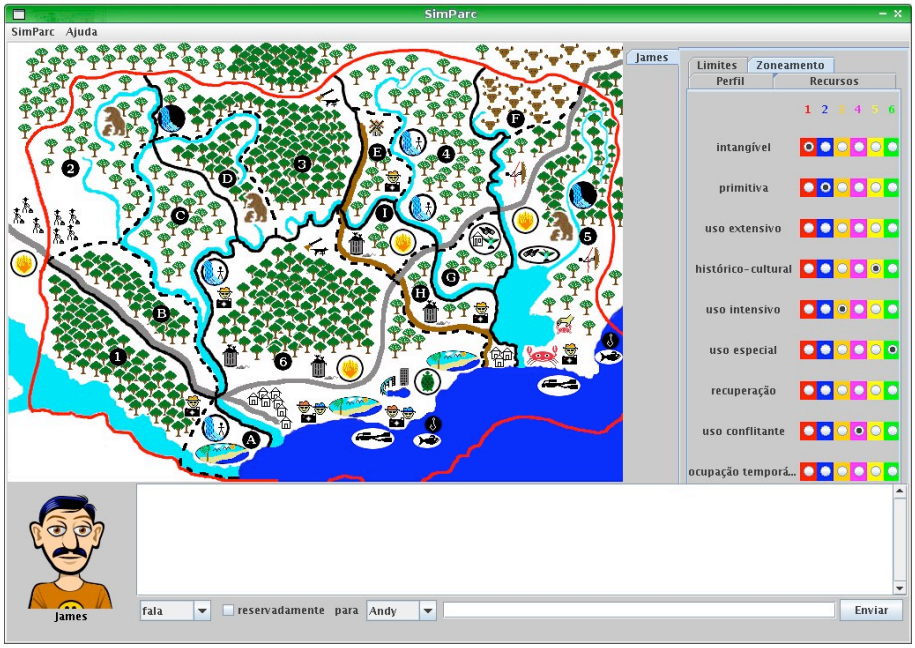

Fig. 3. SimParc game version 1 first computer-support prototype.

Based on the evaluation of the first version of the game – notably via the analysis of the test of September 2007 – and on the evaluation of its computer-support prototype, we then designed a second version of the game, with a new computer support prototype under current construction. Among some specific features,[8] it provides some support for structuring interaction and negotiation among players. We will now discuss how it has been analyzed and designed.

3 Analysis and Design Process

The process of design was based on communication-centered design, and its more agile version, eXtreme Communication-Centered Design [7], design proposals based on the semiotic engineering theory of human-computer interaction[9]. We adapted the

[8] It will also include an artificial agent playing the role of the park manager (making decision, able to explain it, and evaluating players performance), this aspect not being addressed in this paper.

[8] According to it, 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 [17].

application of the methodology to the characteristics of the SimParc project. Figure 4 shows the different phases and sub-phases adopted.

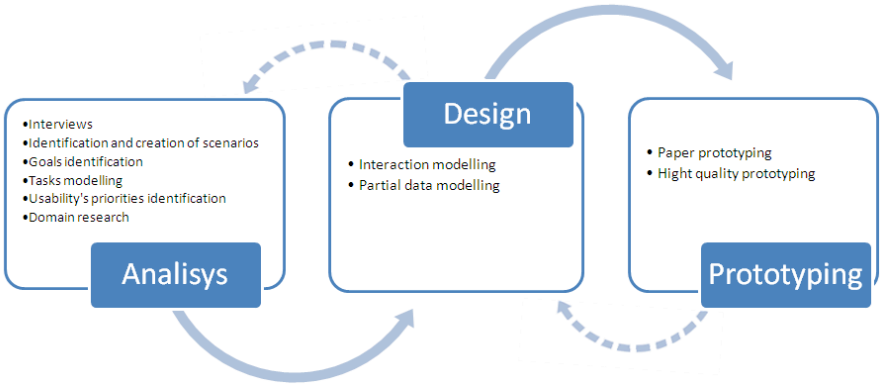

Fig. 4. The process of design.

The output products of the analysis phase are the records 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 at identify contextualized types of usages. The goals diagram (see Figure 5)[10], modeled in the MoLIC language,[11] 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) [9]. 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) [10] for modeling tasks identified from the goals diagram and the scenarios.

[10] Because of the space limitation, we only illustrate some of the notations/diagrams. Figure 5 shows the final goals diagram. Note that there is also an instrumental goals diagram [8].

[11] MoLIC stands for "Interaction Modeling Language for the Conversation" and it is used in Communication-Centered Design [8].

