

Phobia Treatment: Virtual Reality Approach

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Abstract—A phobia is an overwhelming and exaggerated fear of an object, animal, place, situation, or feeling. Often, people with phobias ignore their symptoms and do not get psychotherapy treatment, either because of the social perspective about people who visit psychologists or simply because they cannot afford the cost of psychotherapy. This research paper proposes a mobile application named FaceYourFear (FyF) integrating Virtual Reality (VR) to help any user to live a cybernetic experience (where the outcomes of a session level can help the patient to move to the next level of treatment), overcome the illness, know about phobia symptoms and get extra information on types of phobias.

Keywords- Phobia; Technology; Virtual Reality; Android app; Face Your Fear (FyF).

I. INTRODUCTION

Phobia comes from the Greek word Phobos and it is defined as an “exaggerated usually inexplicable and illogical huge fear of a particular object” [1] like cats, insects or crowded places. It is a type of anxiety disorder that can affect people’s daily life and, in some cases, it can lead to depression. Phobias are part of anxiety mental disorders and cause intense fear of specific objects, situations or some types of activities [2]. Having phobia is much more serious than a normal logical fear, that is, a specific part of the brain has been found to be responsible for some kinds of phobias [3]. Phobias are categorized as specific (simple), social or agoraphobia (complex). Social phobia regards the fear of participating in certain activities in public like eating or speaking. People suffering from social phobia tend to avoid any social events such as weddings or parties, which affects their social lives and increases their chance to develop depression due to their isolated lifestyle.

VR is a computer-generated simulation where people experience the present. It has been developed with the aim to allow users to handle data with ease by offering an active and dynamic way to perceive and experience fake data. VR is quite intuitive, interactive and it is quick in replying to the user’s requests [4]. It has gained a great interest in its application in several fields, including the automotive industry, entertainment, healthcare, architecture, education and military training.

The extent of VR immersion identifies how much a user is involved with the environment. It can also be regarded as how powerful the user attention is focused on the current task or situation. The immersion presence in the context of VR is the perception of being physically present in a non-physical world. It is commonly based on several parameters such as interaction level, image quality, stereoscopic view and the rate update of the display. VR systems can be classified as (a) non-immersive systems, with limited implementation of VR techniques, (b) semi-immersive systems, with high quality graphics in association with large displays and (c) fully immersive systems, which provide the most effective and real virtual experience to users, but require the usage of a head-mounted display [5].

Smartphones are becoming an integral part of our lives. They possess high computing capabilities, are equipped with a variety of sensors, Internet connectivity, high resolution and touch screen, which have led to the development of a tremendous number of smartphone applications in several areas. Recently, VR glasses have been designed for smartphones, where the phone’s display is viewed as VR content.

Museums offer technological and digital options to enrich the user experience in a visit. However, questions arise like which exhibition/museum could I visit? How to tour it and get the best experience? A hybrid approach to make recommendations for museum visits is proposed by [6], including Internet of Things architecture of beacons, data mining and machine learning. The result is a customized tour with augmented reality that contains a set of recommendations on how to visit a set of museums and obtain a better experience of the visit; the prototype is available in Google Play and it is named “Historic Center”.

The research on VR in education is still in an early stage. Khan et al. [7] measured the impact of VR mobile apps on the learning motivation of undergraduate health science students at the University of Cape Town, South Africa. According to the authors, the Attention, Relevance, Confidence and Satisfaction (ARCS) model guided the understanding of the impact of VR on student motivation where differences in student learning motivation before and after using VR apps were conducted (78 participants). Their

results showed that using VR apps increased the learning motivation of students in all ARCS dimensions.

Taking full advantage of this current technology, the present research proposes a system that integrates the smartphone and the VR technologies for phobia treatment.

The rest of the paper is organized as follows. Section II discusses related work while Section III presents the proposed FaceYourFear (FyF) App in terms of architecture and features. Finally, Section IV concludes this paper with future perspectives.

II. STATE OF THE ART

Previsl [8] is a Spanish company that develops and sells VR software. It offers VR Environments for airplanes, elevators (closed spaces and height phobia) and thunderstorms in 13 countries. It provides preparatory flight travel VR scenes such as packing of traveling bags, sitting in terminal and announcements of flights to make the person more comfortable with the environment and anticipate and prepare him/her for the upcoming event. It offers a computer-based VR therapy which is expensive.

