Augmented Therapeutics:

Designing an Augmented Reality Platform for Arachnophobia Treatment

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Designing an Augmented Reality (AR) Platform for Arachnophobia Treatment

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MASTER OF DESIGN
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This research is dedicated to the memory of my friend,
Rohan Singhaal, who died tragically in 2017.
I will always remember you.

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Abstract

We are at a pivotal turning point where technology can greatly contribute to global health. Technology is well-poised to transform how mental health treatment is delivered and accessed, but this transformation requires the combined support and involvement of developers, health care providers, and designers. The potential for immersive technologies, i.e., Augmented Reality (AR) and Virtual Reality (VR), to supplement the treatment of mental disorders—including specific phobias, improve the quality of and increase patient access to mental healthcare is promising. Yet, even in the context of the current global mental health crisis, the real-world uptake of AR/VR technologies by clinicians and patients remains low. One of the causes is the disconnect between the designers building AR/VR apps and the patients and care providers in the mental health field. To understand this disconnect, my research focuses on the challenges surrounding a patient's engagement with mental health applications using arachnophobia as an example. The objective of this thesis is to investigate design practices that can improve patients' and therapists' experiences for Augmented Reality Exposure Therapy (ARET).

Expert interviews were conducted from the fields of psychology and user experience design to 1) inform the needs and identify the gaps of AR applications, 2) identify the underlying design opportunities for AR, 3) discover the factors impacting the patient therapeutic experience and 4) address the gap between clinicians and designers. Additionally, data from expert interviews, qualitative analysis of existing AR/VR applications, and a literature review were used to develop a framework for examining current design practices in AR/VR applications for arachnophobia and to evaluate these applications from a user experience design perspective. The main outcome of this research takes the form of a prototype called Boo—an interactive AR platform to support exposure therapy for arachnophobia.
In particular, it employs user experience design frameworks and fantasy-based serious gaming narratives to enhance the therapist's and the patient's experience. While AR technology is relatively new and is still being tested in clinical settings, it is important to

consider optimal ways of integrating it within existing clinical models of care, with minimal risks, ethical safeguards and an emphasis on building relationships between patients and providers—and in so doing—empowering the mental health care delivery system.
My thesis explores the scope of Augmented Reality for developing better healthcare products, services, and experiences.

Keywords:
Augmented Reality
Arachnophobia
Exposure Therapy
Serious Games
User Experience Design

Acronyms

AR: Augmented Reality

ARET: Augmented Reality Exposure Therapy

CBT: Cognitive Behaviour Therapy

CT: Computed Tomography

DSM: Diagnostic and Statistical Manual of Mental Disorders

EMDR: Eye Movement Desensitization and Reprocessing

ESA: Emotional Self-Awareness

ET: Exposure Therapy

FSQ: Fear of Spiders Questionnaire

HCI: Human-Computer Interaction

HMD: Head-Mounted Display

IMARS: Invisible Marker-Tracking Augmented Reality System

ISR: Information System Research

LCD: Learner Centered Design

MAR: Mobile Augmented Reality

MHapps: Mental Health Applications

MRI: Magnetic Resonance Imaging

NHS: National Health Services

NIMH: National Institute of Mental Health

PTM: Personalized Therapy Management

PTSD: Post Traumatic Stress Disorder

QUIS: Questionnaire for User Interaction Satisfaction

RHI: Rubber Hand Illusion

SG: Serious Games

SUDS: Subjective Units of Discomfort Scale

TL: Therapeutic Lamp

UI: User Interface

UX: User Experience Design

VMARS: Visible Marker-Tracking Augmented Reality System

VR: Virtual Reality

VRET: Virtual Reality Exposure Therapy

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1. Introduction

Immersive technologies such as Augmented Reality (AR) and Virtual Reality (VR), attempt to emulate the physical world by integrating computer-generated content into 360 degree space or to simulate a virtual world by altering the sensory perception, thereby creating an immersive experience. These immersive technologies have the ability to transform how mental health services and treatments are delivered and accessed, but the use of these technologies in clinical settings is still limited. The adoption of AR/VR in clinical settings requires combined efforts from the fields of science, medicine and design. The decrease in computation costs and growing investment in new technologies have enabled the delivery of high-quality, clinically validated therapeutic interventions (Healthcare Business & Technology, 2011; Patil, 2018).

