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Real Time Changing Virtual Environments: A New Tool for Virtual Therapy

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Abstract: *Environments used up to now for therapeutic applications are invariable ones whose content cannot be changed by the therapist or by the patient. However, this is a technical issue that can be solved with current technology. In this paper, we describe a virtual environment that has been developed taking into account this factor. The main technical feature of the environment is that its aspect can be controlled and modified by the therapist that conducts the clinical sessions depending on the emotions that the patient is feeling at each moment.*

The applications of these dynamic changes are not limited to the field of clinical psychology. They open a new arena of possibilities for many other kinds of applications including industry, architecture, medicine etc. The virtual environment that is described in this paper is a step towards a truly adaptive display.

INTRODUCTION

The concept of “adaptive displays” has been considered for many years. It is the use of technical devices that adapt to the requirements of the user, rather than having the users adapt to the device. The term “adaptive display” has referred to displays that change their contents depending only on situational content rather than on any awareness of the user.¹ These adaptive displays can be used in many different applications such as medicine, industry, architecture, and psychology.

In the field of clinical psychology, virtual reality has in recent years been applied to the treatment of psychological disorders. This idea was first voiced in November 1992 in the Human-Computer Interaction Group of the Clark Atlanta University. The first experiment was a pilot study with a 32-years-old woman who suffered from flying phobia. She was treated using a virtual environment² in which she followed eight thirty-minute sessions. At the beginning of each session, the subject had a high level of anxiety, which was decreasing gradually after remaining in the situation for several minutes. This effect also was transferred from the virtual to the real world.

Since this initial study, this technique has been used for the treatment of different phobias. We can point out the environments designed for acrophobia treatment,³⁻⁵ agoraphobia,^{6,7} spider phobia⁸ or flying phobia.^{9,10} Its effectiveness has been analyzed for the fight against other psychological problems: obsessive-compulsive disorders, attention deficit disorders, post-traumatic stress and eating disorders.^{11,12} However, environments used up to now for therapeutic applications are invariable ones whose content allows for only minor changes. As a result, no modification can be made in the contents of the virtual environment even when high emotional responses can be obtained from the user. It is our claim, that the psychologist should have a greater control over the aspect of the virtual environment that is shown to the user.

In the environment that we are presenting in this paper, the psychologist can make changes in the aspect of the environment depending on the reactions of the patient to different parts of the therapy session. This work has been conducted inside the EMMA Project (IST-2001-39192).

DESIGN OF THE VIRTUAL ENVIRONMENT

The purpose of the virtual environment is to be used in the context of a psychological treatment. The user is a person who suffers from psychological problems, such as affective disorders, anxiety disorders or adjustment disorders. All treatment sessions are conducted by a therapist and the virtual environment is used as an aid for this treatment. Both the therapist and the patient are physically present in the room during the evolution of the session.

The patient visualizes the virtual environment in a retro-projected screen, and the interaction is made by means of a wireless joystick.

The application has been developed using Brainstorm eStudio software. This is an advanced, multiplatform real time 3D graphics development tool. It incorporates features such as: the easy inclusion of 3D objects imported from files, erased or animated; generation of 3D texts, whose colors can be changed; adding videos to surfaces; generation of new interfaces and timers; addition of actions to objects when they are selected; addition of sounds; loading or saving configurations. All these possibilities are controlled using the mouse, pop-up menus or drag and drop actions. The interpreted language that is used to program is python. Brainstorm eStudio can be defined as an interface that the programmer can use to create 3D complex visualizations using only tool options.

DESCRIPTION OF THE ENVIRONMENT

The environment can be modified dynamically by the therapist taking into account the state of the patient at each moment during the treatment, so different aspects have been developed. The environment is not a static one. Initially, the user appears inside a big circular-shaped hall with no walls.

The user can visualize the outer part of the environment, which initially is an open area of meadows. The user can navigate freely along the entire environment, even leave the big hall and walk through the meadows.

However, the meadows constitute only one of the five possible aspects of the outer part of the environment. The other pre-defined aspects are: a desert, an island, a forest with many trees and branches, and a snowed city. These five environments can be related to different emotions. For example, the forest with branches can be related to anxiety. On the other hand, if the purpose of the therapist is to induce relaxation in the patient, the island can be used. The desert can be related to rage, and the snowed city with sad situations, so it can be used during the session when the patient is remembering a situation that induces sadness in him or her. The use of each aspect of the environment depends on the context of the session and can be selected by the therapist in real time.

In order to control the appearance of the different aspects that have been developed, a spe-



Figure 1. Aspect of the room.



Figure 2. Virtual environments corresponding to anxiety and joy

cial interface has been prepared. The application is running on a computer separate from the one where the virtual environment has been launched. The therapist can easily select (pressing different buttons) the aspect of the environment that has to be shown at each moment, and the needed command will be sent using TCP/IP to the computer where the environment is running. As soon as this computer

receives the command, the appearance of the environment will change depending on the concrete order that it has received.

