Using Virtual Reality to Raise Public Awareness of Obsessive-Compulsive Disorder: A Preliminary Study

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ABSTRACT

The aim of this study is the development of virtual environments (VEs) for raising public awareness about Obsessive-Compulsive Disorder (O.C.D.). Therefore, the study focused on two main research questions: a) exploring the characteristics of O.C.D. that a VE should incorporate, and b) the user's awareness regarding O.C.D. after navigating the VE. Regarding the first research question, interviews were carried out with four psychologists in order to specify the symptoms of the disorder that a VE should include. Secondly, the interaction scenario was created for the two VEs based on psychologists' interviews and relevant literature. Specifically, two types of O.C.D. were selected: Doubt and Checking O.C.D. and Contamination O.C.D. Three users evaluated the two environments in terms of user experience. Moreover, two psychologists and two persons suffering from O.C.D. evaluated the two VEs in terms of disorder's representation. The final part of the study was about exploring the awareness of 13 users after navigating the VEs. The results from interviews and questionnaires showed that the two VEs contributed to the understanding of the disorder. However, the results for the VE about Doubt and Checking O.C.D. was able to incite more empathy than Contamination O.C.D VE.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI); Interaction paradigms; Virtual reality; • **Applied computing** → Life and medical science; Health informatics.

KEYWORDS

Obsessive-Compulsive disorder, virtual environment, awareness, empathy

1 INTRODUCTION

Obsessive-Compulsive Disorder (O.C.D.) is a neuropsychiatric disorder whose main characteristics are obsessive thoughts and compulsions. Because of its different types, it is difficult for mental health professionals to diagnose and manage the disorder. The average age of onset of the disorder is 19.5 years; in rare cases, symptoms appeared for the first time after the age of 30 [11]. Obsessive thoughts are defined as involuntary, repetitive, stress-inducing thoughts, images, and impulses. The individual attempts to ignore or avoid stimuli that enhance the presence of obsessive thoughts or tries to neutralize and stop these thoughts by engaging in compulsions, i.e. repetitive behaviors and overreactions in order to decrease the level of stress caused by the obsessive thoughts [2]. Some examples of compulsions are the pursuit of cleanliness and order through rituals, the repetition of actions that individuals think will 'magically' protect them and compulsions that are related to order, counting and confirmation [9, 11]. The diagnostic criteria for O.C.D. are obsessions and compulsions that are time consuming (typically lasting for more than one hour per day) and cause disruptions in work, social or other important aspects in the individual's life [9]; furthermore, symptoms are not caused by substance use or other medical conditions and are not related to other mental disorders. As most psychiatric disorders, O.C.D. may occur due to a combination of biological, psychological and social factors. Family studies showed that the occurrence of O.C.D. is doubled in the case of people who have first-degree relatives suffering from O.C.D. [9]. As far as biological factors are concerned, it is argued that neurotransmitters play an important role in shaping mood, sleep, memory, and learning. Apart from neurotransmitters, studies have shown that three areas of the brain are hyperactive in individuals with O.C.D. [9, 18]. Concerning behavioral factors, harsh punishment at a very young age may be associated with the development of O.C.D. Additionally, compulsions may be a result of copying behaviors from one of the parents that suffer from stress or compulsions [7].

1.1 Consequences of O.C.D. in individual's daily life and Therapeutic approaches

Intrusive thoughts are very common during the day. For individuals with O.C.D, the attempts to stop these thoughts may result in these thoughts being more persistent and transforming into obsessions [6, 9]. The reason individuals with O.C.D. overreact to these thoughts is their belief that the thoughts will come true, and have strong feelings of responsibility [9]. Additionally, strong criticism, parental control, and high expectations during the upbringing of a child may lead to perfectionist beliefs that may favor the O.C.D development [23]. The quality of life of individuals suffering from O.C.D. is usually low, since their functioning is affected. Individuals

with O.C.D. are limited in the social and work-related aspects of their lives due to repetitive thoughts and actions without meaning. In several cases, friends, and family of individuals with O.C.D. participate in compulsive behaviors in order to avoid conflicts. The disorder also affects the potential for companionship; as a result, half of the individuals suffering from O.C.D. do not have a partner [21]. On the other hand, individuals that have a partner, experience issues related to distress, and inability to engage in effective problem-solving [21]. Additionally, O.C.D. affects the mood of the individual, leading to feelings of stress, sadness, dissatisfaction from oneself, and the need to engage in compulsive behaviors despite being aware of the irrationality of these [1].

