GULLIVER PROJECT: PERFORMERS AND VISITORS

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Abstract – This paper discusses two projects in our research environment. The Gulliver-project, an ambitious project conceived by some artists connected to our research efforts, and the Aveiro-project, as well ambitious, but with goals that can be achieved beause of technological developments, rather than be dependent on artistic and 'political' (read: financial) sources. Both projects are on virtual and augmented reality. The main goal is to design inhabited environments, where 'inhabited' refers to autonomous agents and agents that represent humans, real-time or off-line, visiting the virtual environment and interacting with other agents. The Gulliver environment has been designed by two artists: Matjaž Štuk and Alena Hudcovicová. The Aveiro project is a research effort of a group of researchers trying to design models of intelligence and interaction underlying the behavior of (groups of) agents inhabiting virtual worlds. In this paper we survey the current state of both projects and we discuss current and future attempts to have music performances by virtual and real performers in these environments.

1. INTRODUCTION

There are many ways to have (real-time) art and music performances in virtual worlds. Here we use 'virtual' to stand for distributed 2D or 3D environments where visualization of environment and activities is an important issue. Many examples of these environments exist. They have developed from chat or game worlds, from computer supported cooperative work environments, teleconferencing environments, etc. In these environments human-like human-like objects have been introduced, sometimes standing for a visitor and controlled by the visitor, but also sometimes standing for a virtual person that has been introduced in the environment to perform and visualize a certain task, in interaction with one or more visitors.

We have developed several virtual worlds. One of them is the virtual theatre, as part of our Agents in Virtual Environments (Aveiro) project. The theatre is a virtual 3D VRML copy of an existing theatre. Visitors can walk around, explore the building and the information that is offered. It includes a 3D embodied agent called Karin, who can answer questions about actual performances and their performers. Since she is accessible on WWW, people can use this system in order to get up to date information.

The second environment we mention is the Gulliver environment. While the theatre environment has the aim of modeling multi-modal human-agent and agent-agent interaction in the context of non-entertainment situations (information services and transaction, teaching, collaborated work, etc.), the Gulliver project aims at creating an environment where visitors can get involved in performances and where the distinction between performers and audience disappears. While the theatre project has already investigated different kinds of interactions and serves the role of a laboratory for research, the Gulliver environment has only been modelled in virtual reality in a rudimentary way and now waits for performers and visitors to interact. For that reason much of our current activities are devoted to issues that deal with generating behavior in virtual reality, with modeling of musicians based on music scores, and with modeling autonomous behavior of embodied agents that have to interact with other virtual agents and human interactors.

In the next section we have a few words about the origins of the Gulliver project. We discuss the theatre environment in section 3. Section 4 is on the state of the art of performances by virtual actors. Interesting issues are the possibility to have a actor's behavior be influenced by the behavior of other players, the reaction of an audience (virtual or real) or, for example, a conductor trying to lead the performance. Section 5 concludes this paper.

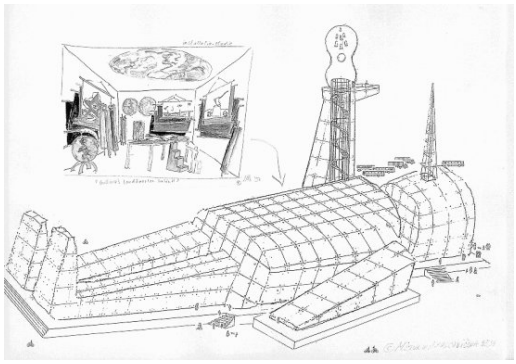

Figure 1. Design of the Travelling Gulliver

2. THE GULLIVER PROJECT

The Gulliver Project of the artists Matjaž Štuk and Alena Hudcovicová aims at building a variety of virtual and real objects that are connected through Internet and that can be visited by the audience, both in reality and in virtual reality environments, preferably by using World Wide Web. The project, as perceived by the artists includes the realization of "Gulliver's Traveling Museum of Living Art", an example of migrating architecture. It is a transportable building made out of light construction material, with transparent walls and designed as a human body that represents Gulliver, the hero of Swift's "Gulliver's Travels", lying on its back (Fig. 1). It is a large construction, visitors can enter Gulliver, see expositions, go to a museum shop or a restaurant, interact with art installations, etc. Gulliver's right arm is meant to be a panorama tower. The arm contains an elevator and stairs. On the hand's palm is clockwork with a carillon and with colors that change according to the time of the day.

