

Using an Edutainment Virtual Theatre for a Constructivist Learning

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Abstract: In this paper we present the first results of a research carried out using a Virtual Theatre by which users can learn different subjects in an enjoying and engaging fashion. In particular, thanks to the software Face3D users can model virtual actors as well as create/elaborate and attend educational performances, “constructing” their own knowledge. The stage is one of the Graphical User Interface of the software and virtual actors are three-dimensional heads (“Talking Heads”) endowed with facial expressions and voice. The scripts are created by students, too. Results on learners’ satisfaction in using this kind of Virtual Theatre as educational tool in classroom situations have been very positive.

Keywords: Learning, Constructivism, Virtual Theatre, FACS, Talking Heads, Edutainment

Introduction

In recent years, a number of storytelling systems in which the user can be a scriptwriter, actor, director or spectator, have been realized (Bohlin, Nilsson, & Siverbo, 1998; Popovici, Serbanati, & Gerval, 2002; Cavazza & Donikian, 2008). In many cases, these systems have been called “Virtual Theatres” (Adamo, Bertacchini, Bilotta, Pantano, & Tavernise, 2010), and their main characteristic has been the employment of pedagogical agents able to promote learning. In particular, in literature, an increased motivation, a stimulation of particular didactic activities, and an enhanced flow of communication have been identified as agents’ primary educational benefits (Bourgonjon, Valcke, Soetaert, & Schellens, 2010). In this view, in virtual environments users can enjoy themselves having an active role, exploring/creating/elaborating the content and learning by doing and/or playing. Therefore virtual space has become not only a tool for representation but also for action and interaction, thus integrating constructivist theories as well (Bednar, Cunningham, Duffy, & Perry, 1995; Bilotta, Gabriele, Servidio, & Tavernise, 2009). This divulgation of educational contents in an entertaining way has often been indicated using the term “Edutainment”, that is the result of the mixture of the words “education” and “entertainment” (Pantano & Tavernise, 2009). Moreover, regarding the learning of different subjects, the Talking Heads of Leonardo da Vinci and Albert Einstein have been modeled and animated for the realization of an enjoyable science lecture, as well as Confucius, Buddha and Pythagoras for the explanation of a philosophical topic (Adamo et al., 2010).

Regarding synthetic actors in Virtual Theatres, since the pioneering work of Parke (1974), the Computer Graphics community has tried to reproduce realistic facial movements for synthetic actors in a 3D environment. Research in this area has implied the development of many techniques for the improving of the physical features (shapes, colours, textures) of the actors, as the deformation of limbs during motion or facial expressions to be performed simulating emotions. Extensive studies on basic facial animation have been carried out, and several models have been proposed, mainly falling into two major categories: those based on geometric manipulation (i.e. parameterization, muscle-based models, and so on) and those

based on image manipulation; each realm comprises several subcategories (Noh & Neumann, 1998). Regarding parameterized manipulation, “Talking Heads” consist of polygonal surfaces which connect vertices moved by control parameters, and most facial expression models are based on Ekman and Friesen’s Facial Action Coding System (FACS) (Ekman & Friesen, 1978). FACS is a coding of the movements of the facial muscles, and in particular of a set of basic human expressions, based on an analysis of facial anatomy.

In this paper we present the first results of an experiment with an Edutainment Virtual Theatre by which, through the writing of texts and the construction/manipulation of talking heads, it is possible to engage students in an immersive and entertaining learning. Virtual actors are constituted by parameterized actors, which perform famous personalities in different fields (i.e. History, Science, and Philosophy). In section 1 the general features of the software and its three Graphical User Interfaces (GUIs) are introduced. In section 2 the creation of virtual actors and scripts is analyzed, and in section 3 first results of Virtual Theatre laboratories are presented. Conclusions are presented in section 4.

1. The Virtual Environment

The software Face3D has been ideated and realized by Evolutionary Systems Group (ESG, <http://galileo.cincom.unical.it/>) at University of Calabria (Bertacchini, Bilotta, Cronin, Pantano, & Tavernise, 2007). It consists of three GUIs: Face3DEditor for modelling virtual heads, Face3DRecorder for animating them, and Virtual Theatre for the performing of the modelled and animated agents.

In Face3DEditor a generic parameterized head model has been realized for being adopted as starting point for the generation of each Talking Head and it is constituted by a low number of vertices (131) that can be moved in order to easily create a new face. A background image (photo or drawing) can be inserted as reference image (Bertacchini, Bilotta, Pantano, Battiato, Cronin, Di Blasi, Talarico, & Tavernise, 2007). The Talking Head can also be completed adding textures realized in other Computer Graphics software (Figure 1).

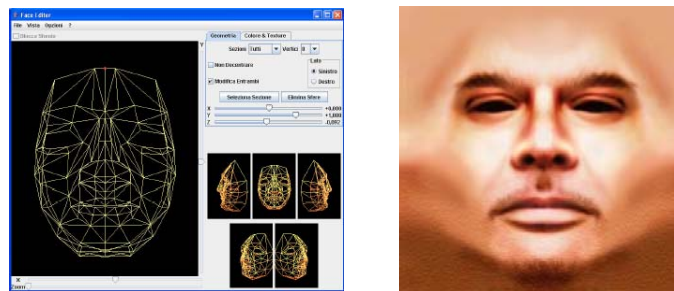


Figure 1. Face3DEditor and an example of texture

A main characteristic of this GUI is the possibility to insert the function “noise”, inspired by Perlin’s “responsive face” (Perlin, 1997), that allows a random movement of head and eyes, providing a more “human” appearance to the agents.