The primary therapeutic approaches for the treatment of O.C.D. are Cognitive-Behavioral Therapy [C.B.T] and Exposure-Response Prevention [E.R.P] [7, 9]. Antidepressants - especially those related to serotonin reuptake inhibitors (SRIs) - are also useful in combination with methods such as C.B.T. [9].

1.2 Importance of public awareness about O.C.D.

Many individuals do not understand that their symptoms are the result of a mental disorder until the symptoms are severe enough to affect their functionality [8]. A potential cause for delay in seeking treatment may be insufficient public awareness regarding mental health in general and O.C.D. in particular. Furthermore, it is also important for individuals to ascertain whether the symptoms are due to personality traits or due to the disorder [8, 20]. Protective factors for the prevention of psychopathology and the results of stress include personal disposition, family cohesion and support outside the family. Research on Chinese teenagers has shown that those with good disposition and social support at school had a lower probability of suffering from O.C.D. [23]. Important support systems for individuals with O.C.D. may include (i) family and caretakers, (ii) neighbors, relatives, and friends, and (iii) religious, voluntary, and state organizations [16]. The participation of family members in compulsive behaviors can exacerbate the individuals' obsessions and prevent them from seeking help. On the other hand, the denial of family participation in compulsive behaviors may lead to lack of affection and disrupt family relations [6]. Consequently, the role of mental health professionals is important in informing family members about O.C.D. and support individuals during therapy [6, 16].

Individuals may choose to isolate and hide the symptoms of the disorder from friends because of stress, anger, and fear of exposure. Individuals with O.C.D. may be stigmatized by friends when choosing to talk about the disorder. This may be due to a lack of knowledge about O.C.D., possibly resulting in the individuals' behavior being recognized as intentional [13]. Thus, empathy is very important in making a population aware of a particular issue about a particular population group [5].

1.3 The use of virtual reality in enhancing empathy about mental health disorders

The use of virtual reality (VR) for mental health purposes has increased in the last decades; VR has been used for awareness purposes about schizophrenia and dementia [12, 19, 24]. In another study to enhance empathy for people with schizophrenia, VR combined with an empathy-enhancing activity was effective. Although empathy is a natural ability, its development is influenced by environmental factors [5]. Typically, a person can experience greater empathy for those they are familiar with as well as for people they perceive as being more familiar to them. Belman & Flanagan [3] state that there are two main types of empathy in social science literature: cognitive empathy (the experience of purposefully trying to understand another person's position) and emotional empathy. It is worth noting that games have been considered as "empathy machines" [10]. Based on this view, VR can be viewed as the ultimate empathetic machine, as it can provide the user the ability to immerse themselves and "live the life of another person" [10, 19]. According to Wan & Lam [24], there is a great need for adequate training of health professionals regarding mental health. In this case, simulation activities can help students to gain experience about mental health in a safe environment [24].

2 PILOT STUDY

2.1 Research questions

O.C.D. appears in 2.3% of the general population and is the tenth cause of disability in the industrialized world [1, 11]. In this case, the individual's social environment can (as long as it is informed and aware) contribute to the early recognition of the disorder and the first steps towards treatment. There are limited applications of VR being used for O.C.D treatment and there is only one work on the design characteristics that a VE should incorporate to be able to enhance public awareness [15]. Thus, the study was focused on two main research questions: (i) What kind of characteristics a VE should incorporate in order to constitute an effective representation of O.C.D? (ii) How user awareness regarding O.C.D. could be increased by the use of V.E?

2.2 Experts interviews and the design of V.E interaction scenario

Regarding the first research question, semi-structured interviews were carried out with four psychologists in order to specify the O.C.D symptoms that the V.E. should represent. Responses showed that the focus on one type of O.C.D. with an emphasis on its variations will be more helpful when it comes to public awareness. Also, it is important to highlight through VEs the feelings of loneliness and hopelessness that are experienced by O.C.D. sufferers, as well as the impairment of their functionality. Furthermore, it is important that the VEs reflect the types of O.C.D. related to contamination, magical thinking as well as doubt about harm and checking.

