

Using Virtual Reality to Combat Fear

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Abstract—Exposure therapy is a technique in behavior therapy to treat anxiety disorders [1]. It is a psychological treatment that was developed to help people confront their fears or phobias. When people are fearful of something, they tend to avoid the feared objects, activities or situations [2]. This becomes a problem when in the process of avoiding their fears, they do have a short term relief but in the long run it gets worse. There are several methods to help individuals in such cases, like, In Vivo exposure, Imaginal Exposure, Interoceptive exposure [2]. These are just a few of the many techniques. One such technique that has been discovered is the virtual reality exposure therapy, in some cases it is used when In Vivo exposure is not practical. The technique also makes it so much easier to use within the four walls of the therapist.[3][4]

Index Terms—Exposure therapy, psychological treatment, phobias, Virtual reality exposure therapy

I. INTRODUCTION

A phobia is a type of anxiety disorder. An individual may not experience any symptoms until they come in contact with the source of their phobia or trigger. In other cases, the phobia is so major that even thinking about the source or trigger can make the person feel anxious or panicky. There are several symptoms associated with phobias like, dizziness, nausea, sweating profusely, shortness of breath, trembling, upset stomach, palpitations. Phobias are not a result of just one reason, there are a number of associated factors. For example, a phobia may be associated with a particular incident or trauma, or may be learned response developed earlier in life from a parent or sibling or genetics, there is evidence proving that some people are born with a tendency to be anxious. almost all phobias, contrary to popular belief, are treatable. Simple phobias are easy to treat through gradual exposure of the source, while complex phobias take longer and involves a multitude of facets such as counselling, psychotherapy and cognitive behavioral therapy.

Virtual Reality Exposure Therapy combines the best of cognitive behavior therapy and In Vivo exposure [5]. It has several benefits over latter. For example, in the case of an individual with a phobia of flying, it is easier to assist the person by convincing him to come to the therapist's office and try flying virtually that convincing them to physically go to the place they already fear so much. Virtual Reality Exposure therapy gives the therapist the advantage of having full control over the situation, in that when the individual is, for example,

watching themselves flying in an aeroplane and gets to a point where they cannot just do it anymore, the therapist can stop the session and help the patient, which is very unlikely when the patient is actually flying. In some studies, the number of dropouts and non-responses rates may reach 50 percent of the participants [6]. Therefore, using VRET is advantageous as it makes use of Information and Communication Technologies facilitating exposure for avoiding patients [6].

There are several other benefits of using VRET.[8] The first being it is fairly inexpensive as compared to In Vivo exposure, this is because after the initial hardware installation there is very minimum to no other cost unlike the In Vivo where you have to spend to go to the source of the phobia during each therapy session. Another advantage is that some findings report that patients are more satisfied and find it more acceptable with VRET compared to traditional approaches [7]. In VRET, the therapist gets an opportunity to control the exposure dose and stimulus. this provides an opportunity to conduct controlled clinical and experimental research.

In this paper, we will discuss the experiment and study on Virtual Reality Exposure Therapy(VRET).[9] The entire experiment is implemented to show how VRET can be used for different types of phobias.[10] The experiment is a simple approach taken for therapy sessions where people may not have access to the expensive hardware used by professionals.

II. EXPERIMENT STRUCTURE

A. Participants

The experiment was conducted with the help of willing participants. We approached ten students who were willing to participate in the experiment. They were explained the entire process in detail. We then circulated a form to all the participants. The form was designed in a format where each participant wrote the number of phobias they have, they then had to mention each phobia and rate it from values one to five, five being the highest. They also had to mention their limits as to when we can stop in the middle of a session.

The responses were then collected and analysed. For the purpose of this experiment, we chose the phobia experienced by the majority and the highest rated one. After analysing the data, we found acrophobia was affecting the majority of the participants. We then chose to first help the participants with acrophobia first. The image below shows the survey form that we circulated to the participants for data collection.

