Design and Development of a Virtual Reality and Web-based Training System for Early Detection and Intervention in Psychosis

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Abstract

Early detection of psychosis by family members and close associates is a critical yet underserved area in mental health support. Existing psychoeducation programmes improve caregiver knowledge but remain largely passive, offering little opportunity for interactive practice. This paper presents the design and evaluation of a VR-based training system that addresses this gap by enabling relatives of at-risk individuals to practise supportive communication in a safe, immersive environment. The system was co-designed with clinicians through an iterative, user-centered process. Scenarios are structured as branching dialogues capturing speech, internal thought, and emotional response, authored via a web platform and experienced in a VR application set in a realistic home context. A mixed-method evaluation with mental health professionals (N=7, SUS: M=81.4, "Excellent") and general users (N=30, CIQ: all factors >=3.8/5) demonstrated strong usability and emotional engagement, providing a proof of concept for clinician-driven VR psychosis awareness training.

CCS Concepts

• **Human-centered computing** → **Usability testing**; **Virtual reality**; **Web-based interaction**; **User studies**; **Collaborative and social computing design and evaluation methods**.

Keywords

Virtual Reality, Human-Computer Interaction, Co-design, User-centered design, Mental Health Training, Scenario-Based Learning

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1 Introduction

Psychotic spectrum disorders are among the most serious psychiatric diseases, putting a heavy burden on patients, their families, and the broader community. In Greece, around 3,000 adolescents and young adults are estimated to experience their first psychotic episode annually [4]. In the absence of timely psychosocial intervention and pharmacological treatment, a significant number of these individuals can follow a chronic path marked by relapses, recurrent hospital admissions, and decreased functioning. Research verifies the fact that early multi-aspect and community-based treatment correlates with a better prognosis and a better result for patients with psychotic disorders [4]. Despite prior initiatives, a gap exists for functional tools suitable for the education of non-professionals, most importantly, family members and close associates, regarding the detection of the early warning signs of psychosis and responding empathetically. Established formats, such as written reports and psychoeducational groups, tend to prove too abstract or passive. Virtual Reality (VR) has demonstrated considerable promise across a variety of mental health domains [2, 6, 7]. However, it is evident that most research has focused on the patient, rather than educating carers on how to identify and support individuals who are at risk [6]. Existing approaches such as the Schiz'Aids psychoeducation program [8] improve caregiver knowledge, but remain passive and lecture-based. VR-based training for mental health staff has shown gains in empathy and subjective understanding [6], , yet this approach has not been extended to informal carers such as family members. Systematic reviews confirm VR's potential for psychosis interventions while calling for broader, non-clinical applications [3]. We address this gap with an interactive VR training system, co-designed with clinicians, that allows relatives of at-risk individuals to practice supportive communication in a safe, immersive environment.

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2 Methodology and Design

The system addresses two distinct user groups. The first consists of clinicians (psychologists and psychiatrists) responsible for authoring training scenarios. The second consists of relatives or close individuals of people at-risk, who will experience the VR-based training. The methodology combines iterative prototyping and user-centered design (UCD) with co-design elements applied in collaboration with clinicians. Regular meetings were held with the Association for Regional Development and Mental Health, EPAPSY PNOES, to gather requirements. The second user group was engaged during the evaluation phase rather than the design phase.

2.1 Defining Training Scenarios

Four co-design sessions were conducted with three clinicians from EPAPSY PNOES, including psychiatrists and therapists. These sessions defined realistic early psychosis warning signs, appropriate dialogue content, and emotional and behavioral parameters for the

non-playable character (NPC), that represents the person of interest (POI). A training scenario was defined as an interactive simulation combining dialogue, emotion, cognition, and movement to create realistic encounters for learning and practice. The interactive dialogue is modelled as a directed graph G=(V,E) where V is a set of dialogue nodes and E represents transitions based on player choices. Each node captures, speech (the person of interest's spoken line), thought (internal monologue), event type triggering animations, and three player responces each linked to an emotion and the next node.

