

Empowering Accessibility: Disability Therapy and Behavior Analysis through the use of Extended Reality Experiences and Biomarkers

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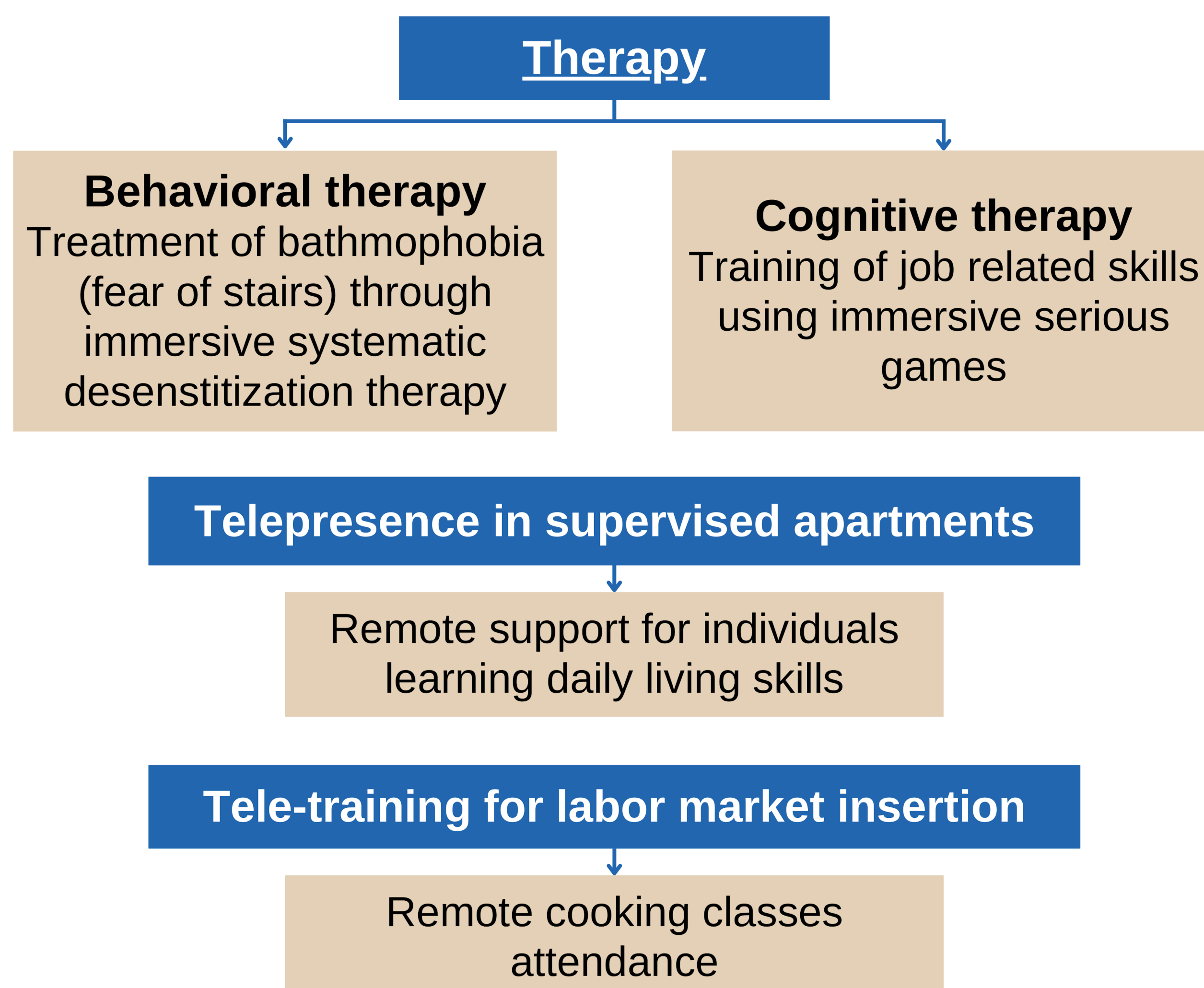
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Overview

Rapid technological advancements in recent years allowed for the widespread distribution of eXtended Reality (XR). Due to its unique features, XR found numerous applications in the fields of healthcare and psychology, despite this, most of the applications and research studies available target neurotypical non-disabled individuals. Pairing XR with wearable biosensor allows to study experiences and behaviour in immersive scenarios. The **Incluverso 5G** project seeks to use XR and 5G technologies as pathways to create a more inclusive virtual and physical world. My PhD will leverage the benefits and opportunities offered by immersive scenarios, integrating them with objective and reliable measures obtained through bio sensors. By combining biomarkers and XR, this research aims to develop effective therapy paradigms targeted to individuals facing vulnerable situations, and, simultaneously, to study interactions within XR, providing valuable insights on the behaviors, emotions and experiences of underrepresented categories.