APPLICATION OF SPECIAL EFFECTS

Besides the big-scale control that we have described in the previous point, the therapist can also control small-scale changes. Different ef-

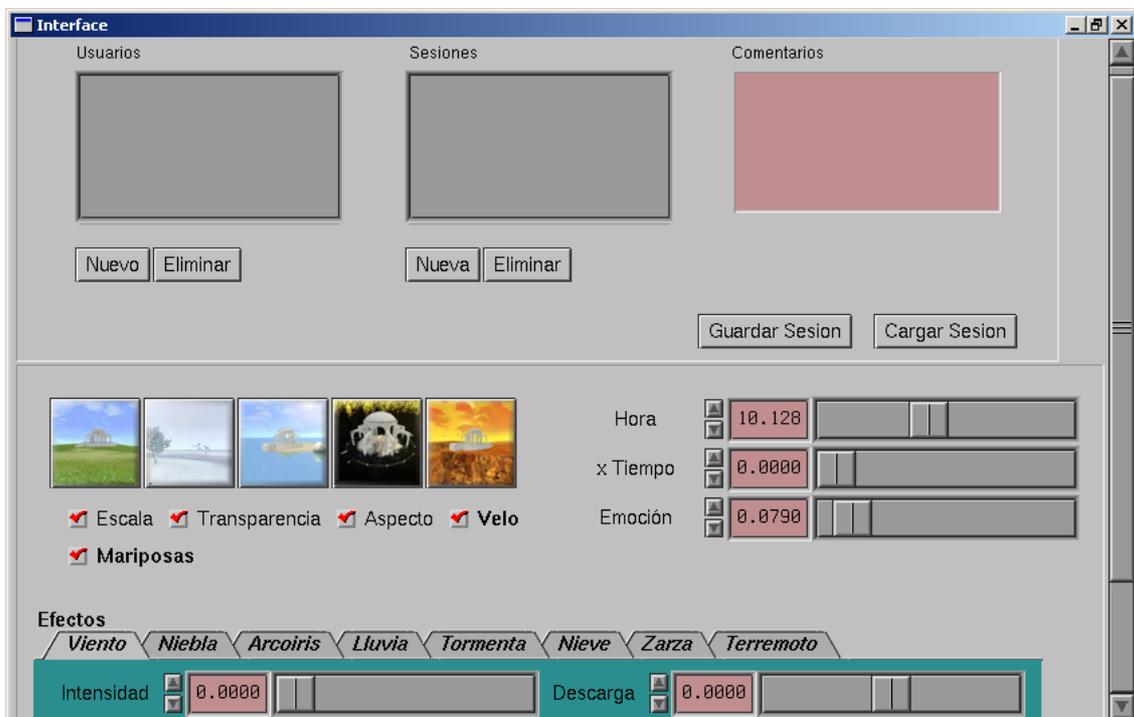


Figure 3. Interface for the therapist



Figure 4. The sad environment snowing and with a storm.

ffects can be applied to the environment: a rainbow can appear, it can start raining, snowing, an earthquake can be generated, and the illumination can change to the one corresponding to different hours of the day and the night.

All these effects are also launched from the same interface that controls the big-scale changes. The therapist can control by means of a slider the moment when the effect is launched and its intensity.

OTHER INTERACTIONS

But it is not only the therapist who can control the personalization of the environment. The user can also play an active role on this task.

The big hall that is present in any of the possible aspects of the virtual environment is composed by different systems that interoperate and allow the patient to express ideas using different items (videos, images, sounds, colors and 3D objects) that can be selected from a database.

Distributed along the environment, there are several places (object holders) where the patient can locate an item from the database, so the 3D aspect of the element will be shown, or

the associated sound or video will be reproduced. This can be used as a way to personalize the environment. These object holders can serve as a mixer tool to combine several elements to form a new complex element. This is achieved if different elements from different categories are copied to the same object holder. There are some special object holders that are placed in a balcony of the room. The patient can modify the size of the objects that are placed on them by means of the loudness of the voice. They will be used as a discharge area where the patient can give free rein to his/her feelings. A system has been programmed that detects the loudness of the input sounds and modifies accordingly the size of the objects placed on those special object holders.

The living book is a special object where the patient can place icons that represent the elements from the database. These icons can be classified in different chapters. It is the instrument that the patient will use to put in order the contents that have been used during the clinical session with the therapist.

Finally, the drain can be used to destroy any element that is not needed anymore.



Figure 5. The living book and the drain.

CONCLUSIONS

Using this new technical approach, different environments can be developed to treat different kinds of psychological problems. The possibility of dynamically changing the aspect of the environment, which is the main improvement of this system from the technical point of view, opens a new area and new possibilities for treating psychological disorders.

Besides, this system constitutes a step forward towards a true adaptive display. The ultimate purpose would be that the system itself would be able to detect the emotional state of the user and adapt its contents to this state without any intervention from the therapist.

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