2.2 VR Simulation Design

The VR experience was designed around a family-oriented use-case. During that, the user (relative), represented as the parent, interacts with a digital NPC, portrayed as an adolescent who refuses to leave their room. To minimize friction for users with no previous VR experience, we used anchored teleportation to move between predefined location and for all the interactions we use only one controller button. Spoken dialogue and internal thoughts are differentiated via Text-to-Speech synthesis (ElevenLabs API) with and without reverb, respectively.

3 Implementation

To instantiate and test the design, we built three integrated components. Firstly, a React/Vite web application for clinicians to create, preview, and manage scenarios stored as JSON in a cloud document-based database (Firestore). Furthermore we developed a Unity VR application that retrieves scenarios via a unique alphanumeric code and executes the branching dialogue with NPC animations and TTS audio. This architecture separates content creation from content delivery, allowing clinicians to update scenarios without any changes to the VR application.

4 Evaluation

A mixed-method evaluation was carried out to assess the usability of both applications. Two distinct questionnaires were used, one for each application. The VR application evaluation also included a qualitative analysis through an open-ended feedback question, yet it was not mandatory for all participants.

4.1 Web Application: Clinician Usability Study

Seven (N=7) mental health professionals (psychiatrists and clinical staff) from EPAPSY PNOES evaluated the web application using the System Usability Scale (SUS) [1]. Participants first received a brief overview of features, then independently completed tasks, primarily using the scenario editor to create, manage, save, review, edit, and delete scenarios with at least four dialogue interactions.

The overall mean SUS score was M=81.4 (SD=7.2). According to Bangor et al.'s interpretation guidelines, this places the system in the "Excellent" usability range [1]. It should be noted that the small sample size (N=7) limits the generalisability of this result; a larger cohort of clinicians would be needed to draw statistically robust conclusions.

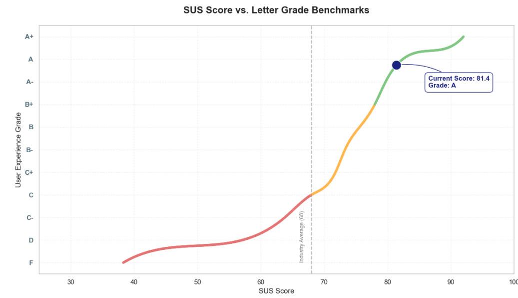

Figure 1: System Usability Scale (SUS) score of the web application relative to standardized letter grade benchmarks.

4.2 VR Application: Quantitative Study

Thirty (N=30) adult participants evaluated the VR application at the Department of Informatics and Telecommunications of the University of Athens. The evaluation involved adult participants of various ages who volunteered to take part. No particular profession or expertise was required.

At the start of the session, a tutorial scene was shown to help participants become familiar with the virtual environment and the basic controls. They were verbally instructed to perform specific movements and interact with elements within the tutorial before proceeding. The training scenario used for the evaluation had been authored by the clinicians from EPAPSY PNOES using the web application. After completing the tutorial, participants entered the unique scenario code into the VR main menu to load it. The code was given to them verbally. Before entering the scenario, each participant was assigned a user role. They were told they were the parent of a child who was refusing to leave their bedroom after exhibiting some signs of psychosis. Participants were then left to complete the experience alone, without any further guidance or feedback.

Most participants (24 out of 30) were in the 18-29 age group, which does not reflect the target population of family members and informal caregivers, who tend to be significantly older. This limits the ecological validity of the evaluation and is acknowledged as a limitation of this study. Prior VR experience varied: 34.4% reported no experience, 28.1% little experience, 15.6% some experience, and the remaining participants were experienced or very experienced.

Participants completed the Customisable Interactions Questionnaire (CIQ) [5], which assesses five factors of user satisfaction with VR and AR systems. All five factors scored above 3.8 out of 5. Assessment of Task Performance achieved the highest score (4.34), indicating that users felt confident navigating the scenario. Quality of Interactions scored 4.29 and Consistency with Expectations scored 4.20, reflecting that the system behaved as users anticipated. Quality of Sensory Enhancements (3.97) and Comfort (3.82) scored slightly lower, flagging areas for future improvement, primarily audio naturalness and headset weight.