Thus, an interaction scenario was created based on the above. Specifically the Contamination O.C.D. VE [Figure 1] was based on the case study of an individual referred as M.R. [4], and the compulsions used are the following: If M.R. doesn't wash his hands enough times, he will get sick and won't be able to complete the university applications; separates his personal belongings from those of his roommate so that they will not be 'contaminated'; Any products that are not organic are thrown away in order to avoid poisoning. The Doubt-Checking O.C.D VE [Figure 2] was based on the symptomatology present in the literature. More specifically: the person experiences pressure, as well as images come to his

Figure 1: Screenshot from the VE about Contamination O.C.D.

Figure 2: Screenshot from the VE about Doubt-Checking O.C.D

mind that he himself or a loved one will suffer by carelessness or neglect; increased sense of responsibility and doubt; repetitive control behaviors as a means of "neutralizing" negative emotions; Doubts about their past actions and re-examination [25].

2.3 Interaction Scenario

The user navigates the desktop VE as the game character, in first-person perspective. There are five rooms, each representing symptoms of O.C.D. from mild to severe, in ascending order (i.e. room 1: least severe, room 5: most severe). Instructions are displayed on the screen in the form of text, such as the following: "The psychologist asked me to describe my story with O.C.D. But to be able to narrate it properly, I need to go through each one of the five rooms, find the dialogues and collect the page from my diary". When users enter one of the rooms, they must perform the compulsion related to this room. Then, a dialogue is displayed. Dialogues are predetermined discussions that users cannot interact with during the gameplay. These discussions are supposed to take place between the game character and an individual from a different aspect of his life (e.g family members, work etc.). After reading the dialogue, a diary page appears which is the key to enter the main scene. Users can then visit a different room. After navigating all the rooms, users can listen to five narratives regarding truths about O.C.D.

The desktop VEs were developed using Blender and the Unity game engine. Then, the VEs were evaluated by three users in terms of user experience and the accuracy of the disorder's representation, by psychologists and two persons suffering from O.C.D.

2.4 Instruments and procedure

After the completion of the evaluation, a literature review showed that the Interpersonal Reactivity Index (IRI) can be used to reliably measure cognitive and emotional empathy. In the study of Rueda et al. [22], the subscale of perspective-taking was used for measuring cognitive empathy while the subscale of emotional concern was used for measuring emotional empathy. The same subscales were used in this study. Overall, the scale includes four factors, each of which consists of seven questions that use a five-point scale (0 = "it does not describe me well", 4 = "it describes me very well"). Apart from the IRI, the users' emotional state was represented in terms of Ekman's basic emotions – happiness, sadness, fear, surprise, anger, and disgust – [17] using a custom ten-point scale. For measuring User Experience, a short version of the UX Questionnaire (https://www.ueq-online.org/) was used.

During the final part of the study, thirteen users (5 female, 8 male) not suffering from O.C.D. reviewed the two VEs, either in person (three users) or remotely (ten users). Remote sessions were held due to restrictions as a result of the Covid-19 pandemic. Before the navigation, users filled in the I.R.I scale, a questionnaire about demographics, and a questionnaire regarding their prior knowledge about O.C.D. After the navigation, users filled in the UX questionnaire [26] and the questionnaire including items related to O.C.D. awareness, as well as the custom items related to basic emotions. The same questionnaire was filled in twice (once for each VE). Finally, semi-structured interviews were conducted with the users after the navigation.

2.5 Quantitative results: The IRI scale

Due to the small sample size, the quantitative results are indicative and are interpreted in terms of the answers that users gave during the semi-structured interviews. The mean score of users' cognitive empathy was 17.9 (s.d. 4.42), while the mean score of users' emotional empathy was 14.15 (s.d. 4.74). Regarding Contamination O.C.D. VE, emotional empathy was correlated with UX (r = 0.609, p = 0.027). In the case of Doubt- Checking O.C.D., cognitive empathy was positively correlated with the emotion of happiness (r = 0.573, p = 0.04) and negatively correlated with the emotion of sadness (r = −0.682, p = 0.01). Additionally, emotional empathy was correlated with the emotion of fear (r = 0.585, p = 0.03) in Doubt-Checking O.C.D. VE [Table 1].

