Chapter 122

Augmented reality in exposure therapy assistance: A clinical point of view

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ABSTRACT
Specific Phobia is a subarea of anxiety disorder, and one of the forms of treatment is through exposure therapy, in recent years augmented reality has emerged as a new alternative to exposure therapy. We propose to evaluate the requirements found in the literature and in the interviews with therapists, to develop a mobile application that fits the needs presented in the clinical context. The study is in the pre-development phase and the outcomes of the interviews for the elaboration of the scenarios, it is expected in the results the insertion of reality in clinical environments in the treatment of animal phobia, and if possible, the inclusion in the Clinical Protocol and Therapeutic Guidelines (CPTGs).

1 INTRODUCTION

A phobia is an anxiety disorder, according to the World Health Organization (WHO) affect today about 400 million people worldwide, Brazil is at the top of the list of countries with the highest percentage of people with anxiety disorders: 9.3% of Brazilians suffer from this mental health problem, including general phobias.

A phobia is defined as an irrational and uncontrollable fear of objects, activities, and feared situations, which does not agree with the risk presented [Albakri 2022], an anxiety generated by a specific object or situation which results in aversion is called a specific phobia, its categorization is based on the nature of the stimulus: animal such as arachnophobia (spider fear), entomophobia (fear of insects); natural environment such as acrophobia (fear of heights), astrophobia (fear of thunder); situational as aviophobia (fear of flying), claustrophobia (fear of closed places) [Albakri 2022].

This is a disease that presents psychological and physiological symptoms: high levels of anxiety, stress, increased heart rate, sweating, and dry mouth; causing a major impact on the quality of daily social life [Kurscheidt 2019]. Based on clinical guidelines, the recommended treatment of specific phobia is therapy and exposure, which treats patients submitting to the object or situation that causes them fear in a safe and controlled way [Kurscheidt 2019 and Albakri 2022].

Augmented Reality (AR) is the form of human-computer interaction (IHC) that integrates virtual objects into the real world in real-time. Thus, it aims to provide users with additional and relevant

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information that is not found in the real world. In the literature, AR is defined by the insertion of virtual objects in the physical environment, shown to the user, in real-time, as support of some technological device, using the interface of the real environment, adapted to visualize and manipulate the real and virtual objects [Rodrigues 2022].

The traditional form of phobia treatment is Exposure Therapy in Vivo (VTE), but in recent years the literature has shown that Virtual Reality Exposure Therapy (TERV) has been pointed out to be an effective and applicable technology in the treatment of anxiety disorders [Botella 2016]. With the emergence of AR, it was paramount for the creation of Augmented Reality Exposure Therapy (TERA), which aims to be the future way of treating anxiety disorder [Hinze 2021] and more recent studies advocate the effectiveness of reality technology in the treatment of phobia in experimental contexts [Hinze 2021, Zimmer 2021 and Ramírez 2018]."

Thus, in the literature review, it was possible to observe some relevant perspectives on the use of AR in the aid of the treatment of specific phobias. However, with the perspective of moving from the experimental environment to incorporating technology in a clinical context, there is a necessity for greater integration between technology and health professionals, with the final objective of better integrating the tool with the treatment procedures and the elaboration of a Clinical Protocol and Therapeutic Guidelines (PCDT)[1] including technology.

This article aims to evaluate the requirements raised through bibliographic research and interviews with professionals specialized in the treatment of specific phobia so that it can be used in the development of a mobile application to add greater efficacy, applicability, and usability in the use of augmented reality technology in the clinical context.

2 RELATED WORKS

In this section, the related papers from a Thematic Literature Review(RSL) are presented, which searched for articles between 2016-2021 on the theme of the use of augmented reality technology to help the phobia treatment of small animals and insects, to answer the research question: "Which the perspectives of the professional specialized about augmented reality technologies in the aid of exposure therapy?". The full RSL can be found in the article [Rodrigues 2022] as well as the documents that served for the writing of the article (documents with the protocol and the analysis of the articles) present in link[1]. RSL led to the following considerations regarding the use of AR in the context of the treatment of phobias.