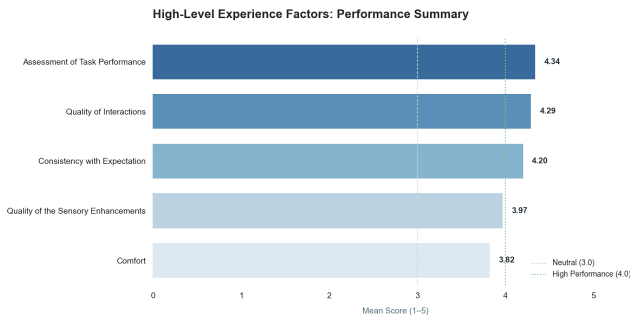

Figure 2: Average mean score per CIQ factor

The highest rated items were related to the Assessment of Task Performance, Consistency with Expectations, and Quality of Interactions factors. Participants reported that they felt confident navigating the scenario and found the system's responses predictable and reliable. These findings suggest the training application successfully supported a sense of agency and control, both essential for task-oriented learning scenarios. The lowest scores appeared in Quality of Sensory Enhancements (mean 4.0) and Comfort (3.82). For sensory enhancements, some users noted minor limitations in auditory feedback and environmental realism, which may have slightly reduced immersion. The comfort scores showed some variability across participants, likely influenced by differences in prior VR experience. Two individual questions are worth noting. The item asking how much mental effort participants invested while communicating with the person at-risk received scores slightly above average. This suggests users were genuinely deliberating over their responses rather than selecting answers arbitrarily. Most participants took their time considering how to interact with the NPC and what response to provide, a finding that was later echoed in the qualitative feedback. On comfort, motion discomfort was a factor for less experienced users, but headset weight emerged as an equally relevant issue alongside motion sensitivity, pointing toward a hardware constraint rather than a locomotion design problem. Overall, the results demonstrate that the system effectively balanced usability, engagement, and realism, offering an immersive yet accessible training experience.

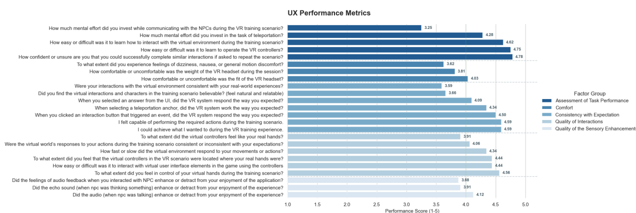

Figure 3: Average mean score per CIQ question

4.3 VR Application: Qualitative Feedback

In addition to the quantitative CIQ, participants were invited to provide open-ended written feedback. Responses were coded and grouped by priority using a thematic analysis approach [5] into high, medium, and low priority improvement categories. Three high-priority issues emerged. First, the audio that represents thought and the UI element that displays the NPC's spoken response overlapped in timing. Users expected the NPC's thought to fully complete before the response options appeared. Secondly, the AI generated TTS voice was perceived as lacking emotional depth, reducing the connection users were meant to develop with the NPC of the person at-risk. Medium priority issues included the NPC interaction pacing feeling slightly slow, requests for longer or more branching dialogues, some trigger placements being slightly off, and the dialogue box occasionally cluttering the visual field. On the positive side, the low-poly visual style was consistently praised for reducing distraction and supporting focus on the dialogue. Teleportation was described as comfortable and intuitive. The one-button interaction model was recognised as well-suited to inexperienced users. The scenario itself was described as thought-provoking and educationally meaningful. Notably, several participants reported mild anxiety during dialogue choices, indicating genuine emotional engagement with the scenario.

5 Conclusion

We presented a VR-based training system that enables relatives of individuals at risk of psychosis to practise supportive communication through clinically co-designed, branching narrative simulations. Strong usability results (SUS: M=81.4; CIQ: all factors >=3.8/5) confirm the feasibility of the approach for non-specialist users. Future work will focus on expanded scenario content, AI-driven dynamic dialogue with real-time speech input, and clinical efficacy trials.

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