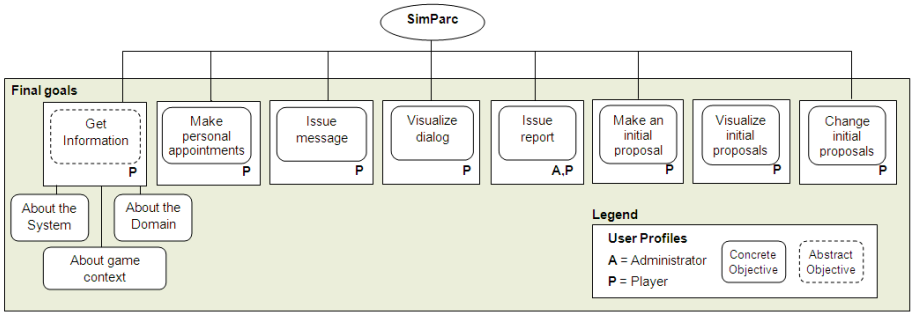

Fig. 5. The MoLIC diagram of final goals.

4 Design of an Interface Language for Negotiation Support

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 [11]. We further believe that the adoption of an interface language, based on argumentation models and linguistics theory, can offer different ways of support to a computer mediated negotiation process. The main objective for that 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 at a better management of the history of the negotiations facilitating the inclusion of artificial agents in the process, increasing 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 [13] 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 visualization of the argumentation, as, e.g., in [12]. Among them: 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; the "Questions, Options and Criteria" (QOC); the "Procedural Hierarchy of Issues" (PHI) and the "Decision Representation Language" (DRL) [12]. 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 inspirations for rhetorical markers is IBIS [12], as well as theories of negotiation, e.g., [14] [19] and Speech Act Theory

[18]. These markers are basically composed of rhetorical identifiers of intention (see Figure 6), the object focus of the intention and of a free speech (see Figures 8.3 and 8.4). These elements give the tone of the dialogue, making clear the illocution, and thus facilitating the expression of the desired perlocution [18].

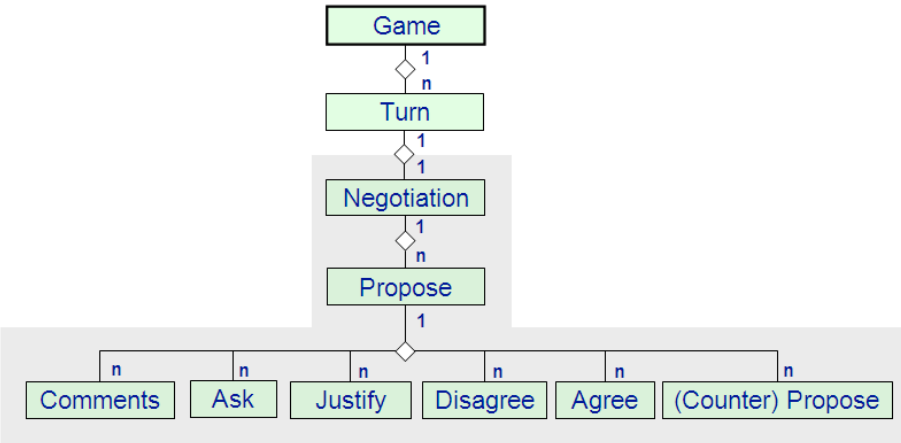

Fig. 6. Semi-structure for the text based on rhetorical markers.

We therefore provide the structure by threading from the dialogue, which minimizes risks of losing context, common in computer mediated communication (via chat) [15]. Figure 7 shows an example of threading based on the proposed structure.

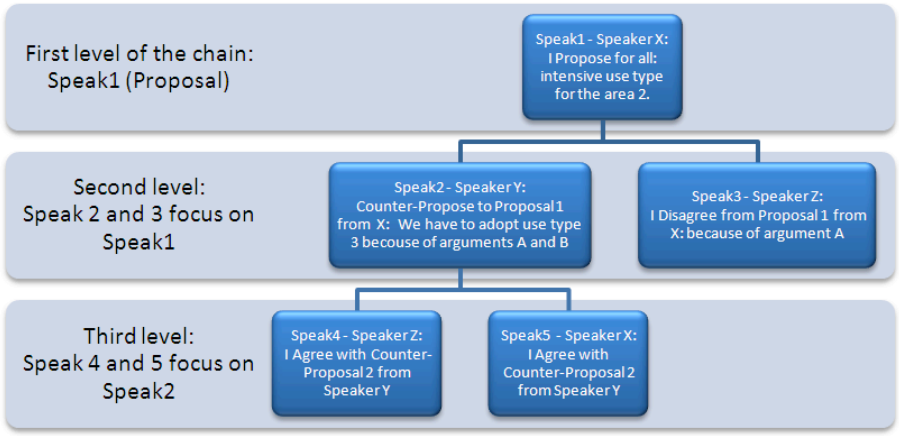

Fig. 7. Example of threading structured by the rhetorical markers.

