Emotionally controlled Virtual Environments: A New Tool for Enhancing Presence through Media Content Manipulation

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Abstract

A participants´ sense of "being there" in a mediated experience is determined by a variety of characteristics or components. The EMMA Project (IST-2001-39192) is interested in analyzing the relationships between presence and emotions, especially for some Virtual Reality applications, such as mental health (both for promotion and treatment goals). This research will help to understand better the development of some psychopathological phenomena and the development of new correcting experiences and learning to cope with those psychopathological experiences.

Mood devices are special hardware and software configurations able to induce different forms of mood enhancement. In this paper, we describe one of the "mood devices" that have been developed inside the project: the EMMA room.

*Keywords--- **Mood devices, presence, emotions**.*

1. Introduction

1.1. Presence and emotions

A participants´ sense of "being there" in a mediated experience is determined by a variety of characteristics or components. There is a consensus that it is formed through interplay of raw sensory data and various cognitive processes. In particular, the most common definition found in literature is the "sense of being there" in one place or environment (i.e. a virtual environment) even when one is physically situated in another [1]. Starting from this view, Lombard and Ditton [2] reviewed a broad body of literature related to presence and identified six different conceptualizations of presence: realism, immersion, transportation, social richness, social actor within medium, and medium as social actor. Presence in a mediated environment can be defined as the sense of being there arising from a perceptual illusion of non-mediation: the extent to which a person fails to perceive or acknowledge the existence of a medium during a technologically mediated experience.

There are many key determinants of presence. However, they have been mainly classified in two groups in the literature: media characteristics and user characteristics. Regarding media characteristics, there are two different groups of factors that can influence the level of presence of the user: media form (which includes the extent and fidelity of sensory information, and the match between sensors and display) and media content (including factors such as familiarity, naturalness, interest, meaning, narratives). Regarding user characteristics, we can point out factors such as immersive tendencies and prior experience.

Other studies [3] have distinguished between external factors (resulting from the virtual environment system itself) and internal factors (ranging from structural aspects to psychological aspects).

The majority of presence studies conducted to date have focused on manipulations of media form and not media content. However, our position is that both media form and media content can affect the level of presence achieved by the user. We intend to investigate how media content manipulations can affect and have influence on presence. In this study, we will focus on the role of emotions, analyzing the relationship between presence and emotions.

Literature on psychological aspects of Virtual Reality (VR) has studied preferentially basic and common psychological processes (perception, memory, etc.) influencing important issues in VR. However, there are other personality and psychological variables that are also relevant to the VR field (suggestionability, dissociation, imagery, absorption, expectations, etc.), one of these being emotions. These variables are important in order to generate and enhance presence. This is especially true for mental health applications of VR. To design virtual environments with therapeutic goals, it might be necessary to put a good part of resources on achieving the highest emotional involvement. The corroboration of this issue would guide researchers in their efforts to achieve virtual worlds that work.

As some studies have pointed out [4], definitions on presence have mostly been cognitively or environmentally

based, generally ignoring the emotional aspects of presence. But emotions play an important role in our subjective judgments and automatic responses, influencing our learning and how we understand, describe and react to the world and ourselves. Important differences have been found [5] in the responses to VR environments between non-patients and (mental health) patients, which proved the importance of emotions for clinical users. Emotions may play a role both as causes and as consequences of presence. It may be said that the higher presence and reality judgment, the higher intensity of emotions the user experiences. Then, if the focus is on designing applications to elicit emotions with the goal to reduce or modify them, the environments have to be able to produce in the users the feeling of being there and of being "real". However, it could also be said the opposite: the higher intensity of emotions and feelings, the higher presence and reality judgment. From this point of view, the focus would lay on designing affectively significant environments. We would need to include those elements with the potential of activating emotions.

Emotions affect behaviors and cognitions, and they can have an important impact on presence. Users "feel" presence. And as presence is unstable, emotions are also continuously changing. If we are able to understand better presence and emotional reactions to VE, we will be able to design more effective "virtual" experiences. Especially in clinical psychology field, but not only, we need to know how to generate and optimize the emotional impact that the virtual experiences have from a therapeutic point of view.

In order to analyze these factors, we have developed several mood devices, which are special software (virtual environments) and hardware configurations designed to generate and enhance presence and emotions. They will be applied in selected populations: people who suffer from emotional problems, people who suffer from restricted mobility and general population.

