Ecole du Louvre
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École du Louvre
8 - 12 septembre 2003

OZANNE PROJECT : A FRAMEWORK FOR INTERACTIVE DISTRIBUTED GUIDED TOURS OF HISTORICAL SITES

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ENIB, France - www.enib.fr/li2

« Acte publié avec le soutien de la Mission de la Recherche et de la Technologie du Ministère de la Culture et de la Communication »

Abstract

In this paper we propose a new metaphor of information retrieving, usable in foundation heritage management and publishing. Based on the net, the user is able to participate in virtual guided tours, sessions of conference-like. A human expert will be the guide for all the connected users. He will use different media (sound/video) to communicate; the members of the guided group will communicate between them through chat sessions.

Each virtual tourist will be autonomous in its 3D world movements but he will receive audio/video information or other multimedia documents or 3D objects, eventually autonomous entities placed in its 3D virtual universe, from its guide.

The guide is able to suggest to its group of tourists some interesting viewpoints during the tour. More, he is able to augment the database, particularly the associated behaviours of the entities. It is enough to analyse the entities in a scene and to attach them some new behaviours. For example, he can place in the environment some virtual guides, and the users will interact with them. These virtual guides recognise some keywords or intentions; i.e. if a tourist spends some time near a specific place, the virtual guide will initiate a dialog upon the place's history. The user is able to cancel the dialog with a virtual guide and return to its group.

The application is based on the ARéViJava (Atelier de Réalite Virtuelle) platform, developed in our laboratory.

Keywords: virtual reality, virtual heritage, multimedia, SGBD, distributed environment, perception, autonomy.

1. Introduction

The application of virtual reality to foundation heritage becomes more and more important with the augmentation of computer power. It is now possible to visualize complex ancient sites (Rebelo, 1999; Frolish, 2001; Gaitatzes, 2000) and to explore them. In this aim some tools are used: 3d interactive modellers (for example 3DS MAX) and graphics libraries (Performer, OpenGL) (Rohlf, 1994). It becomes possible to compute in real time realistic images.

Different ways are used to broadcast the virtual sites. One of them consists to burn CD-ROM. Everybody is able to visit the sites with its own PC. But the illusion of immersion in a virtual world may be increased in a dramatically way by the use of a CAVE-like projection system (Cruz-Neira, 1993). Stereoscopic images are rear-projected onto walls to provide a panoramic display. Internet allows broadcast a virtual world around the world. The easiest way is to download the files which represent the site before to locally display them. Pape et al.(2001) propose a framework to share 3d objects (shapes, aspects, behaviours and states) through the net. With this framework, the users can explore a site in collaborative way and follow a human guide.

Usually, the sites are not inhabited or the virtual humans are only artefacts, implemented by static sprites or static 3d geometry (Magnenat-Thalmann, 1997; Attardi et al., 1999). Ulicny (2002) propose to simulate crowds to increase the realism of the ancient sites: they use a rewriting rules system to describe the behaviour of each virtual human. The interaction between the virtual humans is managed through events.

To describe ancient sites through geometrical data and behaviors of characters isn't always sufficient to well understand these sites. Other information has to be added: multimedia documents (linked with some elements of the 3d scenes) or guides, real guides represented in the virtual world by an avatar and a streamed voice and even virtual guides. Other authors (Milbank, 2003) propose to use XML language to access to useful information.

We have implemented a framework for virtual guided tours by augmenting the classical approach of 3D models with the autonomous entities. By sensing its environment in order to complete their objectives, the entities will increase the realism of the user immersion.

First, we'll present guided tours in an inhabited world. These tours may be eventually distributed on the net, and the guide is a domain expert. Next, we'll populate this world with autonomous entities. One of these entities will be the virtual guide. Finally, we'll talk about some of the implementation aspects.

2. Distributed guided tours

One of historical sites characteristic is their high complexity. This is why only a few part of the historical information is still visible and comprehensible. In order to assure a more direct access at the historical knowledge to the great public, we have chosen to adopt the 3D model guided tour metaphor. The use of virtual reality permits a multi-sensorial immersion of the user. More, the user has the possibility to interact with its virtual environment, and so to better understand it.

The Ozanne project, based on the ARéViJava, uses a such of metaphor and we propose a guided tour of an old part of Brest harbour, in 1810. The buildings modeling was made following the original raised maps from that time of Brest (2001). The textures were obtained from photos of the same maps.