AR and VR show strong evidence of value in healthcare, which is expected to grow from $8.9 million in 2017 to an expected $285 million in 2022 (Ghosh, 2019). The United States Food and Drug Administration (FDA), a federal agency of the U.S. Department of Health and Human Services, has recently approved SurgicalAR, an AR platform for surgical imaging (Genn, 2019). Additionally, the FDA has established the Digital Health Innovation Action Plan (U.S. Food and Drug Administration, 2019) to ensure high-quality, safe, and effective digital health products. Design is broadening its scope and is shaping the future of healthcare practice (Partridge, 2017; Tsekleves & Cooper, 2017; Wildevuur, 2017). Rather than being solely centred on the disease, these developments shift the focus of healthcare towards the experiences, values, quality of life of patients and their participation in care and treatment (Bohman, Wyk, & Ekman, 2010; Sumsion, 1993).

With technological advancements in healthcare and the formalization of digital health policies, there is a clear need for user experience design (UX) for new digital health services and applications (Chandrashekar, 2018; Torous, Nicholas, Larsen, Firth, & Christensen, 2018).

1.1. Background

Many industries have realized the importance of employing UX professionals, while the healthcare industry is still generally is behind in this area. Whether it is the interface for an infusion pump or the software used to manage electronic health records, the healthcare industry lacks sound design practices (Schulte, 2019; Ratwani et al., 2018). The need to develop user-friendly interfaces, communicate clear instructions, improve decision-making and find efficient and effective means of completing tasks in healthcare is essential. The interface design for most digital health platforms is often clunky, overloaded with information, has poor navigation and is years behind current design and technology practices—all of which are factors that negatively affect the patient's experience. This situation offers an opportunity to focus on designing for functionality, effectiveness, aesthetics, and efficiency.

Over the past decade, the application of AR/VR in medical fields has increased, for example, in the education and training of medical professionals (Herron, 2016; Riva, 2002), pre-operative planning (Kumar, Gouthami, & Rao, 2017; Szekely & Satava, 1999), rehabilitation (Rose, Nam, & Chen, 2018), pain management (Matamala-Gomez et al., 2019) and the treatment of psychiatric disorders (Park, Kim, Lee, Na, & Jeon, 2019). There are numerous studies showing the efficacy of using AR and VR for the treatment of mental health problems and anxiety disorders such as phobias, stress-related disorders, depression, and eating disorders (Gorini & Riva, 2008; Maples-Keller, Bunnell, Kim, & Rothbaum, 2017; Opriş et al., 2011; Srivastava, Chaudhury, & Das, 2014). Given the breadth and complexity of anxiety disorders and phobias, for feasibility reasons, arachnophobia has been chosen as a demonstrative example for the purpose of this thesis. It is estimated that more than 40% of the general population suffers from one or multiple fears of specific objects or situations (Oosterink, de Jongh, & Hoogstraten, 2009). A specific phobia is an intense and unreasonable fear or anxiety about an object or situation (Truschel, 2017). Since the symptoms of specific phobias are typically limited to the phobic stimuli and rarely associated with pervasive anxiety outside of the phobic situation, there is a common perception that specific phobias may be less severe than

other anxiety disorders, such as Obsessive-Compulsive Disorder (OCD) or Post-Traumatic Stress Disorder (PTSD). Specific phobia subtypes, such as arachnophobia are often under-reported because the most effective treatments involve a direct confrontation with the phobic stimulus which patients may be apprehensive about (Fritscher, 2019). Another reason for patients not seeking treatment is that the situationally-bound nature of specific phobias allows patients to easily avoid the fear inducing object or situation (e.g. in the case of arachnophobia, patients avoid going to the attic or camping) serving as a disincentive for seeking treatment. As a result, specific phobias receive relatively little clinical attention.

