

Immersive Behavioral Therapy for Stairs Phobia Treatment in Individuals with Intellectual Disabilities

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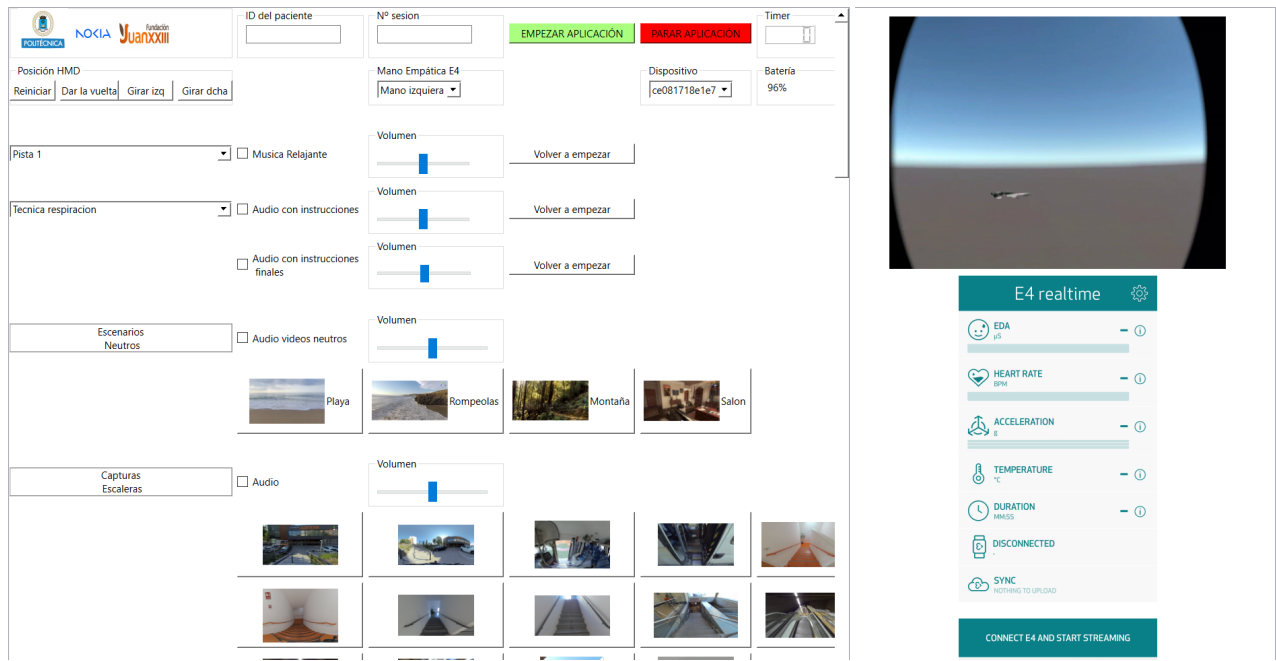


Figure 1: Therapist monitor with control area and user's viewport

ABSTRACT

The combination of traditional behavioral therapy with eXtended Reality (XR) and physiological data facilitates the adaptation of phobia treatment for individuals with intellectual disabilities. Through systematic desensitization techniques, the innovative tool tailors immersive virtual scenarios specifically aimed at addressing fears related to stairs. Therapists monitor and guide the process, using real-time data from the Head-Mounted Display (HMD) and an Empatica E4 wristband to assess emotional and anxiety states. The development of the tool has been designed using therapists' guidelines to ensure a valid transition from classical to immersive therapies. It also aims to ensure equitable access to therapeutic interventions taking into account gender equality and addressing

any potential biases or disparities in treatment outcomes based on gender. This innovative approach holds immense promise for the inclusion of people in vulnerable psychosocial situations.

KEYWORDS

Extended Reality, Inclusion, Equality, Accesibility

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1 INTRODUCTION

Extended Reality (XR) technologies offer an immersive experience that can transport users to distant locations, enriching live therapeutic interventions. XR devices, such as Head-Mounted Displays (HMDs), incorporate sensors that capture patient behavior data, including movement within the environment, head and eye movements, among others. Additionally, non-intrusive sensors can gather physiological signals like heart rate or galvanic response of the skin [2]. Their acquisition not only facilitates understanding the correlation between cognitive functions and patient well-being but also enables the monitoring of therapy progress.

