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Virtual Reality Image Rehearsal Therapy (VR-IRT) for Nightmare Disorders

A special problem in partial fulfillment
Of the requirements for the degree of
Bachelor of Science in Computer Science

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1 Introduction

1.1 Background of the Study

Nightmares are marked by intense negative emotions and usually take place during the rapid eye movement (REM) stage of sleep [1]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the International Classification of Sleep Disorders (ICSD-3), Nightmare Disorder is characterized by recurrent episodes of prolonged, extremely dysphoric, and vivid nightmares, usually involving threats to one's physical integrity, safety, or survival. These nightmares cause frequent awakenings with vivid memories of the terrifying dreams, often leading to substantial emotional turmoil or impairment in daily functioning [2,3].

This study will focus specifically on idiopathic nightmares, which occur independently of conditions such as post-traumatic stress disorder (PTSD). In contrast to trauma-related nightmares, idiopathic nightmares are not associated with any particular psychopathology, and their content can vary significantly [4]. Nevertheless, they still cause substantial emotional and psychological distress to the person experiencing them.

Nightmare disorder can persist for decades if left untreated. Imagery Rehearsal Therapy (IRT), a cognitive-behavioral technique that involves recalling the nightmare, modifying the storyline to create a positive ending, and rehearsing the new version daily for 5–10 minutes, is the only treatment for nightmare disorder that has a Level A recommendation [5]. IRT has been shown to reduce the frequency and intensity of nightmares. However, its effectiveness may be limited for individuals who struggle with generating visual imagery, as the therapy relies on the ability to create new mental images [6].

This is where virtual reality (VR) presents a promising alternative. Virtual reality (VR) immerses users in a 3D, computer-generated environment, either real or fictional, with interactive graphics and sensory feedback like sound, touch, and smell, creating a sense of presence in a physical space [7]. Immersive VR, in particular, allows users to experience a fully interactive 360-degree virtual environment by tracking their movements and updating the display accordingly [8].

VR has significant potential to transform the assessment, understanding, and treatment of mental health disorders. By prioritizing user experience, it can improve access to psychological therapies and enhance treatment outcomes [9]. Its ability to simulate new realities may offer a more engaging and accessible option for individuals who struggle with traditional imagery techniques like IRT .

1.2 Statement of the Problem

Despite the effectiveness of Imagery Rehearsal Therapy (IRT) for Nightmare Disorder, its reliance on mental imagery presents challenges for individuals who struggle with visualization. Current treatments lack an alternative approach that caters to these individuals, which can limit the success of therapy. This study seeks to address this gap by exploring the use of Virtual Reality (VR) to enhance the delivery of IRT.

1.3 Objectives of the Study

This research provides Virtual Reality Image Rehearsal Therapy (VR-IRT) system with the following functionalities:

1. Users can pause the experience to change configurations at any time.
 - a. Alternatively, users can modify configurations before starting the scenario.
2. Users can choose from a variety of environments to set the stage for their experience, select different figures or creatures that will appear in the scenario, and customize the actions within the scenario, including actions for the figures and changes to the environment itself.
 - a. **Falling:**
 - i. Falling from a plane or a tall building
 - ii. **Allowed changes:**
 1. **Environment:** A peaceful landscape, like a lush valley or fluffy cloudscape.
 2. **Action:** Gliding softly, landing on a soft surface, or bouncing gently.
 - b. **Being Chased:**
 - i. A dark alley or empty urban area at night with a menacing figure following you.
 - ii. **Allowed changes:**
 1. **Environment:** A bright, sunlit park or friendly neighborhood.

2. **Figure:** A playful dog or friendly stranger.
3. **Action:** Dancing playfully, stopping to chat, or slowly approaching with a smile.

c. **Death:**

- i. A dark, chaotic battlefield or in an apocalyptic setting with projectiles (bullets and bombs) approaching you.
- ii. **Allowed changes:**
 1. **Environment:** A serene garden or peaceful meadow.
 2. **Figure:** Projectiles turn into bubbles, confetti, floating lanterns. Soldiers turn into kids.
 3. **Action:** Soldiers turning into kids

d. **Feeling Lost:**

- i. In an unknown forest or labyrinth alone.
- ii. **Allowed changes:**
 1. **Figure:** A helpful guide or friendly animal.
 2. **Action:** Providing directions, leading the way, or giving encouraging gestures.

e. **Feeling Trapped:**

- i. In a claustrophobic room or dark space.
- ii. **Allowed changes:**
 1. **Figure:** A supportive friend or comforting figure.
 2. **Action:** Opening doors, encouraging escape, or helping to expand the space.

3. Users can save their preferred configurations for each nightmare, allowing for easy access in future sessions. This includes their favorite environments, modifications to threats, and specific outcomes they wish to rehearse.
4. Users can provide feedback on their experience after every session, which will be saved to their profile for future reference.
5. Sleep experts can access this feedback and the users' preferred configurations to help tailor their treatment approach.

1.4 Research Questions

1. How effective is Virtual Reality Image Rehearsal Therapy (VR-IRT) in reducing the frequency and severity of idiopathic nightmares compared to traditional Imagery Rehearsal Therapy (IRT)?
2. Does the immersive nature of VR-IRT improve user engagement and adherence to therapy compared to non-VR methods?
3. In what ways can VR-IRT overcome the limitations of traditional IRT for individuals who struggle with mental imagery?
4. How do sleep experts perceive the integration of VR into therapeutic practices for treating Nightmare Disorder, and what potential challenges or benefits do they foresee?

1.5 Significance of the Project

This application provides Virtual Reality Image Rehearsal Therapy (VR-IRT) for individuals experiencing nightmare disorders by offering an immersive environment where they can safely rehearse and alter distressing dreams. It can also be a valuable tool for sleep experts, potentially aiding their treatment process by offering a more engaging and effective way to administer therapy and track patient progress.

1.6 Scope and Limitations

1. This application will focus on individuals diagnosed with nightmare disorders, particularly those who experience idiopathic nightmares.
2. This application only addresses the immersive experience of nightmares, which may not encompass all aspects of the disorder.
3. This application focuses on addressing the top five common nightmare disorders.
4. While the application offers a variety of options for customization, the choices available are not exhaustive, and certain limitations exist. Users can select from predefined environments, figures, and actions, but these selections may not encompass every possible variation or scenario.
5. The study's sample size may be limited, potentially affecting the generalizability of the findings to the wider population of individuals with nightmare disorders.
6. The application is only available in English, which may limit accessibility for non-English speaking users.

7. This application does not incorporate augmented reality features, focusing exclusively on virtual reality experiences.

1.7 Assumptions

1. It is assumed that users have access to virtual reality goggles, headphones, and handheld devices, which may limit accessibility for individuals without this specific technology.
2. It is assumed that users possess a basic level of technical proficiency, enabling them to effectively navigate the application and utilize its features.
3. It is assumed that users will actively participate in the experience by modifying scenarios and providing constructive feedback after each session, both of which are essential for enhancing the therapeutic process.
4. It is assumed that users do not have any health conditions (e.g., severe anxiety disorders, epilepsy) that could be exacerbated by immersive virtual reality experiences.

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