Therapist-Guided VR and Generative AI framework for body image exposure in eating disorders

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***Abstract*—Virtual reality (VR) represents an emerging therapeutic modality for eating disorders, enabling body image reconstruction through immersive exposure. This article proposes a framework that integrates generative AI, VR, and therapist-led cognitive behavioral therapy (CBT) to deliver personalized avatar-based interventions to achieve cognitive restructuring and experiential learning.**

***Index Terms*—Virtual Reality, Eating disorders, CBT**

I. Introduction

Eating disorders (EDs) are a heterogeneous class of mental disorders marked by severe disturbances in eating behaviors and associated cognitions and emotions [3]. Among the most prevalent EDs are anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED), all characterized by significant psychological and physiological consequences. A core psychopathological component is negative body image, manifesting as body dissatisfaction and excessive preoccupation with physical appearance, often central to self-definition [2]. Longitudinal studies have identified negative body image as an independent predictor of ED onset, mediating the impact of sociocultural pressures toward thinness and the development of maladaptive body and eating attitudes [13] [12]. Given this association, cognitive behavioral therapy (CBT) for EDs primarily targets body image redefinition and cognitive restructuring of self-image [8]. Nonetheless, a subset of patients exhibits limited responsiveness to conventional treatments [14], prompting investigation into adjunctive technologies. Among these, virtual reality (VR) has emerged as a promising intervention [11], offering controlled, ecologically valid simulations that elicit emotional responses, facilitate exposure to anxiety-inducing stimuli, and promote desensitization to cravings and anxiety [6] [9]. Additionally, neuroscientific findings suggest VR may recalibrate disturbed multisensory integration processes underlying body image distortions [7].

II. Releted Works

Virtual reality (VR) exposure therapy is a promising technology in the treatment of eating disorders (EDs). Research has shown that VR is effective in reducing body image disturbances, fear of weight gain, and body dissatisfaction. For example, a randomized controlled trial that integrated VR-based body exposure into standard treatment for anorexia nervosa (AN) reported greater reductions in fear of weight gain and body image distortion, along with greater body satisfaction and weight regain compared to control groups [10]. Similarly, a 2023 clinical trial observed emotional engagement and a trend toward reduced fear of weight gain in participants who used VR treatments. However, the study's limited statistical power limited the generalizability of the findings [1]. Several meta-analyses have supported the benefits of VR: a 2018 review found that 73% of 26 VR studies reported a reduction in negative emotional responses [4], while a 2024 review highlighted the role of VR in improving body image accuracy and reducing anxiety in several ED conditions [5]. Overall, these findings suggest that VR exposure therapy may be used as an alternative tool to conventional treatments for ED.

III. Proposed Framework

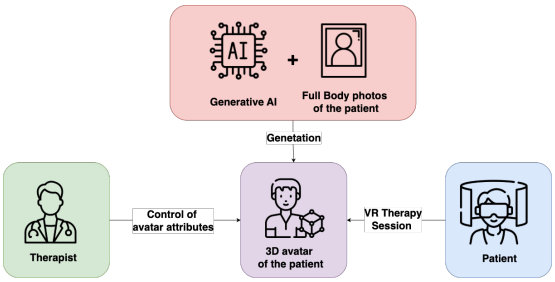

Fig. 1. The proposed framework integrating GAI and VR in therapist-guided treatment for eating disorders.

In this section, we present an innovative framework that integrates generative artificial intelligence (GAI), virtual reality (VR), and therapist-led cognitive-behavioral therapy (CBT) to promote personalization, active patient involvement, and clinical efficacy in the treatment of body image disorders in patients with anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED).

A central element of the proposed model is the generation of two individualized digital representations of the patient. In the first phase, through a structured interaction with the therapist, the patient provides a descriptive prompt, either verbal or textual, that expresses their subjective perception of the body and the cognitive distortions associated with it. Based on this information, generative artificial intelligence models create a first avatar that represents the patient's distorted body image.

This first avatar constitutes the starting point of the therapeutic path and represents the dysfunctional structure that needs to be restructured within the therapeutic process.

In parallel, a second avatar is generated, which accurately reproduces the patient's objective physical characteristics. To this end, artificial intelligence algorithms process full-figure two-dimensional (2D) photographs of the patient, returning an accurate digital representation of the real body. This second avatar serves as a stable clinical reference and constitutes the final objective towards which to orient the therapeutic path of perceptual reconciliation and body acceptance.

Both avatars, after being generated, are integrated into an immersive VR environment in which the treatment takes place. The therapist, through an interactive interface, maintains control over the characteristics of the distorted avatar, progressively modulating the BMI, body distribution, and individual critical areas (e.g., waist, thighs, abdomen) according to the therapeutic objectives and the patient's tolerance. This allows for the construction of a graduated hierarchy of exposure, in which the patient progressively faces variations in the perceived body image, working towards a progressive reduction of the discrepancy concerning the real body image. During each session, the patient wears a VR headset and is guided through a structured CBT protocol that includes:

- Embodiment induction (e.g., visual-motor synchrony) in order to promote identification with the avatar;
- Graduated exposure to problematic body areas through interaction with a virtual mirror;
- Real-time monitoring of discomfort through subjective scales of perceived discomfort (SUDs);
- Cognitive restructuring, during which the therapist helps the patient to address and modify dysfunctional beliefs activated during exposure.

The integration of the GAI enables a highly personalized and dynamic representation of the subjective body image, facilitating targeted exposure to the patient's specific perceptual distortions. At the same time, the progressive comparison with the avatar corresponding to the real body facilitates the process of cognitive updating and acceptance of the bodily self. The system also enables the systematic recording of the patient's emotional responses and the therapist's interventions, producing clinical data that are useful for monitoring the intervention and informing further research.

The hybrid model proposed in this work combines the emotional potential of VR embodiment, the adaptive precision of AI-generated avatars, and the clinical effectiveness of guided CBT, potentially offering an experiential therapeutic approach for patients with significant alterations in body perception.

IV. Conclusions

Virtual reality (VR) offers a promising avenue for treating eating disorders by addressing persistent body image disturbances. Recent evidence indicates that VR-assisted exposure therapy reduces body dissatisfaction, enhances body image accuracy, and mitigates fears such as weight gain in anorexia nervosa. This paper proposes an innovative framework combining generative AI and VR within therapist-led cognitive behavioral therapy (CBT), enabling real-time, personalized avatar-based exposure. This approach enhances desensitization, cognitive restructuring, and experiential learning while preserving the therapeutic alliance. Future research should validate this framework, optimize protocols, and assess long-term efficacy in body image correction and relapse prevention.

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