However, despite their circumscribed nature, specific phobias are associated with serious life impairment (Fritscher, 2019a). The effects of the disorder can greatly impact a person's daily routine, interfere with social activities, and reduce productivity at work. Specific phobias that are left untreated may worsen a person's symptoms and may become precursors to more severe mental disorders (Lieb et al., 2016). It is a common tenet of psychology that to overcome your fears, one has to face them (Amatenstein, 2016). This is the basis of Exposure Therapy—a common treatment for a specific phobia, where the patient is exposed to the source of anxiety in order to overcome their fear or distress. Exposure Therapy, however, is difficult and sometimes impossible to conduct, especially in the case of specific phobias. How can one face the fear of falling without also facing the risk of injury? How can one be exposed to, and interact with, a spider without actually having one physically present?

Augmented Reality could provide an answer. Augmented Reality (AR) is a distinctive technology that mixes the real world with overlays of digital information so that users perceive an enhanced composite view of their surroundings (Azuma et al, 2001) **(Figure 1)**. Current studies have highlighted that technologies such as AR and VR can be used effectively to supplement well-established treatments, such as Cognitive-Behavioral Therapy and Exposure Therapy, allowing easier access to treatment (Ventura, Baños, & Botella, 2018). Research shows that using AR in Exposure Therapy presents advantages over Virtual Reality (Baus & Bouchard, 2014). VR creates a simulated 3D

Figure 1: Augmented Reality in Healthcare with Hololens 2 (Microsoft Hololens, 2019)

environment that shuts out the physical world and detaches the user from their surroundings. AR, on the other hand, provides a greater feeling of presence and reality judgment (the extent to which a person feels that they are in the environment or that the experience is real).

The AR environment produces a more realistic experience for the patients which makes the physiological reactions more evident as compared to the VR environment (Tsai et al., 2018). This is because AR headsets have clear lenses (VR headsets are opaque) which helps the patient to view their surroundings and use their own hands and feet when they interact with virtual objects. In contrast, VR only simulates this experience by using controllers and physical buttons. Moreover, when using VR, patients disconnect themselves from their surroundings by entering into a virtual unknown environment which can alleviate their anxiety and places them in a vulnerable state.

AR presents a balance between the real and digitized content as it provides patients with an environment that feels safer. Currently, AR is in the early stages of research and clinical testing (Javanbakht, 2018), whereas VR for Exposure Therapy is further along and its use is expanding within clinical settings (Park, Kim, Lee, Na, & Jeon, 2019). However, the inclusion of user experience design practices in developing AR for mental healthcare

can help to improve clinical outcomes. It can also help to overcome the barriers of low patient engagement and usability which is currently impacting the use and adoption of mental health applications (Alqahtani & Orji, 2019). Employing design practices can also enhance therapy and reduce attrition rates (Chandrashekar, 2018).

User experience (UX) is fundamentally focused on the dynamic, subjective and context-dependent ways in which a user engages with a product or system (Norman & Nielsen, 2019). By adopting UX principles, we can better understand the possibilities of AR technologies in mental healthcare. It is proposed that by furthering opportunities for implementing Augmented Reality in healthcare we can contribute to transforming patient experiences and health services.

1.2. Objectives

The objectives of this research are to:

- ***Identify*** the range of techniques in use for Exposure Therapy for arachnophobia;
- ***Understand*** the effectiveness of and challenges in Augmented Reality Exposure Therapy;
- ***Investigate and Propose*** design practices that can improve patient's and therapist's experience for Augmented Reality Exposure Therapy.

1.3. Research Methods and Analysis

To accomplish the above objectives, the following research methods were employed:

a. Semi-Structured Expert Interviews

Semi-structured interviews are a type of interview in which some questions are predetermined and others arise during conversation. These conversations helps to gain insight into what users think about a product, service, experience or

process. Semi-structured interviews were conducted with the following groups, in person, over the phone, or through video calls:

- ***Psychologists (n=3):*** For the first group, 3 psychologists who practice Exposure Therapy were interviewed.
- ***User Experience Designers (n=4)***: The second group involved 4 user experience designers. Two of these designers are working with immersive technologies and the other two work on design projects in the healthcare industry.

b. Analysis of Existing Arachnophobia Therapy AR/VR Applications

The analysis helped to examine the current state of user experience design for mental health applications. I evaluated these applications to identify usability issues.

Note: for convenience, in this document, the word 'therapist' is used to refer to a psychologist, psychiatrist, certified psychotherapist, or counselor utilizing Exposure Therapy.

