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

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Antecedents

Clinical rationale

- Traditional VR PTSD treatment: the approach is to simulate with high realism the traumatic events
- A possible limitation of this approach is that it could be difficult to reach all patients.
- VR exposure treatments have been addressed to very specific populations (Vietnam veterans and September 11th victims), and the virtual scenario was very similar for all patients.

BUT:

- if we want to treat different trauma populations (Vietnam or Iraq war, rape, terrorism or tsunami victims, sexual abuse situations, pathological grief, etc.)
- we need more **flexible virtual scenarios** that can evoke different stressful events.

Emotional Adaptive Display

- VE contents must be continuously adapted to the emotional state of the user.
- VE contents must be easily customized with personalized contents of the patient
- VE must respond in real time to different emotional reactions of the patient
- VE should be changed in real time (aspects, space, time) by the therapist

SOME ADAPTIVE DISPLAY CHALLENGES

"..automatically adjusts its contents to the constantly changing state of the observer.."

"..be able to impedance match the display to the observer.."

" One exciting derivative of the clinical work is an adaptive display that actually shifts within a narrow range of modes according to the physiological/cognitive state of the user"

E. T Schmeisser (C&B special issue AD)

Technological challenge

Main goal

The development of **easy to use** and **customizable VE** that may be **adapted in real time** to the **patient's needs**

The therapist must be free to tune the patient experience according to the specific therapeutic needs.

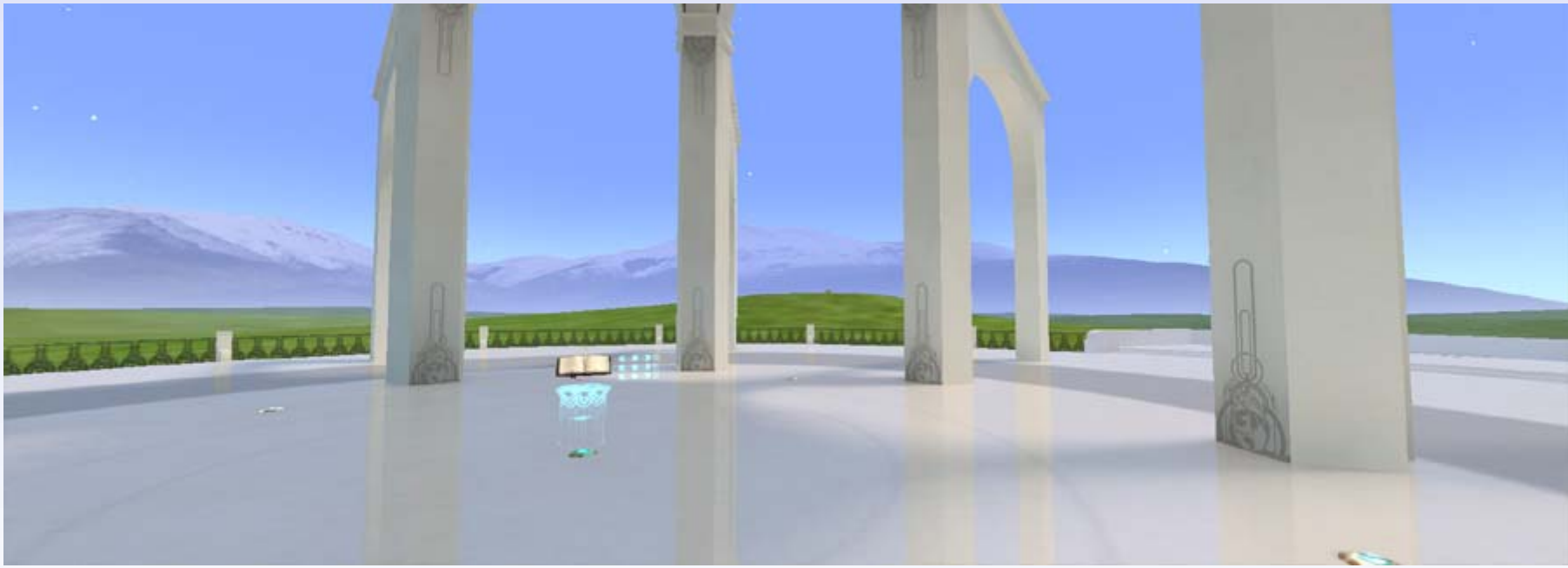
It allows **real-time modifications** of the virtual scenarios (a beach, a field, a desert, a solitary and snow-covered place);

Use of **different realistic natural effects** (fog, rain, change from night to day, earthquake, rainbow...);

Use of **personalized objects** and significant **symbols** (from 3D objects to real photographs) to anchor the virtual experience to the personal history

Technical description EMMA room

- PURPOSE: the room will help the user to remember and re-live past personnel experiences
- Modelled as a big hall with circular shape, with no walls, so the outer environment can be visualized
- HARDWARE: The environment is projected in a big retro-projected screen. The interaction device is a wireless joystick.