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This work focuses on developing a practical tool to help individuals with intellectual disabilities overcome anxiety associated with stair-related phobias, also known as bathmophobia. Utilizing the systematic desensitization technique [1], the tool aims to assist patients in managing emotions triggered by anxiety-inducing situations and reducing avoidance behaviors. Unlike traditional therapy methods, the inclusion of immersive technology offers several advantages. Instead of relying solely on imagination exercises, patients can engage with 360-degree videos, simplifying the process for those with intellectual disabilities. Furthermore, immersive technology allows patients to encounter various stimuli within the same physical space, enhancing their sense of presence. Incorporating an advanced photorealistic body visualization system enables users to experience embodiment fully, essential for addressing stair-related fears effectively. Additionally, immersive technologies provide therapists with a more controlled environment to guide interventions, utilizing digital biomarkers to tailor treatment for individuals with intellectual disabilities.

This work aims for the inclusion of people with a higher level of dependency and, therefore, with very specific therapeutic needs. It also aims to introduce gender equality by ensuring equitable access to therapeutic interventions and addressing any potential biases or disparities in treatment outcomes based on gender.

It is worth mentioning, that this work takes part in a project that also involve other use cases that are telepresence for supervised apartments, aimed at people who are more independent, but require external supervision, and tele-training for labor insertion, aimed at any type of person, although designed and evaluated with people who have some degree of intellectual disability.

2 THERAPY DEVELOPMENT

The therapy program spans over a duration of 6 months and comprises various stages aimed at addressing the phobia. Initially, the therapy begins with systematic desensitization, a crucial step focused on relaxation techniques and breath training. Patients are guided through imagery exercises involving neutral scenarios, accompanied by audio aids to facilitate controlled breathing. Subsequently, the therapy progresses to the exposure of videos showing staircases familiar to the patient. Throughout this phase, emphasis is placed on utilizing relaxation techniques and music to alleviate anxiety. The final stage introduces immersive 3D environments featuring stairs, providing patients with interactive experiences where they can navigate the surroundings. Therapists have the ability to control various parameters within the virtual environment, allowing for personalized treatment. Patients are supported with relaxation techniques to navigate through their fears effectively.

3 THERAPIST APPLICATION DEVELOPMENT

An application has been built for the therapist to control the session. This application has been developed in python to have a control area and a user's viewpoint.

The connection to wirelessly control the HDM has been done with a websocket server. This controls all functionalities developed in the Unity application that is being run from the headset. It also includes an adb client that wirelessly connects the HMD to the application for the therapist to have control on what the patient is

seeing. Additionally, a server over MJPEG is used to see the data from the wristband Empatica E4. The wristband connected to a phone is being mirrored through the server. For its development, the functionalities that it must have, have been identified:

- Control over the launch of the application. When the application is launched, the patient's ID is saved together with the session number and the hand on which the bracelet is worn.
- Control over the position of the HMD.
- Control over the launching of each of the 4 phases, with absolute independence.
- Control over the audios to be played (relaxing music, which can be played parallel to the audios with instructions and audios with final instructions).
- Control over imagination scenarios to be launched.
- Control over staircase scenarios to launch.
- Control over what the user is visualizing.
- Through the application it is possible to customize variables such as the movement of the escalators or the sound (the presence of wind or noise). This allows to adapt the sessions much better to the Anxiety Hierarchy that has been previously elaborated with each participant.

4 UNITY APPLICATION DEVELOPMENT

The software components that run on the HMD are an application developed using the Unity game engine to create immersive virtual scenarios. The application can switch among different scenes and bring the user there. There are two types of scenarios. The first includes 360° videos that are played in the environment. These videos are also divided into two categories. The first one consist of relaxing neutral scenarios, while the second one show captures of real stairs. The second type of scenario includes 3D designed spaces of known feared stairs. The 3D scenes cover different types of stairs and different parameters can be controlled:

- Regular stairs. To add more difficulty and overcome more fears other parameters that can be controlled by the therapist are transparency of steps, whether there is railing or not, etc.
- Bus stairs. To create and replicate a more real situation the bus doors can be controlled to be open or not.
- Mechanic stairs. To add more difficulty, the movement and sound of the stairs can be activated or disabled.

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