In Face3DRecorder (Figure 2) users can animate the Talking Head synchronizing facial expressions with pre-recorded files of speech. In particular, the user can select eight emotions (neutral, anger, surprise, sadness, fear, joy, disgust, attention) that have been standardized using FACS. Recognition tests of the implemented expressions have also been carried out (Bertacchini, Bilotta, Gabriele, Servidio, & Tavernise, 2006).

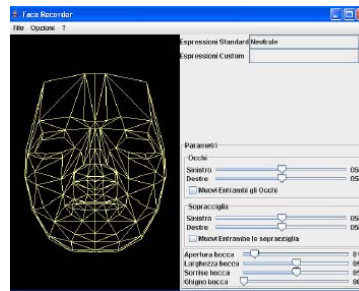


Figure 2. Face3DRecorder.

However, since human facial expressions are characterized by very rapid changes, Face3DRecorder allows both the creation of new small alterations in these emotions and the set of their speed.

In Virtual Theatre (Figure 3) it is possible to import the animations of the Talking Heads created in Face3DRecorder, as well as to create and to manage the performance of different virtual agents.

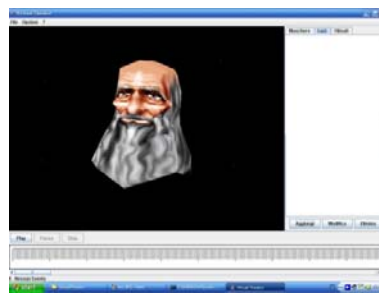


Figure 3. The “Virtual Theatre.”

At the moment the only available version of the Face3D software is in Italian, but a multilingual version will be realized; moreover, it will be distributed to accompany a publication for schools.

2. The performance in the Virtual Theatre

Different agents can be created according to the contents; for example, characters like Albert Einstein or Pythagoras (Figure 4) can be very useful for the comprehension of their theories.



Figure 4. Albert Einstein and Pythagoras' Talking Heads

Talking Heads can also be characters of ancient comedies or tragedies, for the teaching of Greek and Latin works. In fact, the user can model the masks created by the Greek author Menander (342-290 A.C.) to represent characters of many comedies (Figure 5). Moreover, also characters modeled on the basis of a picture of a “real” person can be realized.

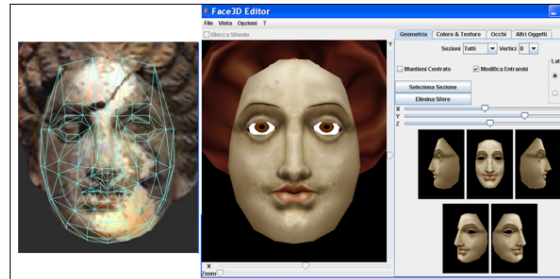


Figure 5. An example of modeling on the basis of a Greek mask picture.

Scripts can concern different subjects: starting from a given text, they can be elaborated by learners in creative writing laboratories or, in some cases, by teachers. Regarding the opportunity of interaction, students can also be a part of the cast, performing “live” during the virtual show. In particular, students have to follow different steps: choose the lesson to be represented in a given course, organize the script of the story, and then use the Face3D software to model/animate the faces of the characters. Finally, by the GUI Virtual Theatre, they can create and participate to the performance.

3. Virtual Theatre Laboratory

We have tested learners’ satisfaction in using our Virtual Theatre as an educational tool in classroom situations; in particular, a laboratory at a grammar school in Cosenza (Italy) has been carried out. The sample was constituted by 40 children (20 male and 20 female) between 9 and 10 years old, belonging to two different classes, with a basic knowledge on personal computers. Their tasks have been: the choice of the topic in the “Foreign Language and Culture” course to be represented; the arranging of the script of the story in a group writing laboratory; the recording of the dialogues; the modeling of the characters on the basis of the content to perform; the synchronization of the recorded files with the facial expressions; the participation in the performance.

The following materials have been used: a questionnaire on students’ data (age, sex, class) and familiarity with the use of personal computers; the Face3D software visualized on personal computers; the Questionnaire for User Interface Satisfaction by Lund (2001). The hypothesis is that the Face3D software, and Virtual Theatres in general, can be an effective device for educational aims, because more students are involved in the construction of their learning, more they learn. In each class the Virtual Theatre has been presented and a list of the tasks has been provided. Each student has compiled the data questionnaire and then has started a six-hour laboratory. Finally, each subject has compiled the Questionnaire for User Interface Satisfaction, which measures users’ opinions on software utility, easiness of use and learning, satisfaction.

Since the starting of the laboratory, children have been enthusiastic and results of questionnaires have reflected their attitude. In fact, the 98% of the sample has shown great satisfaction in the use of Face3D software, the 94% has affirmed that the Virtual Theatre created is useful, and the 99% that it is easy to learn. Finally, the 97% has declared that it is also easy to use. No relevant gender differences have been found; for example, regarding satisfaction in the use of Face3D as learning tool, the 26.90% and the 64.1% of the male subjects has declared to be satisfied and very satisfied, respectively (91% of the sample); the 31.68% and the 63% of the female subjects has declared to be satisfied and very satisfied, respectively (94.68% of the sample).

4 Conclusions

Many studies have shown that an active learning can remarkably enhance students' learning efficiency as well as a rich interaction can provide fruitful feelings of participation in educational process. Therefore, an innovative virtual theatrical environment has been ideated and realized at University of Calabria (Italy). Positive results of a previous experimentation with 20 teachers and 30 high school students (Adamo et al., 2010) on the use of Face3D Virtual Theatre as leaning tool have been confirmed in a laboratory with children.

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