1. INCLUVERSO 5G: Use cases

Fostering an inclusive physical and virtual world through XR.
Three immersive experiences use cases targeting individuals in situations of psychosocial vulnerability:

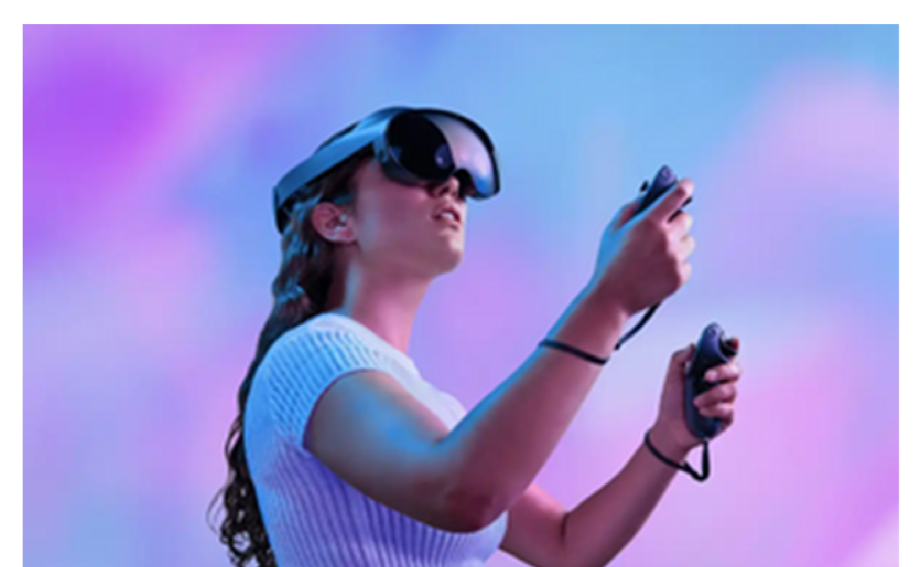


2. Behavioral therapy

Traditional exposure therapy applied through the use of **immersive experiences** under supervision of a therapist.

Relaxation

- Teach relaxation techniques using 360 videos and audio guides
- Slowly remove aids so that relaxation can take place autonomously



Exposure

- Expose subjects to fear inducing VR scenarios
- Teach to apply relaxation techniques to relieve anxiety and overcome fear
- Therapist can switch between scenarios to aid subjects in the process



Biomarkers

- Heart Rate (HR), Electrodermal Activity (EDA) and Muscles Activation (EMG) are recorded
- Biomarkers provide information on subjects' mental being and their progress



3. Cognitive therapy

Job inspired **immersive serious games** to **train** attention and inhibition **skills** directly **applicable** in the **workplace**

Objectives

- Develop an effective immersive serious game for skill training
- Facilitate easier labor market integration for intellectually disabled individuals

Serious games

- Games designed with an educational purpose
- Work scenarios of interest for the individuals
- Tasks aim to address critical job-related skill deficiencies in subjects
- Targeted skills are cognitive

Grocery clerk
Sales assistant
Waiter

Biomarkers

- Eye tracking, head movements, HR, EDA, and EMG will be recorded
- Emotions, anxiety, and saliency will be analyzed
- Insights on both the therapy and the experiences and behaviors in XR will be extracted



4. Other research directions: Point Cloud Saliency

In addition to the activities related to the Incluverso5G project, an **analysis of eye tracking data** from a **QoE experiment** is underway. The **objective** is to create a point cloud **saliency dataset** and to **study** the **effects of transmission and compression** on users gaze

QoE experiment

- 40 participants evaluating the quality of point compressed and transmitted point clouds
- 4 sequences coming from the JPEG Pleno dataset
- 3 standard V-PCC rates were used
- 3 transmission loss rates were simulated

Process

1. Compute fixations using I-VT
2. Remove short fixations and saccades
3. Assume a 3° error on the measured gaze
4. Search points falling in the gaze cone
5. Remove non visible points
6. Color points based on a gaussian function