CleVR [9] was established in 2010 in the Netherlands with the aim to offer VR environments for various domains. They provide software for VR Exposure Therapy (VRET) in association with Delft University of Technology. The software is being used to treat flying and social phobia. The patients can experience the virtual environment with the help of Head-Mounted Displays (HDMs) and observe the entire environment all around them. Meanwhile, psychotherapists have full control on changing the environment by increasing or decreasing the complexity level.

Spider-World [10] is a computer-based VR therapy with an additional ability feature to feel the object. As the name suggests, it is used to treat patients with spider phobia. Under this treatment, the patient can touch a virtual spider with the help of a cyber hand, generating the illusion of a spider touch. Certainly, this type of tactile augmentation doubled the effectiveness of VR treatment by improving the patient confidence level towards the phobic stimulus.

Phobos is VR software developed by PsyTech LLC [11]. It was specially designed to treat phobic patients using a gradual approach. The software is based on VR Exposure Therapy (VRET). It provides private environments for the patients to manage their anxiety symptoms, including interactive VR environments of some phobias such as flying, height, spiders and crowded spaces.

The VR medical center [12] was established in the USA with the purpose of treating phobic patients in the most suitable, affordable, and convenient way. The medical center has the VR equipment and the required software to make the treatment possible. The center currently treats a number of phobias, including fear of flying, driving, public speaking and thunderstorms. The medical center uses the Cave Automatic Virtual Environment (CAVE) and HDM setups to treat patients.

In addition, numerous mobile applications have been developed under this context. Beat Social Phobia [13] was developed by Andrew Johnson, a clinical hypnotherapist, and released by HiveBrain Software in 2013. It is an app that

provides audio instructions from the psychotherapist to think in a more positive way. It helps to identify the specific phobia, its symptoms and how to deal with it. It helps to become more confident, relaxed and calm in social places. The Beat Social Phobia app sessions are twenty-six minutes long and divided into four parts: introduction, relaxation, social phobia and awakening. However, it does not provide any video tutorials or immersive environments for the phobic patient. Thus, the patient cannot experience the actual situation causing the phobia (virtually).

Byten Phobia Treatment [14] was developed by Paul Mckenna in 2013 and released by Once Byten Limited. It runs on iOS and provides an audio session. The patient can select one of the phobias from the list, listen to the sessions at their own pace and try to think in a different manner towards the phobic agent. This app has some weaknesses such as it does not offer videos or exposure therapy environment for agents which does not help the real experience of the phobia itself. The option to reverse the audio session to a specific point is not offered, so the user has to listen to the whole session again. Quite often, the app freezes and does not response at all.

Cure Phobias and Overcome Fear [15] is an Android app developed in 2009. It is offered by MasterMind Apps and also provides an audio session of therapy that is meant to promote positive thinking in users to overcome their personal problems. It gives a textual description of the phobias and provides tips to overcome them. It contains some flaws such as unfriendly user interface and the audio session is quite long, causing loss of attention. Sometimes, the audio does not play at all and, occasionally, becomes unresponsive.

Arachnophobia Free app [16] has been developed in association with two leading psychiatrists to treat people with spider phobia. It is offered by Thrive Technologies Limited. The app is supported by iOS and it is based on VRET where patients are exposed to spiders in a gradual manner. In early stages, the spider is represented as a little cute pink character named "Itsy" and, as the game progresses, it turns to a real looking spider. The user can retake the session to get over their fear. The app provides guided therapy with the help of a virtual doctor called Dr. Freeman. The app presented in [17] is of high quality and has been winner of Cambridge University Technology and Enterprise Club (CUTEC) at Cambridge University. However, its drawback is that it treats a single type of phobia.

Created by Malmum Developers, VR Height Phobia addresses height phobia [18]. It has three levels, and the users may easily navigate through them and may repeat any level until they become comfortable. However, it has poor graphics, and the user has to launch the app again after completing each level.

Developed by Virtual Speech, the goal of the Public Speaking VR [19] app is public speaking phobia treatment. The scenes are provided with many people seated and some distractions are created with noise and voice of people talking. This helps the app user to boost his/her self-assurance to face the real settings confidently. Some of the

setbacks include blurred transitions while, sometimes, the splitting screen does not work.

Our contribution in this field is a mobile application that assists patients with exposure therapy sessions at any time with ease and lets them face their own fear. It is designed to provide an affordable therapy instead of costly treatments and to avoid long waiting hours for appointments. Since the environment is controlled and gradual, the users can repeat the sessions at their own will. There are several levels of treatment that the patient might be gradually exposed to. As the patient becomes more comfortable, s/he can move to a more intense level. Furthermore, patients can learn about the different types of phobias and their respective symptoms through the application. In addition, the application assists the user to search for a psychotherapist in the selected location (UAE in our case) and to make an appointment. Finally, it is worth mentioning that our application can run on iOS and Android platforms.