1.4. Chapter Overview

This thesis contains four chapters following this introduction (Chapter 1). ***Chapter 2 Literature Review*** contains a review of existing literature with a focus on current research in the field of Augmented Reality Exposure Therapy for arachnophobia, recommendations on designing mental health applications and enhancing the patient's experience through the use of serious games. ***Chapter 3 Primary Research***, includes an examination of existing mobile and VR applications for arachnophobia and the analysis of semi-structured interviews with therapists and user experience designers. ***Chapter 4 Design Outcome***, outlines the design opportunities and the design process for creating a prototype of an AR-based platform therapy for arachnophobia. The prototype is a conceptual design of how the patient experience of the AR therapy platform can be enhanced. Lastly, ***Chapter 5 Conclusion***, outlines the research findings, limitations and ends with a discussion of future work possibilities.

1.5. Summary

This study explores how the user experience can be enhanced for Augmented Reality Exposure Therapy for arachnophobia. This is possible by better understanding the relevant research concerning treatment methods for arachnophobia i.e., Exposure Therapy, and how these traditional treatment methods can be aided by AR technology. This study proposes that including user experience design practices in the development of interactive AR narratives can improve the experience and the quality of care being provided to patients. The benefit of using Augmented Reality in Exposure Therapy is that patients can feel as if what they are experiencing is real—making the treatment process more effective and safe.

2. Literature Review

Increasing expenditures in the healthcare industry and the need for cutting-edge technologies for the development of novel diagnostics and treatment therapies are propelling the need for integrating Augmented Reality (AR) and Virtual Reality (VR) technology in the healthcare industry. VR for Exposure Therapy has started to expand and is widely recognized as a positive tool in the treatment of phobias. However, the integration of AR in clinical settings is still limited. AR offers an effective alternative for VR phobia therapy and proposes potential avenues which can improve the delivery of mental healthcare services. To better understand the potential of AR for Exposure Therapy, this study reviews relevant research completed in AR for arachnophobia treatment. It starts by providing a brief introduction to phobias and its subtype arachnophobia. To better understand how the user experience for an AR application can be enhanced, section 2.3.1. introduces the design recommendations for creating a mental health application.

2.1. Phobia and Specific Phobia

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), a phobia is a type of anxiety disorder, defined by a persistent and excessive fear of an object or situation. Specific phobia, also known as simple phobia, is a category of phobia where an individual has an intense irrational fear of a specific object, situation or animal that poses little or no actual danger. For instance, the fear of dogs, needles, heights, and flying are a few examples of specific phobias (American Psychiatric Association, 2013). The National Institute of Mental Health suggests that phobias affect approximately 9.1% of U.S. adults. Of adults with specific phobia in the year 2017, an estimated 21.9% had a serious impairment, 30.0% had moderate impairment, and 48.1% had a mild impairment (National Institute of Mental Health, 2017). These numbers might not be fully accurate as mental disorders are often under-reported. This can be attributed to many factors, including the stigma associated with mental illness and lack of adequate funding or insurance coverage for treatment. Since these disorders can be disabling, proper diagnosis and effective

treatment for these conditions are very important. Although patients often realize that their fear is unreasonable, even the thought of facing the feared object or situation may bring on severe anxiety symptoms and distress. The avoidance and anxious anticipation of and distress triggered by the feared situation(s) may interfere significantly with everyday routines, occupational (or academic) functioning, social activities and relationships. Exposure to the phobic stimulus almost invariably provokes an immediate anxiety response, which may take the form of a panic attack—a sudden and intense feeling of terror with physiological effects (Psych Central, 2017).

2.2. Arachnophobia

Arachnophobia comes from the Greek words, Arachne, meaning spider, and Phobos, meaning fear. For humans, spiders are among the top five most feared animals; in the UK, about 30% of women and 20% of men are anxious, nervous, or frightened when confronted with a spider (Davey, 1994a). A specific phobia of spiders has been documented to be the most common phobia related to animals, with a prevalence rate of 3.5% (Jacobi et al., 2004). Those who suffer from arachnophobia have an abnormal, persistent and excessive fear of spiders that interferes with their daily routines. They may be unwilling to participate in activities that carry a heightened risk of exposure to spiders and will go to great lengths to ensure they are not exposed to a spider. In many people, the fear of spiders elicits a disgust response. People with severe arachnophobia have an extreme aversion to spiders, and they may be afraid to go into their basement or feel anxious during hiking or camping outdoors.