Technical description EMMA room

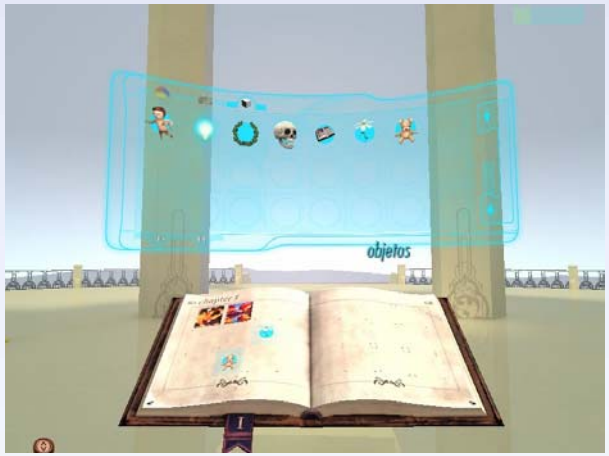
- **Object holders: places where elements can be stored.**
- **Types of elements:**
  - 3D objects.
  - Videos.
  - Images.
  - Sounds.
  - Colours.
- **Types of object holders:**
  - Environment object holders.
  - Database object holders.
  - Living book object holders.
  - Discharge area object holders.
  - Drain.

The database screen

- **DESCRIPTION:** Composed of several tabs that give access to the different element categories.
- **INTERACTION DETAILS:**
  - Each category is made of an array of special object holders.
  - They do not disappear when the user picks them.
  - Scroll bar module.

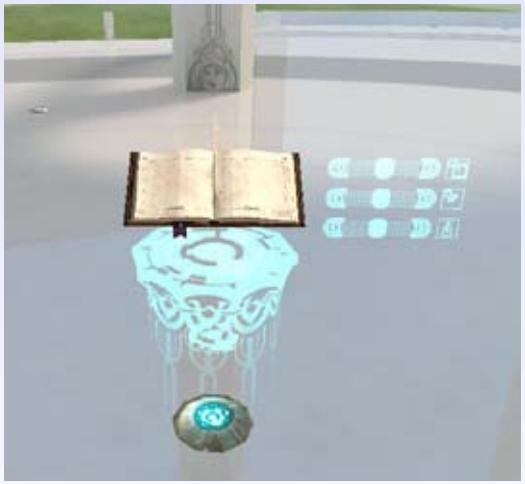
The living book

- **DESCRIPTION:**
  - The most important piece of the environment.
  - Formed of object holder arrays organized in pages.
  - Titles to the different chapters can be added.
  - Purpose: to help the user to re-live the past as it happens with family photographs and home videos.
- **INTERACTION DETAILS:**
  - Elements can be copied to the living book from the database screen or from an environment object holder.
  - Only clicking on the correct slot.
  - The order can be changed later.



The environment object holders

- **DESCRIPTION**
  - They are a means to personalize the environment.
  - Elements can be taken from the database or from the living book (also from other object holders).
- **INTERACTION DETAILS**
  - An object holder can act as a mixer tool to combine several elements to form a new complex element.
  - Interaction: to pick the element from an object holder and drop it in any other object holder.



The discharge area

- **DESCRIPTION**
  - Interactive way to modify the environment depending on the emotions of the user.
- **INTERACTION DETAILS**
  - There are three special object holders that are in the balcony of the room.
  - The user can **modify** the shape and aspects of the objects that are placed on them **by means of the voice**.
  - A system has been programmed that detects the loudness of the input sounds.