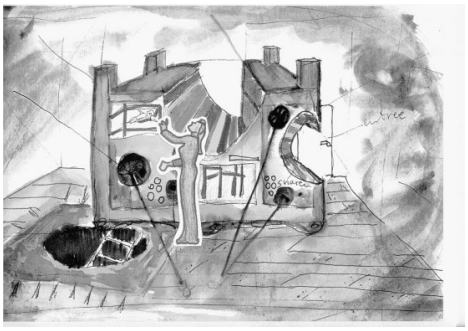

Figure 2. Design of the Kitchen

Part of the museum is 'Gulliver's Kitchen' (Fig. 2). This kitchen is meant to allow visitors of the museum to change the environment using multi-modal interaction. Visitors can use gestures or speech utterances to change color patterns on Gulliver's skin or to orchestrate the carillon in the palm of the right hand of Gulliver. It is assumed that the traveling museum and has some counter parts. The main counter part is a virtual Gulliver (Fig. 3) that is accessible through Worldwide Web. Wherever the physical Gulliver appears it should draw the audience's attention to the virtual Gulliver. Moreover, the audience should be able to connect to the virtual Gulliver and experience what is going on there through the 'Kitchen'. In this paper the emphasis is on how we can use this environment, building on research in the Aveiro project and on projects performed by other research groups, to have performances by interacting autonomous agents and visitors.

3. THE AVEIRO PROJECT

As mentioned, in our AVEIRO project we work on interacting embodied agents in virtual environments. For that reason we built a laboratory-like environment representing a theatre in our hometown. In this virtual theatre we can find the usual locations: entrance hall, information desk, coffee stands, performance halls, stairs, lounges, stage, etc. Users that access the WWW-

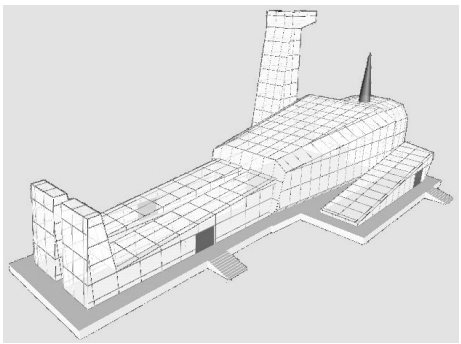

Figure 3. View on Virtual Gulliver

page of the virtual theatre can visit the locations, explore the building, etc. The environment contains books, posters, paintings, etc. on which visitors can click to obtain more information, to hear music or to activate certain events. E.g., clicking a poster will give more information about the performance displayed; clicking a TV screen activates a video preview of a performance. Using the mouse simple melodies can be played on a virtual keyboard. A seating map is available in the environment on which a user can click to get transported to the corresponding chair in the main performance hall. On stage is a simply animated piano player and a slightly more advanced dancer that can perform baroque dances on stage corresponding to music that is played. Standing behind an information desk is Karin, a 3D animated avatar that can enter into a dialogue with the visitors about performances and performers. Karin is in fact the interface between the visitor and a database containing information for the current season. Questions can be asked in natural language and Karin uses visual speech to articulate her answers. See [5] for a survey of the virtual environment.

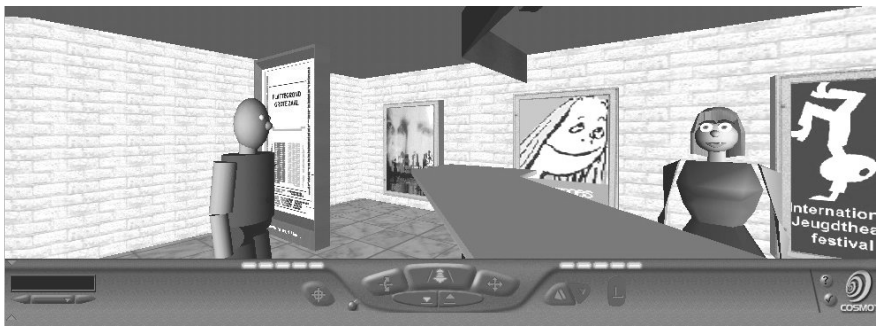

Figure 4. Embodied Visitor visits Domain Agent Karin

In recent years various versions of this environment have been investigated. These versions included the introduction of other agents, e.g., a navigation agent, the introduction of speech access, the introduction of an agent platform and allowing multiple users to enter the environment using the DeepMatrix system [6]. Fig. 4 displays a situation where a visitor represented by an embodied agent approaches the information desk. Experiments are going on in which Karin also displays natural gaze behavior during her interaction with a visitor.

4. VIRTUAL AND AUGMENTED REALITY PERFORMANCES

In sophisticated systems that have become known as interactive theater, interactive cinema or interactive story telling, multiple players connected by a network can take part in a performance as actors. The performers are represented as avatars in a virtual environment and with motion capture systems (cameras or sensors) avatar movements can be made to reflect player movements. Gestures, touch and facial expressions of the players can be tracked and given as input to the avatar's animation algorithms. With the help of speech technology the player's emotion and utterances can be interpreted. Plays can have branch points and due to the interactions particular branches can be chosen. The virtual stage may have actors that are provided by the theater and that show some autonomous behavior according to some action patterns. They have a role, but the way they perform this role is determined in interactions with the human player and its alter ego avatar. See Takahashi et al. [8] for a recent example of interactive theater.