III. FYF APP

A. Pre-Survey

To develop a fully functional and good quality VR mobile app that helps with the treatment of phobias, a survey was conducted among people of different ages, genders, and professions. The data collected provided a quantitative insight into phobia related questions. In addition, the obtained feedback from Survey Monkey helped in the elicitation of requirements and features to be considered when developing the app.

The gender participation ratio was 64% females and 36% males. The age distribution was as follows: 70% in the range of 18-24 years, 13.5% in the range of 25-34 years, 10% in the range of 35-44 years and 6.5% in the range 45-54 years. Of the 77 respondents, 72.73% live in the UAE while the remaining ones live outside of the UAE (Palestine, Syria, Turkey, KSA, Germany, Egypt). The main purpose of knowing the respondent's location is closely related to some countries phobias patterns. This happens because phobias are frequently based on each local environment factor.

Participants were given a phobia list and were asked to select the one(s) they suffer from. The results were as follows: 4.22% - arachnophobia; 8.42% - claustrophobia; 6.85% - glossophobia; 13.51% - aquaphobia; 11.81% - acrophobia; 12.43% - achluophobia; 6.85% - avidophobia; 8.56% - entomophobia; 4.43% - hemophobia; 9.59% - ailurophobia; 13.33% - other responses included war, fighting, sexual assault, my wife, snakes, cockroaches or not having phobia at all.

Another inquiry was closely related to whether the participants' phobia was related to a specific event. 84.42% of them simply stated no. Furthermore, to help understand the symptoms that occur when a person encounters the phobic agent, the most common symptom (50%) was rapid heartbeat. Some respondents specified other side-effects such as trouble breathing, panic attacks, shaking, nausea, running away and sweating.

For those who have phobia, 54.67% of the respondents stated that they searched already for a specialist. Concerning

the preference of way of treatment, 17.14% favor treatment with pills while 82.86% prefer treatment by exposure to the feared object/situation. The last question was related to the adoption of a mobile application for phobia treatment. 63.51% were positive towards this idea.

B. Development

The *FyF* App consists of a three-layer framework composed of the presentation, business and data layers. The presentation layer contains the user interfaces which represent the scenes and was developed in Unity. The business is a service layer that contains Java (JS) and C# scripts to interact with the data layer for processing purpose and to display the scenes and give the appropriate feedback to the end-users.

This VR-based phobia app runs on Android OS for smart phones. It also requires the use of VR glasses, such as Google Cardboard [20], which come in an affordable cost and in order to experience the phobia environment. The users of the app are phobic patients and the psychotherapist. The patient is the one who experiences phobia environments. S/he has the option to search for a nearby psychotherapist and to send the experience feedback from the app to the psychotherapist. For the psychotherapist, s/he may use the app to receive the patient experience outcome and to discuss/follow up with the patient.

In its development, several software packages have been used to create realistic and high-quality scenes, including animations and audios to provide a realistic and natural experience for the end-user. The game engine choice was Unity3D [21] with its nice feature of multiple OS platforms. In a reference note, Unity is a game engine that supports simulations, desktop, websites and apps, including a Software Development Kit (SDK) for virtual and augmented reality. Google SketchUp [22], a powerful and user-friendly Computer Aided Design (CAD) created realistic effects. Max 3D [23], used to develop 3D animations, models and characters, provided realistic and professional graphics and it has been used to develop some extra VR environment features. Audacity audio editor provided multiple features of music editing and merging recording sounds. It was used to develop sound effects of water waves and darkness sound at night for the aquaphobia and achluophobia environments. Blender Software has been used to create 3D models and developing characters, videos and audios. It offers animations and high-quality graphics. Besides, it also supports natural environment and object creation such as raindrops, flames, smoke, rainbows and sky movements. Cardboard SDK, a VR based support compatible with Unity to develop VR applications, has been also exploited to develop immersive environments.

In the phase of system analysis and requirement elicitation, meetings and interviews have been conducted with a psychotherapist in Abu Dhabi. In addition, a thorough literature search has been done to get an insight into the existing methods of phobia treatment.

C. GUIs

A set of interfaces has been designed by considering the usability and user experience, where the displaying menus and functions are clear, the navigation is easy, the colors are well-chosen, the images are clear, and the text font size is suitable. Figure 1 (left) presents the screen when the user first launches this app (it stays for 5 seconds) while Figure 1 (right) presents the main screen with three options: “Experience VR”, “Get to Know Phobia”, and “Nearby psychotherapist”. It was designed as a wheel with graphical icons for each selection.