1.2. Mood disorders

The target of EMMA is not focused on mental disorders, but on emotional experiences that are present in these selected populations. The purpose is to study the mood devices' usefulness to improve emotional welfare.

The word "depression" or "anxiety" refers to distressful and uncomfortable moods. Often used to describe moods that all of us experience from time to time, these emotions can also be symptomatic of true clinical-medical disorders. Periods of depression and anxiety are quite common. Secondary to other medical or psychiatric illnesses, some individuals experience lengthy, often repeated or chronic episodes of these emotions for no apparent reason when they are otherwise physically well. These people are said to suffer from a mood disorder, where altered moods are central or "primary" and are accompanied by other symptoms, such as disturbances of sleep, weight changes, lack of energy, exaggerated worry and tension, low self-esteem, and so on. As mental disorders, both anxiety and depression are considered the most common mental illness, whose effects bring significant and costly problems. Mood

disorders are important public health problems, due to its high prevalence, its comorbidity with other disorders, and their important negative consequences on the sufferers' quality of life. Epidemiological studies throughout the world [6] indicate that the life time risk for Major Depression ranges from 10% to 25% for women and 5% to 10% for men, and the prevalence rates appear to be unrelated to ethnicity, education, income, or marital status. In the case of anxiety, several studies have also shown high prevalence rates (for instance, 13% for social phobia prevalence, 10% for panic attacks). Furthermore, Adjustment Disorders, characterized by clinically significant emotional or behavioral symptoms in response to identifiable psychosocial stressors, are very common, and epidemiological figures vary widely as a function of the population studied and the assessment methods used [6].

1.3. Goals

Our goal is the investigation of the use of engaging media for the development of non-addictive, mood-stabilizing experiences, in particular, after analyzing the possible emotional impact of high compelling synthetic experiences characterized by a high level of presence.

"Mood devices" will provide innovative ways of coping with distressful emotions, that will be better than existing approaches, for different users: users who suffer from psychological problems (affective disorders, anxiety disorder, adjustment disorders), users with acute restricted mobility (the emotional mediated experiences that bedridden patients could have by means of mood devices may help relieving their anxieties, reducing their pain, and encouraging them in their fight against diseases), and mood enhancement for general population (relaxation environments through TV or VR; presence-enhanced synthetic environments for entertainment, etc.). We intend to achieve a more complete understanding of presence and reactions to mediated experiences. This will help us in creating more effective experiences for emotional learning, which could be useful in many different contexts.

Another innovation is to use VR as a "new realistic laboratory" [7] where to study behaviors, emotions, thoughts, basic psychopathological processes, individual differences and emotions. This "realistic lab" will allow to do research with a high degree of validity. It is classic the dilemma between the different types of validity. It seems that we usually sacrifice something regarding the internal or external validity: As a greater control is needed, it seems necessary to turn to the "artificiality" and/or "simplicity" of the lab. The "virtual laboratory" could help overcoming this dilemma creating significant contexts, with high external and ecologic validity, in which certain questions can be tested with a high degree of control and accuracy.

2. EMMA room

We are going to describe in this paper one of the mood devices that we have developed: the EMMA room. The main characteristic of this mood device is that its aspect can be changed dynamically controlled by the therapist

depending on the emotions that the user is feeling at each moment. We intend to study the role that this environmental changes can have on the level of presence experienced by the user.

In order to visualize the virtual environment, we have selected a big retro-projection screen where the virtual environment is projected. The navigation and interaction device is a wireless joystick.

In the following points, we are going to describe the main elements that compose the environment.

2.1. General description

The room developed will help the user to remember and re-live past experiences.