2.1. Use-cases

In the Ozanne project it is possible to adopt several discovering modes, i.e. a personal mode or a distributed one; in the latest case the users are connected on the Internet and may participate in some guided tours.

2.1.1. Local application

The user is using the application for freely visiting the 3D universe. In this case, he will discover informations linked with specific places or objects; this approach is a classical one, being used on many of multimedia CD's. But the 3D space permits its users to immerse within it, by manipulating objects and by interacting with some animated entities in the environment.

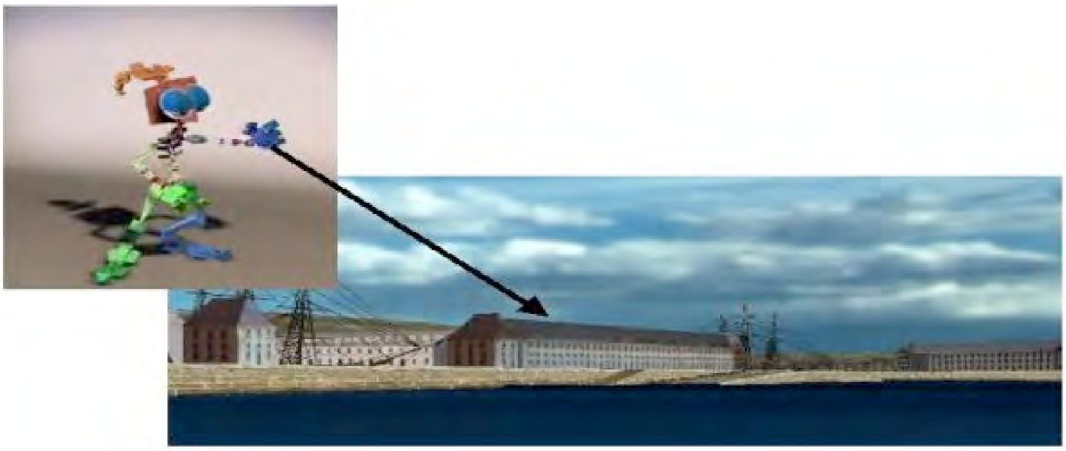

Fig. 1: Penfeld (old Brest region) view with ships.

2.1.2. Local version with DB connection

A first augmentation of the local version of Ozanne project is the web connection. The associated links to the universe's objects permit the user access to a multimedia database. This information: images, texts, sounds, videos or 3D objects may be introduced into the universe and make them persistent by the user, in order to improve the information associated to its application. The database and the links are subjects of permanent updates. This update's mechanism permits the user to obtain permanent evolving information, in the rhythm of database's changes.

Fig. 2: The application permits DB connections.

2.1.3 A virtual tour

Users are in a scheduled meeting with a domain expert. The guide proposes to its group some guided tours. The user will connect to one of this proposals. He/she will conserve its autonomy in 3D movements during the tour, but will be able to receive multimedia informations (videos, sounds) and to participate into *chats* sessions, in order to exchange some information with other users.

More, he will be able to demand more information to its guide. For this, the guide will send some multimedia or even 3D objects. The received 3D objects can be autonomous entities, placed in user's environment or in some other virtual museums, from within the application.