Number of phobias

☐ 1

☐ 2

☐ 3

☐ more than 4

Describe your Fear:(this is the fear that affects you the most) *

Long answer text

Rate the fear you mentioned Above *

1 2 3 4 5

☐ ☐ ☐ ☐ ☐

Fig. 1. The form circulated to the participants to write down their phobias and rate them each

B. Procedure

We obtained the consent from the participant after the meeting. They also were informed that they could tell us to stop the sessions any time they were uneasy or uncomfortable. The entire procedure was planned to take a minimum of one and a half months. The participants provided a schedule that they were most comfortable with. There were two to four sessions each week, depending on the availability of the participants.

During the first meeting with each participants, they were explained in detail the entire procedure of the experiment. We made sure they all understood the process and answered all their questions.

C. Apparatus

Virtual Reality is a technology that uses a specialized visualization equipment commonly known as "headsets".[11] These headsets produce experience of stepping into an artificial environment by providing an immersive experience for the user. Our experiment deals with making use of VR technology to produce an immersive environment modified based on patient requirements and past experiences.[12]

The system also included a VR application, for that we developed an android application. For this purpose, we needed an android OS mobile phone to play the 360 video for the participant to look at and get an immersive environment experience with the help of the VR headset.

D. Treatment

The therapy sessions were held at least twice a week to a maximum of three sessions for the participants who had more time dedicated to the experiment in their schedule. As mentioned above, the entire experiment was held for a total duration of one and a half months. The minimum number of sessions a participant had were 10 and the maximum being 15. Of the ten participants who were willing to participate in

the study, 5 were dealing with acrophobia. Three participants of the ten had 10 sessions as they were busy, while the other seven had all fifteen sessions.

The first week of the entire duration was spent looking for participants willing to attend the sessions. The first session was devoted to gathering information, explaining the entire Virtual Reality Exposure(VRE) therapy, both the computer science approach and the emotional viewpoint were talked about in detail. The participants were informed of the emotional stress they might go through in sessions trying to face their fears. We also showed them relaxation techniques like in the Rothbaum et al. and also gave them a sign to show us during the sessions whenever they felt they could not take it anymore during the session. We also familiarized the participants with the virtual reality headset, we showed them how it was to be worn and how it would work.

During the next two sessions, the participant was exposed to the virtual environments (VEs). In the second session, they were exposed to a VE on the first floor of a building, the participant at this time could have a 360 view of the VE. We were always present to help the participant when they were anxious or panicked. In the third session, they were exposed to a VE on the second floor of a building, similar to the second session. They were given the emotional support they needed during each of these sessions. After the third session, we asked them if they were comfortable with moving to a higher VE.

In the fourth and fifth sessions, the participants were exposed to a VE on the bridge, one at height of 16 feet and the second being 20 feet. They were able to look down and also have a 360 view of the bridges. We requested the participants in these sessions to look down and tell us what they were feeling. In the subsequent sessions, they were exposed to VE on the rooftop of a six storey building, on a glass elevator and taken higher as they were comfortable. Each time, the participants were asked to tell us how they were feeling and if they would like to continue. We noticed with each consequent sessions, they were more willing to move to a higher level. They were less anxious and had a positive attitude towards the upcoming session.

At the end of each session, they were given a form to rate their fear level from one to ten. For participants who did not feel better after a certain session, we gave them a repeat of the previous session on the same level of height but different VEs.

III. APPLICATION DEVELOPMENT

A. Requirements

- 1) An Android phone with a gyroscope or a VR Headset with an inbuilt screen.
- 2) Unity Game-Engine
- 3) GoogleVR SDK
- 4) Customized animations in 360-degree environment through which the participant will navigate