It has been modeled as a big hall with circular shape, with no walls so the outer environment can be visualized.
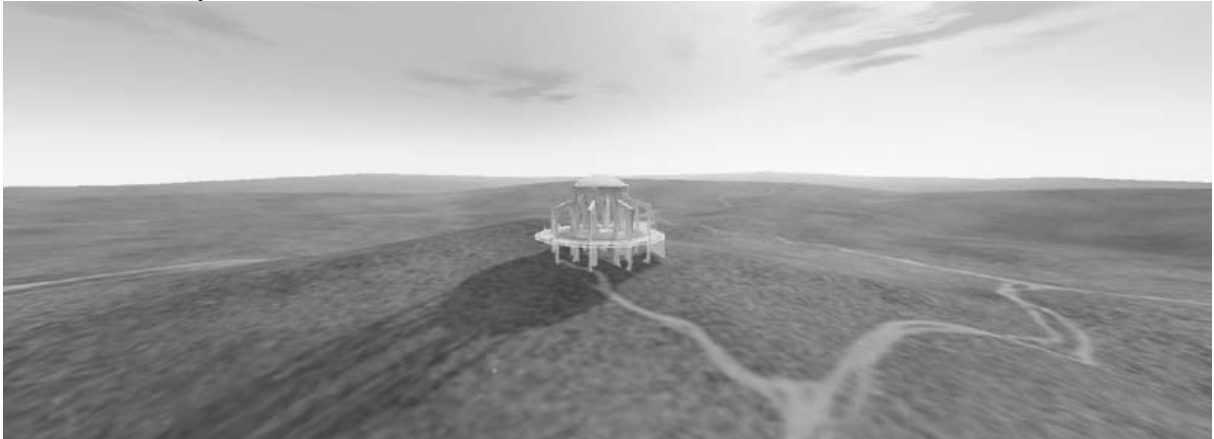
Figure 1 Room external aspect

Figure 2 Room internal aspect

The environment includes a set of different systems that will interoperate allowing the user to express ideas by mean of items, mixing or modifying their characteristics and changing their positions. Most of the systems have been programmed as object holders. They are the places where database elements can be stored.

There are different types object holders:

• The environment object holders allow the user to show the three-dimensional aspect of an element, or to play the associated sound or video.

• The database object holders only show the element iconic views and store them in the database screen.

• The living book object holders. This special 3D object allows the user to show and classify the element iconic views in the different pages and chapters defined by the user.

• The discharge area object holders allow the user to put any element on them to interact with it.

• The drain, which in fact does not hold any element, has an interface that is exactly the same as the other object holders.

A virtual keyboard has been created that allows the user to label elements of the environment object holders or chapters in the living book.

There is also a special module called the inventory. This interface consists on a set of object holders that is always shown on the screen. At any moment on the session one of the object holders is active and will receive the next picked element or give the next dropped one depending on what the user does. It is used as a way

to translate elements from one place to another in the environment.

In the following points, we are going to describe in more detail the main elements of the environment and their functionality.

2.2. The database screen

2.2.1. Description

The database screen floats around the big hall. It is composed of several tabs that give access to the different element categories of objects that can be hold and used inside the system: sounds, videos, images, three-dimensional objects and colors.

2.2.2. Interaction details

Each category is made up of an array of special object holders; its special feature is that they do not disappear from the screen when the user picks them to the inventory tool. Instead, a copy of the element is made and put on the inventory tool.

A three-dimensional scrollbar module has also been used on the database screen development. A tab module has been created that allows several pages on the screen. This module has also been used with some modifications on the living book development.

Figure 3. Database screen aspect

2.3. The living book

2.3.1. Description

The living book is the most important piece of the environment. It is also formed of object holder arrays and, as the database screen, it is organized in pages. Each page represents a chapter of the living book. A title can be introduced for each chapter by using the virtual keyboard or if no title is introduced the page is considered to form part of the previous chapter.

The main use of the living book is to help the user to re-experience or re-live the past as it happens with family photographs and home videos. It is the instrument that the user will use to keep and put in order all the contents he/she has worked with the psychologist during the session in the virtual environment.

The main reason to design this tool as a book is that it permits the same functions in the real world so the users will understand its use in a natural way. The living book, however, is not written mainly with words. The

user writes it with the different kinds of materials used in the EMMA environment: 3D objects, images, films… will be manipulated in the environment, so the user can move them, keep them in the book and recover them from the book at any moment. The user can change the situation of any object inside the book.

The living book is a completely flexible tool, every user can adapt it, and it is useful to keep together all symbols with emotional meaning for the user.

2.3.2. Interaction details

Initially, the living book is empty. The user can select the elements that will be introduced at each of the chapters directly from the database screen or from an environment object holder. The way of acting is the same: the user has to select the object just by clicking on it; then, the element will be introduced in the inventory; finally, clicking on the correct slot inside the living book, the element will be copied there.

Once the elements have been copied in the book, their order inside a chapter can be changed at any moment on the session just by picking an element (to the inventory) and dropping it on a different slot. When an element is dropped on a slot previously occupied a swap is made between the inventory element and the living book one, making it very fast and easy to change the order of elements in the book.