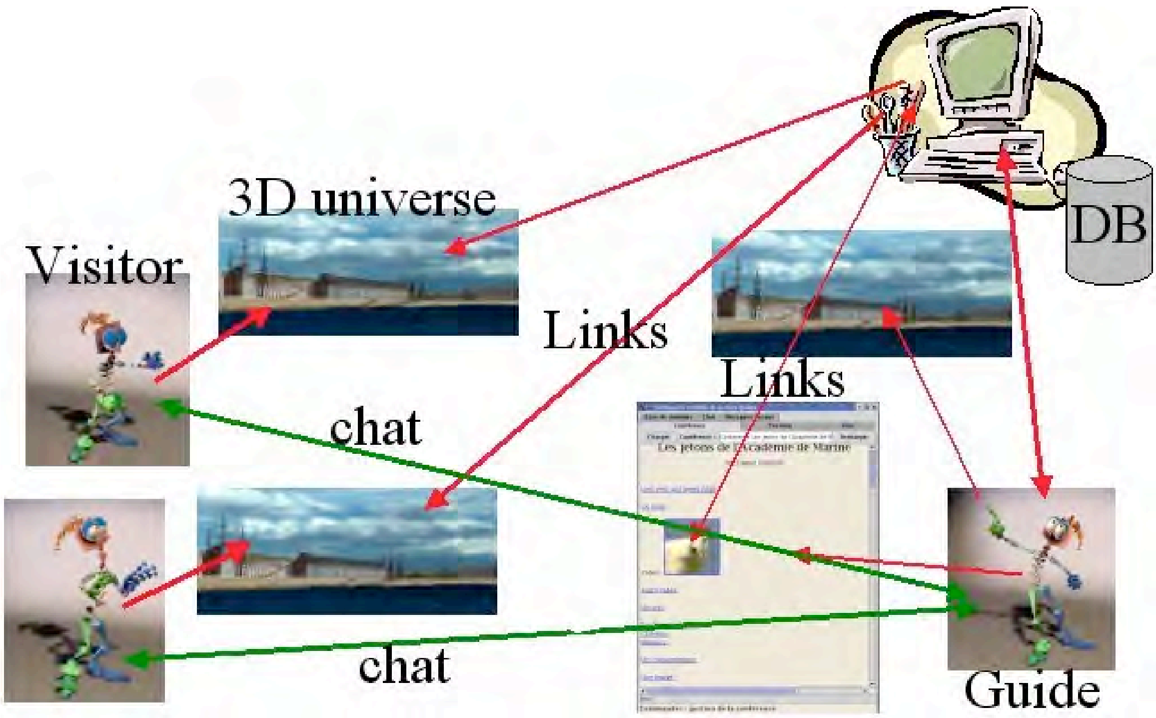

Fig. 3: The distributed application's architecture.

2.2. The real guide

In the last use-case, the guide's role is fundamental; together with the database administrator, he will continuously improve the information.

For preparing its conference, the guide need to edit a HTML document which will permit him/her the rapid selection of informations, eventually from the database, used in its presentation. Here, the links to the images or the keywords from the web page will be interpreted by the application as SQL requests for access to the database.