The new and emerging field of psychotherapy being explored is Augmented Reality Exposure Therapy (TERA), which is beginning to show promise in the treatment of specific phobias, such as fear of spiders and cockroaches [Botella 2016, Fatharany 2021 and Ramirez-Fernández 2021]. Recent studies

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[1] PCDT explains the criteria of efficacy, safety, effectiveness, and cost-effectiveness for the formulation of recommendations on health interventions [BRASIL, 2015]

indicate that this treatment is achievable, effective, and a producer of well-being when compared to other established methods[Hinze 2021, Zimmer 2021, and Kurscheidt 2019].

TERA is a recent variation of psychotherapy that combines the help of devices such as Mobile [Kurscheidt 2019, Albakri 2022 and Zimmer 2021], Head-mounted screens (HMD) [Kurscheidt 2019 and Botella 2016], Computers [Fatharany 2021], Haptical [Ramirez-Fernández 2021 and Kurscheidt 2019], augmented reality with a method called cognitive behavioral therapy (CBT) proved to be a very effective clinical treatment and its effects can be m be observed even at the neural level [Hinze 2021], in the literature THE TERA show similar effects compared to In Vivo Exposure Therapy (VTE). The use and combination of CBT, TERA, and VTE of these three components in sets offer better results than just one, used alone, in addition to avoiding some weaknesses present in each individual [Ramizes-Fernández 2021].

In [Ramírez 2018], presented a customized version of the taxonomy considering factors/attributes specific to the visual stimulus and three main categories in exposure therapy: Realism, Interaction, and Intensity; for [Vinci 2020], theoretical, functional, and implementation issues that should be contemplated by AR for greater efficiency and effectiveness in the application of the technology, these questions can be modified and tested to determine the best and most effective combination.

In this review, a low number of subjects submitted to augmented reality technology in the context of exposure therapy was evidenced, by the nine studies filtered in RSL only [Fatharany 2021, Botella 2016, Zimmer 2021 and Ramírez-Fernández 2021] applied a randomized controlled study with subjects and the other presented the experimental study as a prototype. Another finding was studied that was monitored with therapists [Botella 2016] or was conducted by professionals in the field of psychology and psychiatry [Zimmer 2021].

In the literature, no Clinical Protocol and Therapeutic Guidelines (PCDT) that present augmented reality technology in the aid of specific phobia treatment were found in the selected studies; [Ministry of Health 2019] based on the elaboration guide: scope for PCDT it is important to inform whether the technologies that will be recommended in the PCDT are available in the SUS or whether they should be evaluated by the National Commission for the Incorporation of Technologies in sus - CONITEC to recommend or not their incorporation. Only health technologies registered in ANVISA, with an indication in bull, as well as interventions not considered experimental by the Federal Council of Medicine may make up the scope of the *CPTG*.

Therefore, because of these findings, there is no significant number of studies that are being conducted in the clinical environment with the follow-up of therapists, and we propose to investigate in the following topic the limitations and perspectives of specialized professionals to obtain a clinical view of the use of AR in the clinical context.

3 METHOD

In the first moment, we sought to conceptually understand the phobia and the process of the therapist of exposure, highlight the scenarios of professionals, and identify the problems and limitations, from this point, the structure of the study consists of the following stages: (a) bibliographic research presented in section 2, (b) semi-structured interviews, (c) elaboration of scenarios, (d) development of a mobile application, (e) analysis of results and final consideration.

3.1 SEMI-STRUCTURED INTERVIEW

For the interviews, five professionals trained in psychology and/or psychiatry, specialized and/or experienced in the treatment of specific phobias, are interviewed. The interview is conducted based on a script with pre-fixed questions that can be consulted at the following link. However, the dialogue is kept open, giving freedom to the interviewee. It seeks a greater understanding of the process of treatment of specific phobia and the identification of scenarios in which AR could be incorporated into the work of health professionals. However, it is also sought not to influence the meaning and objectives of this study, so as not to harm the information provided by the professionals interviewed.