Figure 4. The living book and the database screen

2.4. The environment object holders

2.4.1. Description

The environmental object holders will be a means to personalize the environment. The user will be able to select the different elements (sounds, images, videos, colors, 3D objects) directly from the database or from the living book. These elements will be relevant for the patient, and will be selected with the help of the therapist during the session.

2.4.2. Interaction details

An environment object holder can serve as a mixer tool to combine several elements to form a new complex element that will be used exactly in the same way as the

others. When a complex element is placed on an environment object holder, all the forming elements are shown simultaneously floating around the object holder.

The way in which the user interacts with elements consists on picking them from any object holder to the inventory tool and dropping them in any other object holder. When an element is dropped on an environment object holder that already has an element inside, a composed element is created with the sum of the elements, for example, sound and image or geometry and colour.

Figure 5. Aspect of an environment object holder with a book geometry

2.5. The drain

2.5.1. Description

The drain is an element of the environment where the user will throw any element that is not needed anymore. Objects that are placed in the living book or in the room can be dropped to the drain in order to destroy them.

The drain is placed in a corner of the room.

The user puts inside the drain any object he/she wants to get rid of. At that moment, an animation is launched and some noises are heard that show that the element is being destroyed.

Figure 6. The drain

2.5.2. Interaction details

As it has been explained before, the drain behaves in a very similar way to the rest of object holders. When the user drops an element from the inventory to the drain the element is deleted from the inventory. The only difference is that no element is created on the drain object holder.
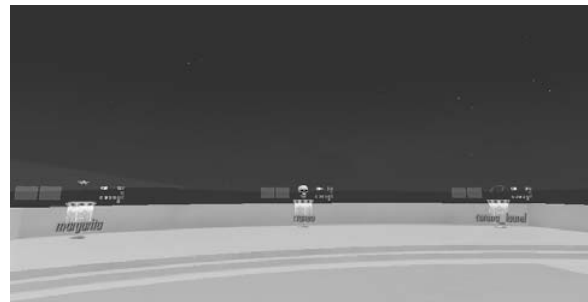
2.6. The discharge area

2.6.1. Description

One of the targets in EMMA is to give the environments an interactive way to behave and the ability to be modified regarding the emotions of the user returning him/her a feedback and establishing a communication.

The emotional discharge system provides a personal and private space where people could give free rein to their emotion with nobody watching or evaluating them with the exception of the psychologist. With this system, it is possible to modify the characteristics of the virtual environment in function of the emotions of the users, returning to them some kind of response, as it happens in the communication with another human being, and avoiding the possibility that the users could "hide" their emotions. However, the answer of the virtual environment is different from the answer that the user could receive from another human being. This answer is expressed in modifications of the environment the user is immersed in.

With the emotional discharge system, the user can manipulate the objects of the environment. This is the way to carry out the change of the meanings that the objects have for the user. This is not different from the rest of the environment, as for example working with the living book. The previous work will teach the user to give personal meanings to the objects inside the system.

During the work in the discharge area, as it happens in the rest of the environment, the user will be accompanied by the therapist. The psychologist and the user will work together this experience from a psychological point of view.

Figure 7. Emotional discharge area

2.6.2. Interaction details

There are three special object holders that are in the balcony of the room. In these object holders, the user can

modify the shape and aspect of the objects that are placed on them by means of the voice (shouting in a louder or softer way). 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. More than one object holder can be active at the same time. In this case, the aspect of the objects placed in all of them will change simultaneously.

2.7. Dynamic changes of the environment

2.7.1. Description
One of the main interests of this environment is that its aspect can be changed dynamically depending on the emotions of the user. As long as the therapist will stay with the user during each session, he/she will be the person that will select the aspect of the environment depending on the emotions that the user is feeling at each moment during the session.

We have designed four pre-defined aspects for the outer part of the virtual environment corresponding to four different emotions: joy, relaxation, rage and anxiety. The therapist can select between this four options. And, besides, it is also possible to select between different effects that can be applied to the environment: fog, rainbow, rain, snow, earthquake, and so on.