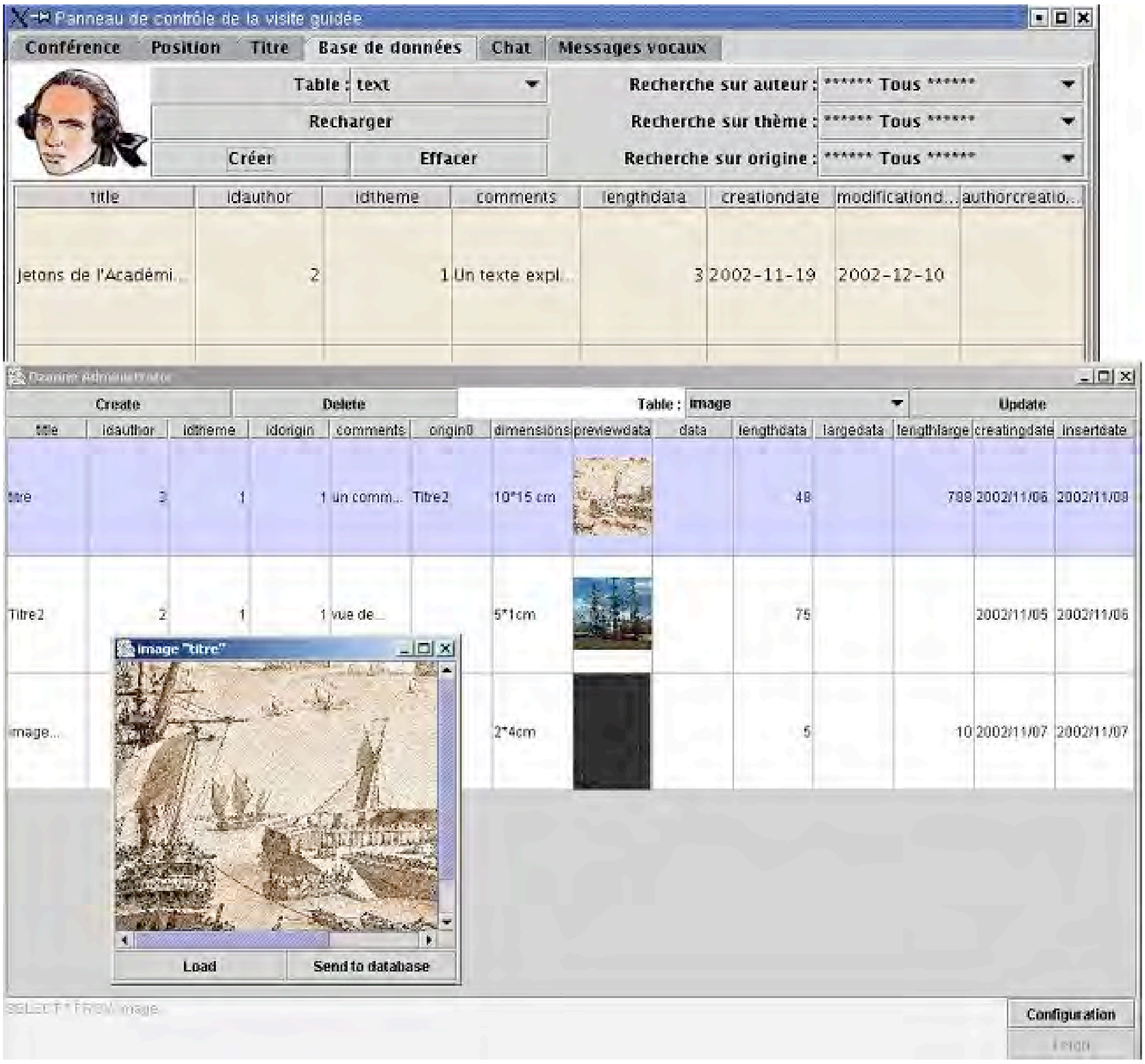

Fig. 4: Augmenting the database.

Fig. 5: The conference's text and its link through DB.

Fig. 6: The guide's control panel.

3. Augmenting the virtual tours

In order to realise the tourist immersing in the *spirit* and *atmosphere* of the historical site we have follow the *immersion*, the *interaction* and the *autonomy* principles (Tisseau, 2001).

3.1. Presence through senses

The principles of *immersion* and *interaction* corresponds to the sense of *presence*; giving the impression of being there to the user which is able to interact and modify its environment.

3.1.1. The immersion

The user's setting in situation was realised based on its senses, particularly on its visual and auditive ones. For this, we have introduced the ***virtual environment*** as a union of all ***perception*** and ***emission*** fields of the entities, which populate a multi-dimensional ***informational space*** (Popovici, 2003). These are generalizations of ***medium***, ***nimbus, aura***, and ***awareness*** notions as they were introduced by Benford (1993). We were inspired by the human perception mechanisms (Hefco, 1997), as Herrero did (2002, 2003), and we adopted a fuzzy approach. The virtual environment evolution is based on ***informational links*** established between the entities that populate the environment. These entities are looking for carrying out some specific tasks in order to achieve their objectives, in other words, they interact with their environment and with each other.

3.1.2. The interaction

Here we have to put on work the constructivism of Piaget: we learn better by making ourself. For this, we have to permit to the user not only to observe but to *act* on the environment. In general, this action will be an object movement, for example by pressing a lever to making work a crane.
The interactions between agents are of cause-effect type: any change of the agent's state represents a possible cause and may be followed by a ***stimulus*** emission. In our approach, the stimulus is a container that conveys information regarding the agent state. At the same time, it is the object of the agent's perception (see figure 7).

3.2. The entity's autonomy

But, because an environment without its users seems like an empty theater stage waiting its *actors*, we need to taking into account yet another principle in order to transform this user-oriented world, the principle of *autonomy* of some of its components.
The environment is inhabited by entities which live their lifes, each with its own goals. These entities are autonomous in the measure of their adaptability to their dynamic environment, accordingly with their *psychological* profile and objectives. For this, each entity has to be able to *perceive* its environment, to *decide* and *react* accordingly.