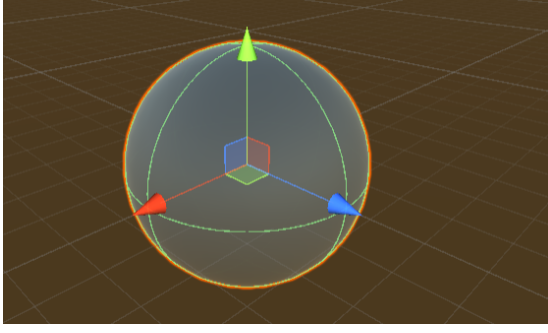


Fig. 2. Creating a sphere in Unity Environment

B. Procedure

The complete application is created in Unity Game-Engine. As shown in Figure 1, a sphere was created with a radius of (50,50,50) and placed at the origin. The camera angle was set to be in the center of the environment as well. To accommodate the visuals so that they appear on the outer edge of the sphere as opposed to the default inner-sphere view, a C# script was used. Once this is done, material of the sphere is set using a Shader program, this material is used to control the appearance of the objects. Shaders are small scripts that calculate the color of each pixel rendered, based on lighting and information pulled from their materials. Figure 2 shows the custom animation that runs in a loop, also providing an immersive VR experience. The project includes various animations depicting each stage in the experiment process.



Fig. 3. Immersive VR Environment viewed by the participant

For the purpose of this project, an android application was created as well. If a phone has an in-built gyroscope will support the app. Google Cardboard can be used to create the VR immersive environment while using the app. Figure 3 shows how the scenes would look on a smartphone.



Fig. 4. Immersive VR Environment viewed on android phone

IV. RESULTS

The results for the sessions conducted can be found in table 1. We were able to observe that for most of the participants the ratings of the fear decreased with each session they attended. Sometimes they still experienced a lot of anxiousness and felt no difference compared to the previous session. This was especially common with the higher floors or higher levels of heights.

After the session, they were really anxious and felt scared when they were exposed to the higher levels of height VEs. They were advised to practise the relaxation techniques taught during the first session.

TABLE I
SCORE RATINGS AFTER SUBSEQUENT SESSIONS

Session Number	Ratings		
	Participant 1	Participant 2	Participant 3
Session 1	10	9	10
Session 3	8	9	9
Session 5	7	7	8
Session 7	7	7	7
Session 10	6	4	5

^aTable 1. Shows a sample of ratings

Table 1. shows the progress of 3 randomly chosen participants. It is clearly seen that the ratings of each were gradually dropping after each session. The sessions were randomly for the table. The ratings in table 1. depict their emotional condition or anxiousness after the session.

V. CONCLUSION

We were able to see significant improvement in the participants. The participants also felt like they were able to face their fear better than before they started attending the sessions.

VRET was able to improve their anxiety and they were able to go into glass elevators and not panic. They were trying to go to higher levels to try and fight their phobias.

Although there are several advantages of using VRET, there is one major disadvantage. That is, the therapy sessions for major phobias cannot be done without any medical professional present. All patients react differently when exposed to their triggers and it would be very difficult for a non-professional to be able to calm an anxious patient during an ongoing session.

Another disadvantage is that even when VRET is cheaper than other traditional methods, it is still inaccessible to other people. The average price of the smart-phone based VR therapy system is USD 600, which is still very expensive for most people.

VI. FUTURE WORK

For this particular experiment, it only dealt with acrophobia. For the application generated in this project, a lot more

phobias can be covered. Immersive scenarios for other phobias can be created to help the participants fight the source of their phobias. The system can easily deal with phobias like aerophobia, claustrophobia, agoraphobia and many more.

We could improve our participant or patient monitoring systems.[13][14] In the experiment, the only way to know if the patient was benefiting from the sessions was the feedback we received from the patient themselves and from observing the patients reactions during the sessions. There may be instances where one could assume the participant was doing well even if they were not feeling good.[15] There may also be cases where the participant may not be able to completely disclose what they were feeling to us due to the feeling of embarrassment. This in turn could have affected the ratings they gave at the end of each session. The main future improvement would be to deploy a heart rate monitoring system to keep track of whether the patient is anxious or not with the presence of a medical professional.

Another thing we can do in the future to make the system better is to include audio effects in the 360 video, that way the immersive environment would appear to be more convincing. Like when they are going up the lift, we have sound effects of an elevator. We could also try and create the environment in the VE during the session in the experimental lab itself. This would help the participant feel like they are actually present in the VE created.

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