3.2 SCENARIO DEVELOPMENT

Based on the findings of the previous sections aiming to highlight the important points during the interaction of the professional with the patient during the treatment of specific phobia, the objective is to propose scenarios of insertion of augmented reality technology with a focus on three different points such as Diagnosis, Exposure Therapy, and Evaluation. The scenarios will be created based on the requirements raised through interviews and literature review and should be presented to the interviewed professionals in their care for validation.

3.3 DEVELOPMENT

The FobiAR application, developed by the authors, uses Unity3D in (version 2022.1.0a13 [64-bit] Unity Technologies, San Francisco, CA, USA) under Windows 11 Pro for Workstations (version 21H2) and compiled into a standard Android Package file (.apk). Based on the evidence of RSL presented by Rodrigues [Rodrigues 2022] showed that 60% (23 studies) were developed with Unity, indicating the wide use of the (Toolkit) which offers developers the ability to create and develop virtual scenarios and objects in 2D and 3D, and supports the following API: Direct3D on Windows and Xbox 360; OpenGL on MacOS; Linux; OpenGL ES on Android and iOS; WebGL on the Internet.

For the development of FobiAR elements such as logo, buttons, app icon, and background of the application (background), which are part of the visual material used in the application as well as the user interface (UI), were created on the canva.com site. The Vuforia Engine is found at the address developer.vuforia.com, is (version 10.10) is a software development kit used as an AR engine, which allows

image, object, and text recognition that are known as markers (targets) that are images recognized by the AR engine and replaced in real-time by a 3D model. bookmarks are pre-processed by Vuforia Engine and integrated with Unity. They will later be recognized by the API within the camera image stream and replaced with one of the 3D models.

For the es everything, the FobiAR application is tested on Samsung smartphones (model: Galaxy A51, screen: 6.5 inches, resolution: 2400 × 1080 px, RAM: 4GB, storage: 128GB) running Android 12 in version One UI 4.1. For application installation, permission is requested from unknown sources and the device camera. No additional application installation is required for fobiar application operation. After that, no other configuration or Internet connection changes are required in application usage and all data is stored locally.

4 PRELIMINARY RESULTS

4.1 PARTIAL RESULT OF INTERVIEWS

Some important aspects about specific phobia in diagnosis, treatment, follow-up, and evaluation were raised, which served as software requirements for the development of the FobiAR application:

In an interview with a psychiatrist trained in 2010, he has a specialization in behavioral therapy and traffic medicine, he currently works: (i) in a private practice, attending several psychiatric plans from the age of 16; (ii) in a university hospital in child and adolescent psychiatry serving a syntomic public until the age of 12 with some type of abnormality or behavior alteration such as autism; (iii) in the federal institute working in psychiatric expertise of the servers.

(a) Specific Phobia (EF) happens when the subject is exposed to the causative agent of phobia, and presents an intense fear and a feeling of uncontrol, people may have physical symptoms with heart attack, dyspnea that shortness of breath, a sensation of that will happen something, and the most common EFs in subjects are: getting into an elevator, Fly airplane and some specific venomous animal such as snake, spider, and cockroach.

(b) Subjects do not seek professionals to treat only EF, usually seek when they have comorbidity or other symptoms associated with anxiety, depression, panic syndrome, or when it is hindering daily activities.

(c) ICD 10 which is in transition to ICD 11 is the main classification reference used in Brazil, the DSM-5, which is American, serves as an alternative reference. The ICD and DSM-5 assist us in the diagnosis and treatment of presenting parameters such as symptoms, period, age, clinical characteristics, and others.