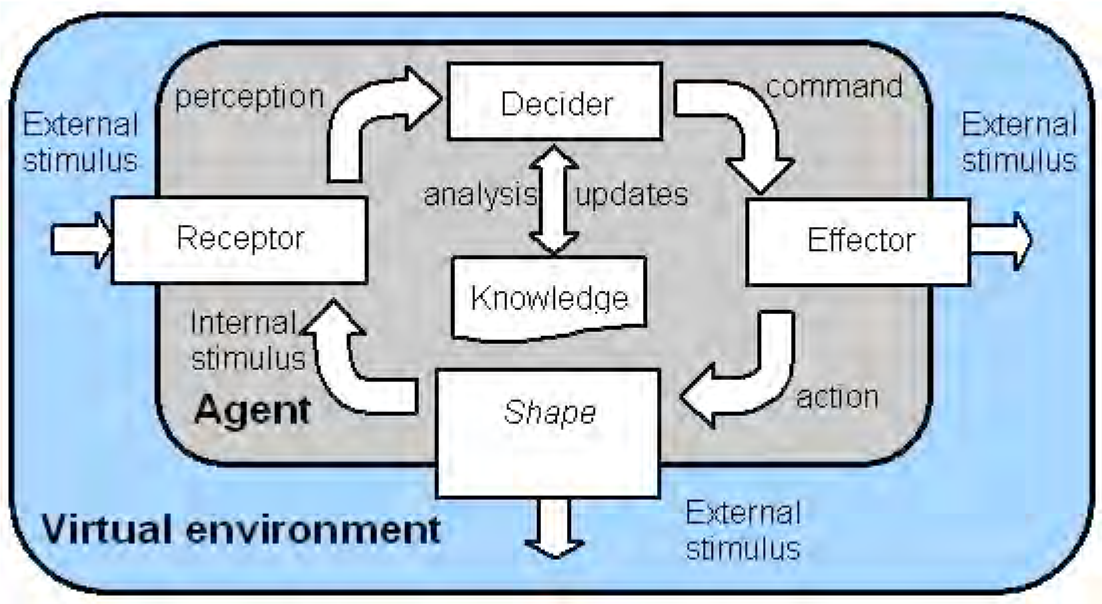

Fig. 7: Interaction between the agent's components and environment.

During the virtual agent's life, the agent's state is given by the values of its attributes that are the generators of its informational shapes. The shapes' variations are produced by the effectors and are perceived by means of the receptors, under the form of stimuli.

These modifications may be initiated by the reception of an external stimulus such as a change in environment followed by emission of internal stimuli. The receptors generate perceptions based on these stimuli. The perceptions, in turn, will activate the decisional component, which will send orders to the effectors.

In order to evolve in the virtual environment, an agent uses its world model. This model is internal to the agent and is situated within agent's knowledge. Many categories of information such as the agent's objectives, abilities, perceptions, and/or sentiments are modeled and stored in the agent's knowledge, too.

3.3. The virtual guide

The context in which the agents exist provides a framework that defines what their objectives should be and will give the sense of the agent's actions within it. For this, we invoking the *virtual theater* metaphor (Popovici, 2002), and we create environments which are populated with autonomous characters. These characters, according to their roles, may changing replicas between them, and based on their structure are able to *feel* the environment and to *react* at environment's changes. Like in the classical theater, we make use of the spectator, the actor, and the stage manager as the author, as main roles of virtual agents.

From this perspective, the historical site's environment is populated by virtual agents which perform some activities in specific places, the *virtual theater actors*, by the visitors which can interact with the environment and its habitants, the *spectators in the theater metaphor*, and the real guide, which is *the stage manager*, responsible with the site organisation and the tour advancement.

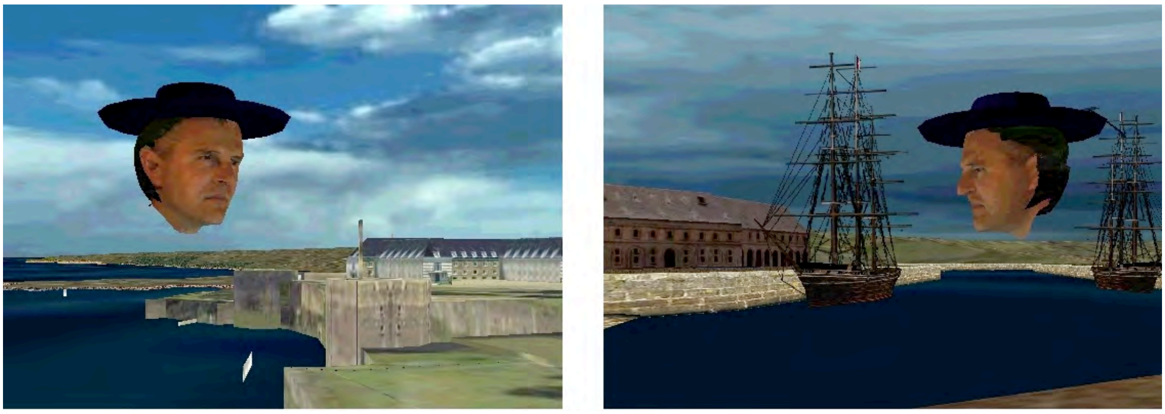

Fig. 8: Screenshots with virtual guide – old castle and harbour sites.