Figure 8. Aspect of the outer environment corresponding to joy with the EMMA avatar

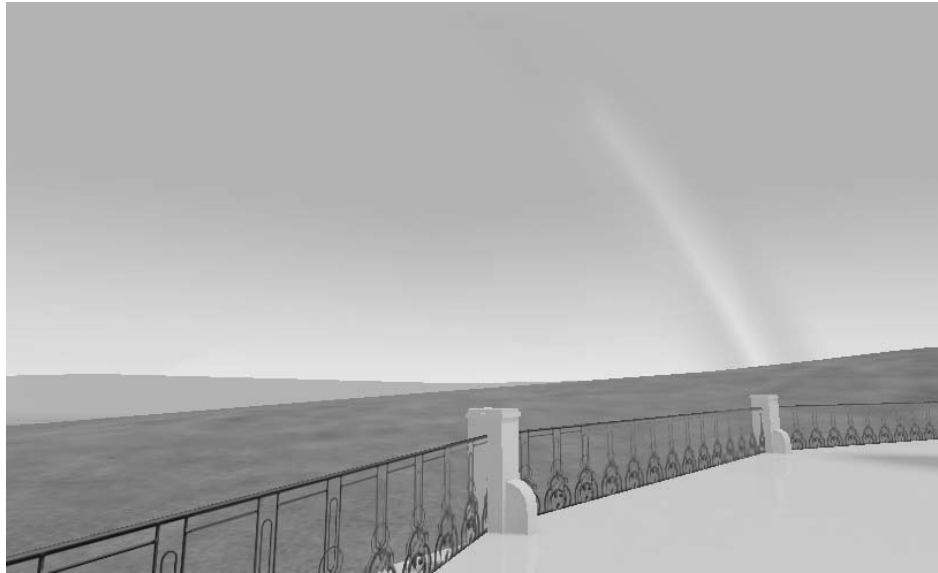**Figure 9. External aspect of the environment corresponding to anxiety**

Figure 10. Environment with the rainbow

2.7.2. Interaction details

In order to achieve these effects, a special interface has been prepared that allows the therapist to control several aspects of the appearance of the outer part of the EMMA room. The application for controlling this appearance is running on a computer different from the computer where the virtual environment is running. The commands that the therapist introduces are sent using TCP/IP to the environment computer, and the appearance of the environment changes depending on the command that the computer has received.
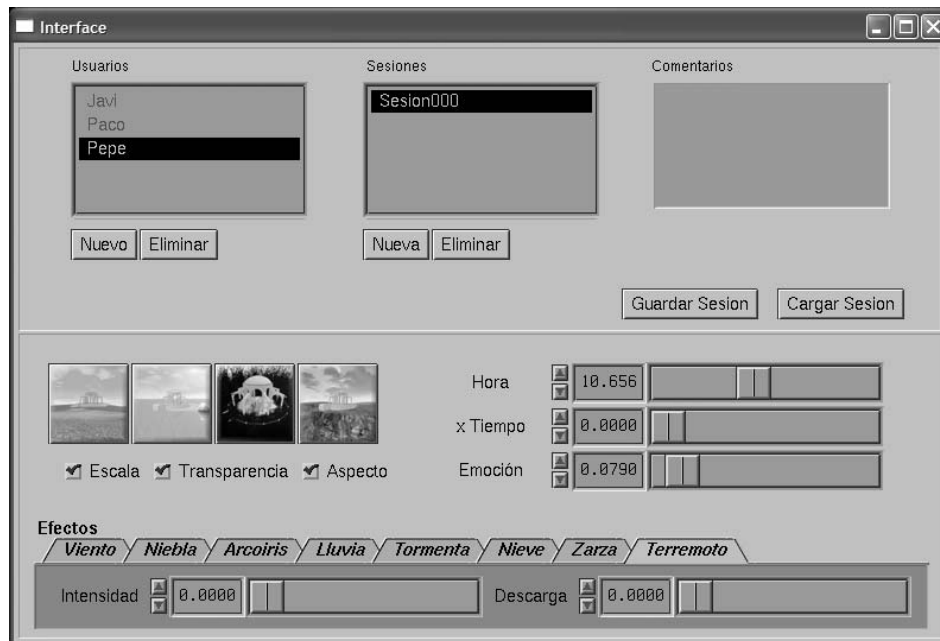

Figure 11. Aspect of the therapist's interface

Conclusions

It is our position that variations in both media form and media content can influence presence. The fact that content can affect both presence and emotions suggests a need for research to understand the relation between the two.

Using this environment, we are measuring aspects of presence and emotion in order to study the influence of the emotiveness of a media experience –manipulated through variations in media content- on presence and we expect to obtain soon conclusive results.

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