2.6 Qualitative results

Regarding the Contamination O.C.D. VE, the understanding of the disorder was apparent due to handwashing, items being cleared out of the way, and related dialogues. Furthermore, the stress was apparent when it came to crossing the room quickly due to germs. The displayed messages were also referred to as helpful of understanding O.C.D. Another recommendation for improvement was to be a visual transcription of the narratives except from audio clips after the navigation in each VE. As for the empathy, the dialogues were described helpful in perceiving emotions such as sadness, stress, and despair. Despair became quite apparent whenever the game character did not engage in compulsive behavior on time. Furthermore, the dialogues showed that the game character was in denial to admit that he suffers from a disorder.

Table 1: Correlations among cognitive- emotional empathy and the emotions of the participants

Empathy categories Emotions (Pearson's r)	Cognitive Empathy		Emotional Empathy	
	V.E 1	V.E 2	V.E 1	V.E 2
Happiness	r=.475, p=.101	**r= .573*, p=.04**	r=-.475, p=.10	r=-.535, p=.059
Surprise	r=.183, p=.549	r=-.335, p=.262	r=-.336, p=.261	r=-.268, p=.376
Sadness	r=-.17, p=.95	**r=-.682*, p=.010**	r=-.100p=.745	r=-.229, p=.452
Fear	**r=-.564*,p=.05**	r=-.347, p=.246	r=-.187, p=.540	**r=.585*, p=0.03.**
Anger	r=.349, p=.242	r=-.495, p=.086	r=-.506, p=.077	r=-.528, p=.064
Disgust	r=.275, p= .363	r=-.196, p=.521	r=-.333, p=.266	r=-.339, p=.258
User Experience (Pearson's r)	r=-.088, p=.774	r=-.032, p=.918	**r=.609*, p=.027**	r=-.480, p=.097

2.7 Discussion

The results showed that emotions and affective states such as fear, sadness, surprise, and anger were higher in the Doubt-checking VE. Additionally, there was a correlation between emotional empathy and the emotion of fear. Emotional empathy is defined as the search for similarities between the user and the game character [3]. Some users commented during the interviews that they had obsessions related to order and they felt stressed during the game. Furthermore, repetitiveness was referred to as a helpful element in understanding the stress and the insecurity of the game character. Repetitiveness was also described as a main symptom of Doubt and Checking O.C.D. [25]. In particular, the interviews showed that the dialogues were helpful in highlighting the consequences of the disorder in various aspects of the game character's life. Additionally, some of the participants mentioned that it would make the VEs more engaging if the dialogues would be held with avatars instead of world decorations.

Regarding the Contamination O.C.D. VE, users commented that the game character's stress was apparent during the gameplay. In particular, dialogues were characterized as helpful in understanding that the game character was forced to obey his thoughts even though his daily life was negatively affected. This is in accordance with the fact that 78% of individuals had compulsions and it was difficult to stop them despite recognizing them as irrational [9]. Additionally, another improvement was related to the visual representation of the character's emotions- specifically, blurring of the screen due to the increase of the game character's stress, allowing users to choose an avatar (for the game character), and also navigate the VE in third-person perspective.

3 CONCLUSIONS, LIMITATIONS, AND FUTURE WORK

The pilot study described in this paper supplements existing literature according to which VR can be used for the management of mental disorders, and especially anxiety and phobias. One of its main advantages as a medium is that it can easily simulate situations that the individual would not be able to face in reality [14]. Results showed that the VEs contributed to the understanding of the disorder. During the interviews, users referred that hands' washing and objects' picking were related to the understanding of Contamination O.C.D. On the other hand, the Doubt and Checking VE contributed more to the understanding of the game character's emotions. In particular, repetitiveness helped users to understand the

stress and the insecurity of the game character and was mentioned as a criterion of O.C.D. understanding. The results were further reinforced by the relation of cognitive empathy to the question about the perception of the game character's emotions. A correlation between emotional empathy and the emotion of fear was observed. This result was supported by users' comments during the interview that they had obsessions related to order. One of the restrictions during this research was the Covid-19 pandemic that prevented most of the reviews from being on site. A suggestion for future research would be the examination of O.C.D. awareness with a larger sample. Additionally, it is suggested that more types of the disorder be included in future research.

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