Figure 1. Welcome (left) and main (right) screen.

The “Experience VR” screen (Figure 2) gives the user two options to select: (A) Water phobia (aquaphobia); (B) Darkness phobia (achluophobia). Afterwards, s/he will be directed to the “Session” screen. For any new VR user, it is advisable that s/he chooses a short session first although real treatment requires long ones (30 minutes, according to doctors). Additionally, the session level time is setup automatically. The scenes for the three levels of aquaphobia and achluophobia are revealed in Figures 3 and 4, respectively.



Figure 2. “Experience VR” (left) and “Session” (right) screen.

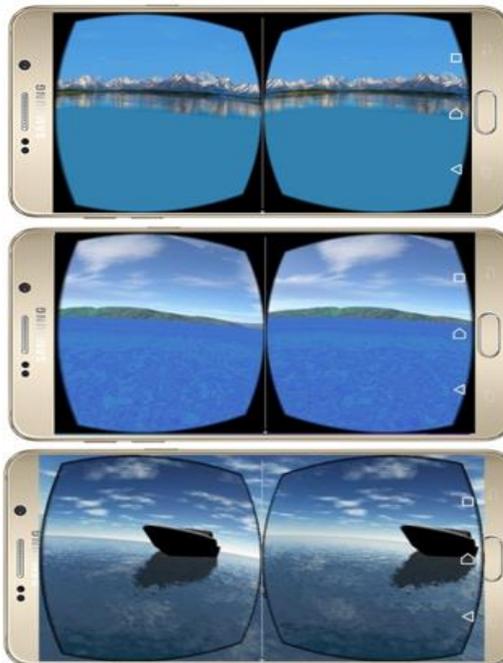


Figure 3. Aquaphobia level 1 (top), level 2 (middle) and level 3 (bottom).

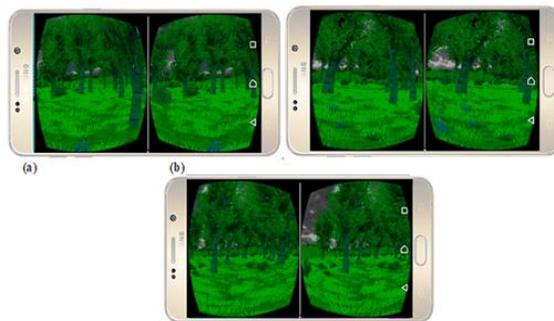


Figure 4. Achluophobia (a) level 1, (b) level 2 and (c) level 3.

The “Nearby psychiatrist” helps the user to find the nearest psychotherapist, as shown in Figure 5. For that, the user selects the city from the list box menu. Once the city is selected, another sub-menu listing all hospitals that have a psychiatry department is shown to the user. For usability purposes, we opted for list boxes to make it easier rather than typing the name of the city and hospitals and, naturally, to reduce user typos. When a hospital is selected, the address and telephone numbers are disclosed.

Our proposed app, FyF, has been tested from the functionalities and usability perspectives. A group of students from the university in Abu Dhabi have been selected to test our app. The selected participants suffer from the above-mentioned types of phobias. The overall results have shown to be promising. However, this testing phase requires long time and, more importantly, requires the opinions of psychotherapists in the field, which is our next step in the plan.



Figure 5. The nearby psychotherapist screens.

IV. CONCLUSION AND FUTURE WORK

In this paper, a VR-based mobile app is proposed to assist phobic patients. It has an easy-to-use interface to be used for the initial treatment. It provides patients with appealing features, such as virtual exposure to the phobic situations or objects, textual descriptions on types of phobias, their symptoms and treatments, search function for nearby psychotherapists, audio that helps them to relax and report submissions capabilities to his/her doctor. This app also provides the virtual environment for patients to gradually get exposed to each stimulus to overcome their fear. Patients may experience a 360-degree view of the phobia agent environment along with sounds to provide a realistic scene. At last, users can turn on music when they feel uncomfortable or move to higher exposure levels.

As future improvement, we plan to gather feedback from experts in the field such as psychotherapists in case our app needs improvements. Also, we plan to add the use of a smartwatch to be connected where, during any VR session, the user heart rate is being monitored. In the case the heart rate becomes high, the user will be given an option to exit or play a calm audio. If the heart rate exceeds a certain rate (100 bpm for adults), the session will be closed automatically. Additionally, we plan to extend the app to add other types of phobias.

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