As in any real guided tour, it is possible that some of the tourists to temporary quit their group to get some other see sites. For this, the real guide, a domain expert, can place in the environment some virtual guides and users will interact with. A virtual guide is basically a virtual agent, so an autonomous entity in our vision, which have as objective to assist the user in its visit. More, he is able to recognize some keywords or intentions; i.e. if a tourist spends some time in front of an historical artifact, the virtual guide will initiate a dialog upon. Based on the keywords he recognizes, he is able to browse the database and try to answer to the user's questions.

The *scenario* the virtual guide has to follow contains a sequence of interesting hint points in the tour without being constraints. Doing so, the user is free to choose its tour having an expert behind, too.

The user is able to cancel the dialog with its virtual guide and return to its group.

4. Implementation

As we have already said, Ozanne project is based on a software platform developed in our laboratory (Laboratoire d'Ingénierie Informatique)□ **AréViJava** (Tisseau, 2001). ARéViJava is a software platform designed for developing virtual reality applications. The core is based on Java™ language. As graphical render we are using the Java3D API, based on OpenGL or DirectX and J3DFly for graphical objects persistence and navigation. In this software components context, our platform realize the multi-agents simulation.

Ozanne use **ARéViJava** for virtual universes loading, for navigation in this 3D space and for entities animation. More, Ozanne permit to its users DB connections and information publishing.

In order to simplify the programming aspect of developing, we are currently implementing an interactive virtual universes editor: ARéViJava Authoring Tool. Using it, the user is able to generate XML files which specify the universe, language and platform independent. This file, is then analyzed and translated into Java™ language. Only the entities behaviors are necessary programmed and then loaded into application.

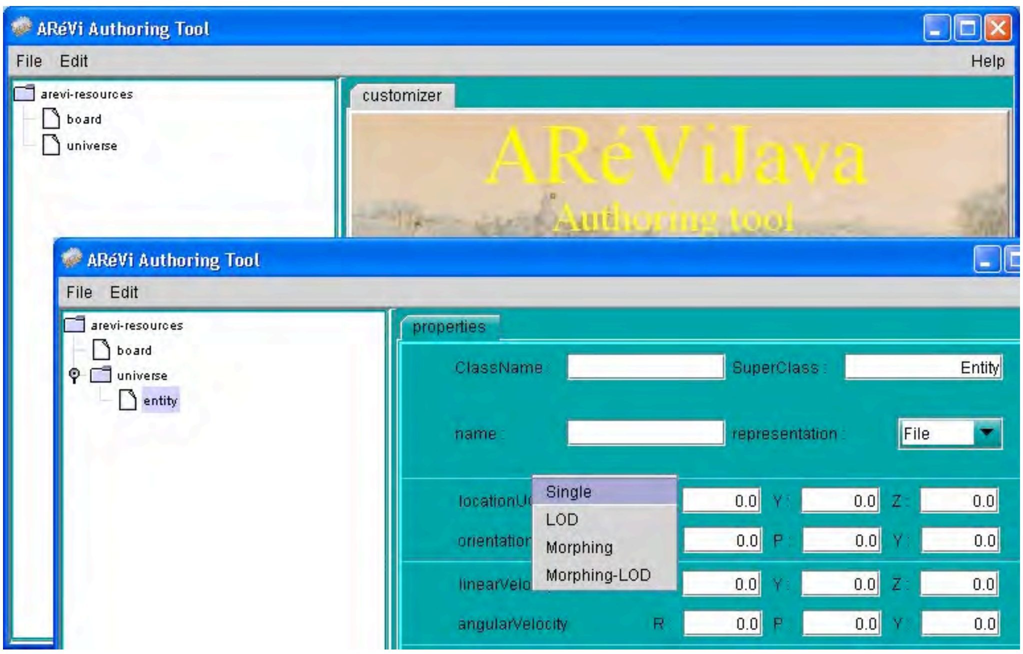

Fig. 9: Editing panels of ARéViJava Authoring Tool.

5. Conclusions and future works

We propose an environment for distributing heritage using virtual reality. This technology allows to access complex and dynamic information. By using the autonomy of some virtual environment entities, the historical space becomes inhabited, so more realistic. Other aspects as multimedia or network distribution were implemented based on Java language facilities. The application is based on the ARéViJava (Atelier de Réalité Virtuelle) platform, developed in our laboratory.

Our future interests are concerning the believable behaviours module and cooperative aspects.

6. Acknowledgements

Thanks are due to the Raised Map Museum (Musee des Plans Reliefs) from Paris and to Alain Boulaire, the organiser of the exhibition “Brest au temp de l’Académie de Marine” for faciliting the access to the original scaled-model of Brest harbour.

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