In complement to this semi-structure applied to the text, we propose to model each speak from players as an object. These objects have the following attributes: identifier, sender, receiver(s), marker, focus, and a free text (See Figure 7). This

modeling eases at the management and indexing of dialogue by the system. For instance, filters may be applied to analyze the history of a dialogue, e.g., filtered along a given speaker, or a specific type of marker. But it also opens the way for its processing by software agents.

5 Prototype

The outputs of the design phase are: interaction diagrams, class diagrams, class and entity relationship model for the database. We then created a fast prototype in order to evaluate the appearance and usage. In the following we focus on the prototype interface corresponding to step 3 of the game, i.e., negotiation between players. It is indeed a central part of the game, when the shared knowledge is jointly negotiated and built. We would like to emphasize that we try to balance a support for some structure of the text of the dialogue and also sufficient fluidity.

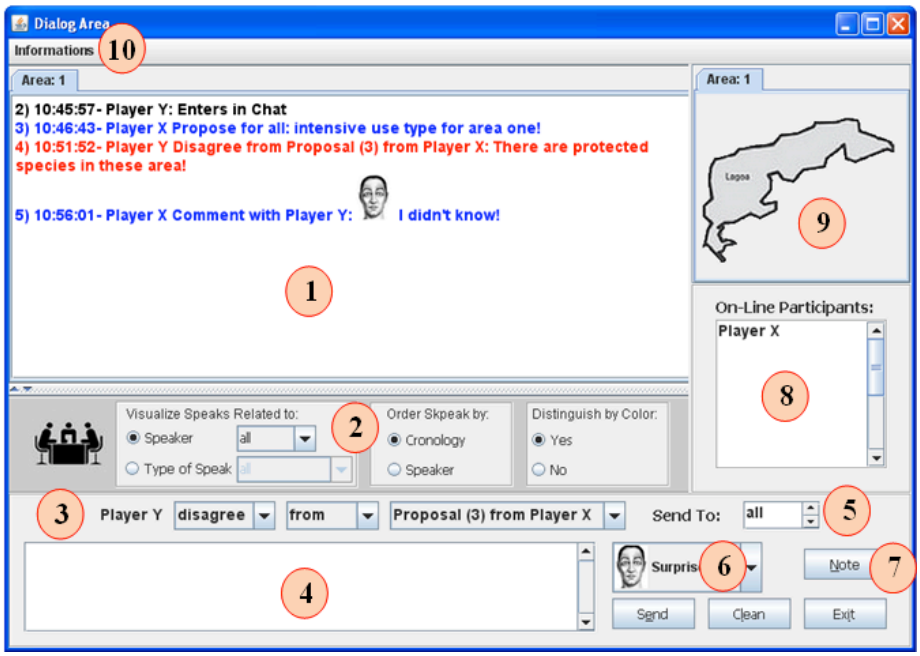

Fig. 8. Prototype interface for the negotiation step.

The prototype user interface (see Figure 8) includes an area (Fig. 8.1) for the history of messages exchanged. The area (Fig. 8.2) 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 (Fig. 8.3) contains options for semi-structure of messages via rhetorical markers for intention (e.g., disagree). The area (Fig. 8.4) is for writing the actual contents (text) of the message. The area (Fig. 8.5) allows selecting the recipients (unique or multiple) of

the message to be sent. The area (Fig. 8.6) 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 [16], which generates iconic facial expressions of emotional states from the virtual manipulation of the muscles of the face.

There is an area (Fig. 8.7) for personal annotations, allowing the user to make and record personal notes during the negotiation.[12] There is also an area (Fig. 8.8) with the list of participants and their roles that, in accordance with the C3 (Communication, Coordination and Cooperation) model [20], is a form of support for coordination. There is an area (Fig. 8.9) with the view of the object negotiated and its geo-processed representation. Last, menus (Fig. 8.10) are available with 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 phases, the system use and help.

6 Conclusion

Our current prototype is under construction and will be tested with players. We are planning to use epistemic tools proposed by semiotic engineering [17] to test and evaluate the acceptance and usability by users as well as practical experiences during game sessions. The members of the project are also currently working on other parts of the computer support version 2 for the game, and on introducing artificial agents, for assistance, as in Simulación [3], and for replacing human players (park manager or players), as in ViP-GMABS [4].

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[12] This need was observed during test with players (see Figure 2).

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