(d) The way of diagnosing is very subjective, ICD 11 has specific symptoms to aid in the classification, for example, people who have EF should present such symptoms for a certain period; how this should be ruled out from other diagnoses such as claustrophobia that is different from EF.

(e) In the treatment there are two verses: (i) the medication that is rarely used only in severe cases, and (ii) the therapy mentioned as the gold standard of treatment is the psychotherapy that aims to discover the cause of fear and works with gradual exposure until overcoming stressing object. It is the most effective therapy considered for a specific phobia of animals.

(f) As well as the diagnosis, the treatment and evaluation of the subjects are subjective and may vary according to the behavior and feedback presented. There is no leveling or metric in treatment and evaluation, the therapist observes the patient's response to treatment, if he has already managed to get close to the stressful object, or if he can already get into the elevator.

In another interview, with a clinical psychologist, Ph.D. in social psychology and specialist in anxiety disorder with a focus on cognitive behavioral therapy, a pioneer in Rio de Janeiro in the use of virtual reality technology in the psychological care of anxiety disorder in the phobia niche.

(a) In my experience in the office comes the phobia of the elevator, the phobia of flying, and then social anxiety, the fear of heights. The phobias are inside the hat of the disorder of anxiety, present symptoms such as heart attack it seems that the heart is coming out of the mouth, feeling that is lacking air in the environment, tremors, blurred vision, feeling of fainting, abdominal pain and very great difficulty to be in the dosed lugs.

(b) There is a demand for treatment and it is not today, people seek to do this type of treatment because they see that life is paralyzing. I have a patient who is afraid of rain and storm, she gets obsessed and knows how many millimeters of chu will fall in the neighborhood where she works, in the neighborhood where she lives this situation is getting so limiting in certain aspects that she understands that she needs to seek help.

(c) EF is easy to diagnose, it is possible to observe the characteristics of anxiety as the escape from dreaded situations added to physiological symptoms. In the treatment, cognitive behavioral therapy seeks to understand the cognitions of patients, that is, thoughts or beliefs as dysfunctional thoughts: (i) that are not real solutions, (ii) thoughts that have no chance of happening. The behavioral part would be the exposures also called systematic desensitization that causes the patient to lose emotional burden gradually, controlled, and safely.

(d) In Vivo exposure therapy will always be the best way to treat phobia, following virtual reality and thirdly to imaginary. Through a platform using virtual reality technology, I can serve several patients anywhere in the world by addressing different types of phobic scenarios and repeating this situation as many times as I see necessary.

(e) no protocol defines the use of virtual reality in the treatment of phobia, to fit the patient to the scenario, seeking to identify the level of exposure hierarchy, from the most anxiogenic to the least anxiogenic, through questions and anxiety questionnaires.

(f) Augmented reality can be very interesting to be explored in the animal exhibition because you can easily have a pigeon, a cat, a spider, or a cockroach. For those who are afraid of a spider, manage to put an augmented reality of a very realistic crab hairy with red eyes, she will have symptoms of anxiety.

4.2 PRE-DEVELOPMENT

Further studies were necessary to understand the functionalities of API, ToolKit, SDK, and other tools used in the development of AR; we already have experience and mastery of the fundamental techniques to develop the fobiar application, but waiting for the outcome of the interviews and elaboration of the scenarios, at the moment we do not have the functional application. The activities of the discipline of HCI were extremely important in the creation stage of the design, raising elements such as visual identification, colorimetry, and personas, among others.

Figure 1 - FobiAR app logo

Source: Own Authorship (2021)

The logo of the FobiAR application as shown in Figure 1, represents the use of augmented reality technology in a mobile device, the predominant colors of the logo are Yellow, Gray, Blue, White, and Black; the dashed is in Black to highlight drawing according to the theories of colors, yellow in the 3D cube, Gray at the top and bottom of the smartphone and Light Blue to illustrate the background in Gradient Blue on which the sensation of calm passes. The main elements that make up the logo are the design of a smartphone which refers to which device the augmented reality application will be executed, the other element passes the object's projection effect, and the cube represents the three dimensions of a 3D object along with the letters AR coming from English (Augmented Reality).