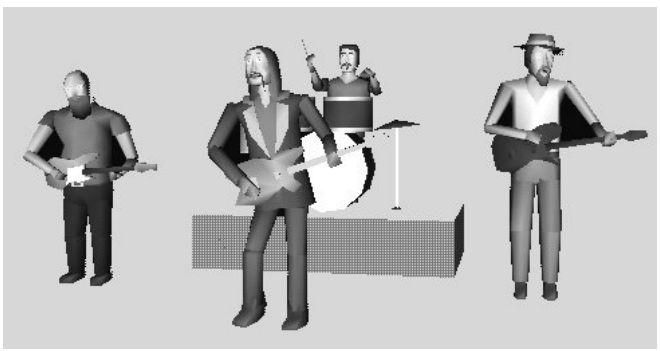

Figure 5. VRML Band (Dennis McKenzie, Geometrek)

There are also several examples where the actors are musicians. In its most primitive form we have a band of virtual musicians just playing along. There is no variation and there is no interaction between the musicians or between the musicians and a possible audience. See Figure 5 for an example. More interesting are examples where we can provide the musicians with different scores and there is an automatic mapping from these scores to audio and corresponding animations. See e.g. Figure 6, where a virtual drummer is displayed that is animated from a Midi-score that is provided as input [Kragtwijk]. In this project, performed at our research group, we are also experimenting with the possibility that drum movements of a human player are detected by sensors and transformed to animations of the virtual drummer. In September 2001 a concert was organized where we asked two student bands to replace their real drummer with the virtual drummer (see Fig. 7). The audience was asked to wear 3D glasses (Fig. 8).

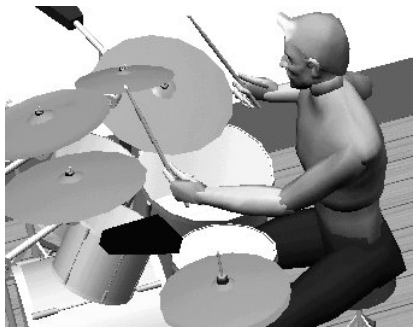

Figure 6. Virtual Drummer

Figure 7. Virtual Drummer in Concert

There are several other projects that we would like to mention. The Diva project [4] allows a visitor, wearing a data dress suite, data gloves and a sensor-mounted baton, to conduct an ensemble of animated players holding different musical instruments. The conductor can lead the tempo and direct the playing of particular instruments. Clearly, animations of musicians and instruments have to be done in real-time, reading the movements from an animation file, synchronized with the music.

In the VirJa (Virtual Jazz Session System) project [2] a virtual jazz piano trio is modelled (see Fig. 9). The aim of the project is to simulate the interaction between human players (using musical sounds and visual cues). The system enables virtual musicians to listen to other virtual and human players and to see each other's bodies and gestures. MIDI data of each player's performance is received by the other players to react upon. The gestures of he human players are recognized by a real camera, those of the virtual players by a virtual camera. In [Walker] a model for musical improvisation is developed, based on conversational turn-taking, that allows the collaboration of different players using a shared platform.

Two other projects that we like to mention here are the virtual piano player [1], a project aimed at modelling the interaction between a virtual piano player and the virtual piano, and some projects [7] on computer animated opera singers or jazz musicians.

Figure 8. Audience During Concert

5. CONCLUSIONS

In this paper we surveyed the developments in our projects on the design of virtual interest communities, the way people can represent themselves in these communities and how they

can explore and interact, not only with each other, but also with community agents with task and domain knowledge. In particular we looked at the possibility to have collaboration between visitors and domain agents. In particular we looked at the possibility to have joint performances of real and virtual musicians. Modelling autonomy in virtual actors is one of our main concerns in the near future.

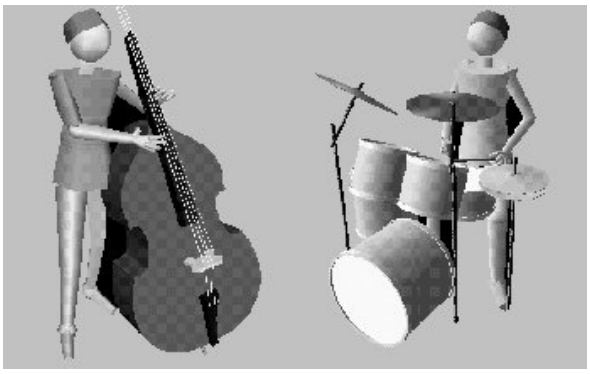

Figure 9. Jazz Musicians in the VirJa Project

Acknowledgments

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