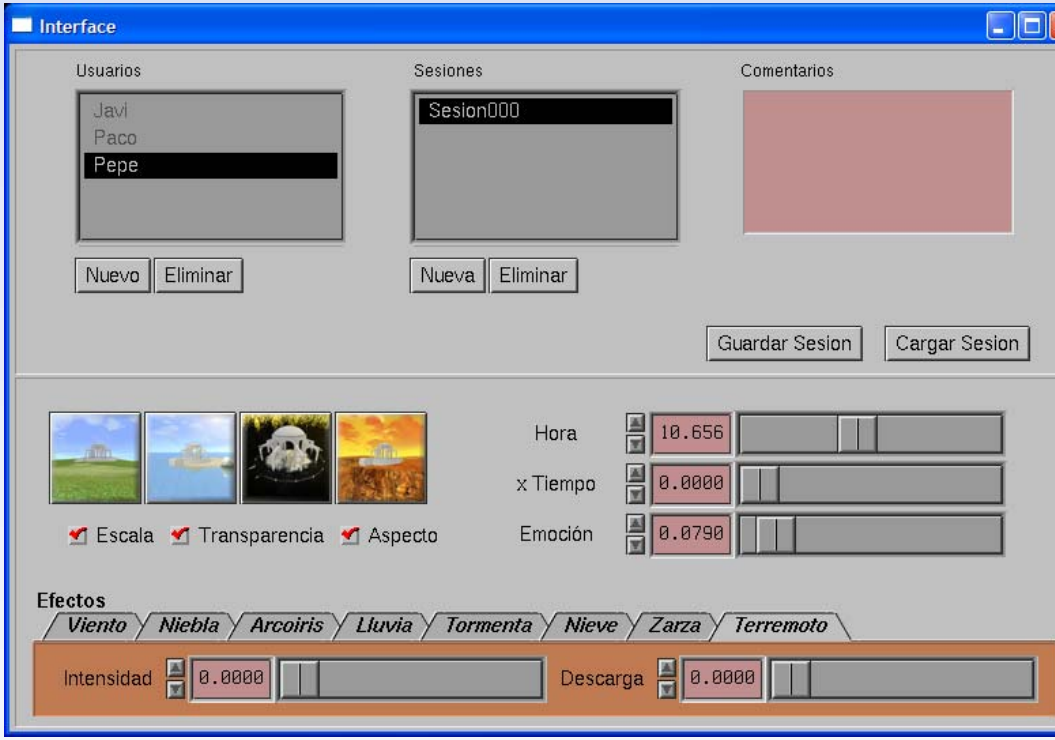
Dynamic changes of the environment

- DESCRIPTION:
  - The aspect of the environment can be changed by the therapist depending on the emotions of the user.
  - Five pre-defined aspects for the outer part of the virtual environment:
    - Joy.
    - Relaxation.
    - Rage.
    - Anxiety.
    - Sadness.
  - Several effects can be applied to the environment:
    - Fog.
    - Rainbow.
    - Rain.
    - Snow
    - Earthquake
    - …

Technical description EMMA room

INTERACTION DETAILS

- 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 applications runs in a computer different from the computer where the virtual environment is running.
  - The commands are sent using TCP/IP.
  - The appearance of the environment changes depending on the command that the computer has received.



Future developments

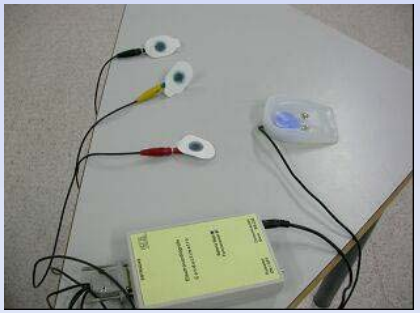
- To automatically adapt to emotional state

  - First trials with customized physiological sensors

  - Developments with facial tracking, brain functional images, EEG

- To integrate in an Augmented Reality interface
  (new book of life)

- To integrate several more natural interfaces (tangible interfaces, postural navigation…)
(new book of life, new grasping metaphors)



Conclusions

- **We have presented a therapist guided Adaptive Display (AD) for the VR treatment of PTSD**

- **Clinical results are very promising (EMMA project, C. Botella, 12 patients)**

- **AD technology for PTSD is proven to be a useful tool:**

  Permits to individualize and personalize the environments fitting the emotional state of the user

  Can be used for different type of problems in the PTSD

- **Improvements to be made both in:**

  More natural interfaces (visualiztion, interaction, navigation)
  Non intrusive automatic detection of the emotional state

Thank you for your attention

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