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Figure 2 - FobiAR app home screen

Source: Own Authorship (2021)

Figure 2 shows the home screen of the FobiAR application where the user will have options to enter login and password if they have already registered in the application, after informing the login and password the user must click the Button Login which they will authenticate to obtain the access. If the user is not registered have the Create Account button. If the user has forgotten the password has the option I forgot my password. For more information about the app, click the About FobiAR button.

Online courses such as: (i) Mobile APPS In 3 Days from CV Zone were paramount to add practical knowledge in development with ToolKit Unity; (ii) Augmented Reality created by Victor Padovam of the Udemy platform assisted in understanding the use of markers in the Vuforia portal and integration with Unity. An experimental prototype was presented in the discipline of topics in applied computing.

Figure 3 - Splash screen of the ARMed application.
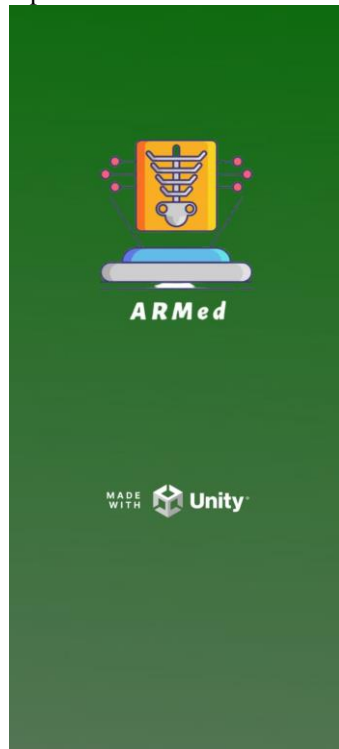
Source: Own Authorship (2022).

Figure 3 presents the home screen in the upload of the ARMed application, which is directed to access the camera on the first use of the application it is necessary to allow the use of the rear camera of the device so I can recognize the markers (targets). As shown in the following figures.

Figure 4 - Screen clipping by triggering AR on ARMed.
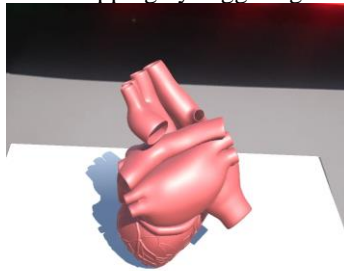
Source: Own Authorship (2022).

Figure 5 - Screen clipping by triggering AR in ARMed.

Source: Own Authorship (2022).

Figure 4 shows a three-dimensional heart projection overlaid on a specific image preconfigured on the Unity and Vuforia platforms to trigger augmented reality technology. Figure 5 demonstrates the Cardiopulmonary Resuscitation (CPR) technique with animation in both scenarios: (i) the professional performing CPR maneuvers; (ii) the subject presenting symptoms.

4.3 EXPECTED RESULTS

We intend, from bibliographic research and interviews, to find scenarios that allow the identification of RA as a complementary tool in exposure therapy in a clinical environment in the treatment of animal phobia. Thus, the development of a mobile application that can be adapted to (i) the needs of therapists; (ii) at the hierarchical level of exposure presented by the patient; (iii) in the CPTG preparation guide.

5 CONCLUSIONS

Based on the assumption of incorporating augmented reality technology in the clinical body as a new alternative in exposure therapy to aid the treatment of animal phobia, this study was based on exploratory methodology, seeking allusions and indications within other studies already conducted. Semi-structured interviews were also used with the therapists to which he is performing, but in two interviews it was possible to observe some important requirements that will contribute to the development of the mobile application. It is necessary to end the interviews and to develop the scenario to develop the application; a prototype version of the application will be presented to the interviewed pro physicals for evaluation and validation.

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