2.2.1. Symptoms

A patient with arachnophobia, on being exposed to a spider, may react by either screaming and running away or freezing in place. They would be unable to kill or trap the spider themselves and hence rely on others to rescue them from the situation. Although symptoms of arachnophobia may appear initially during childhood or adolescence, they can also appear during adulthood. Typical symptoms include dizziness, trembling

and sweating, feeling of losing control, rapid heart rate, hot or cold flashes, chest pain, choking sensations, nausea or other gastrointestinal distress (Psych Central, 2017a).

2.2.2. Causes

Experts are still uncertain what causes arachnophobia, although there are a variety of theories. One of the most common theories put forth by research in evolutionary psychology—a theoretical approach to psychology that attempts to explain human behaviour (Downes, 2018)— suggests that arachnophobia was a survival technique for our ancestors as spiders have long been linked to illness and infections (Verywell Mind, 2009). This theory also classifies a phobia as a learned response, i.e., it leaves an impression and can be acquired by learning. For instance, when a person sees their family member shriek in terror and runs out of the house at the very sight of the spider, chances are the observer, learns the same reaction and is more likely to develop arachnophobia. Davey (1991) conducted a study to understand what about spiders frightened phobic patients the most. The response to the study lacked consensus but there was general agreement that the real cause of arachnophobia is hidden—it is something that arachnophobes are not immediately aware of. Davey (1991) says,

> Some people feared their hairiness, others their legs, others the fact that they tend to move quickly and unpredictably, some didn't like their eyes, and thought that spiders were staring at them. (p. 301)

Davey (2011) mentions in his other studies that in addition to fear, the emotional reaction of disgust to phobic stimuli plays an important role in the cause and maintenance of anxiety disorders. He notes that the disgust emotion is a primary response that has evolved to prevent the spread of disease to stimuli from things like mucus, faeces and vomit—all of which may carry pathogens that could spread disease. The common reaction to these types of stimuli is to avoid touching them or feeling nauseous. He notes that the level of spider fear is related to levels of disgust and that treatment for arachnophobia progresses more successfully if disgust responses are also targeted in treatment.

2.2.3. Treatments for Arachnophobia

There are many different approaches for the treatment of arachnophobia such as hypnotherapy, eye movement desensitization and reprocessing (EMDR), anti-anxiety medications and self-help groups. The most common and effective treatment for arachnophobia is Exposure Therapy (ET) with Cognitive Behavioral Therapy (CBT) (Adler & Cook-Nobles, 2010; Chambless & Ollendick, 2001). Exposure Therapy involves exposing the patient either by flooding (exposure to the most intense feared stimulus) or gradually exposing (systematic exposure of slowly increasing intensity) to the anxiety source without the intention to cause any harm (Marks, 1979). The guiding principle of ET is that avoidance of a feared stimulus reinforces the fear, while exposure diminishes it. Cognitive Behavioral Therapy (CBT) is a psychotherapy treatment that works by:

> Changing people's attitudes and their behaviour by focusing on the thoughts, images, beliefs and attitudes that are held (a person's cognitive processes) and how these processes relate to the way a person behaves, as a way of dealing with emotional problems (Martin, 2019, p. 1).

CBT focuses on stopping the negative thoughts that are associated with the feared object or situation, replacing them with more rational thoughts by teaching patients new information-processing skills (such as watching a documentary on spiders) and coping strategies (Kaczkurkin & Foa, 2015). With reframing the cognitive processes, a person can learn to change the way they look at spiders so that they no longer perceive the spiders as disgusting and dangerous. CBT helps the patient to learn to gain control over their cognition, emotion, and behaviour via gradual exposure to the phobic stimuli (Leutgeb, Schafer, & Schienle, 2009). In ET for arachnophobia, the patients are trained to eventually hold a live spider without feeling anxious. Sometimes the anxiety is so high, that one cannot imagine participating and continuing the therapy. As a result, the drop-out rates for Exposure Therapy are higher than other therapeutic interventions (Choy et al., 2007).

Despite the established effectiveness of ET, it has limitations (Juan et al., 2005). Exposing patients to the real source of their fear can be expensive and time-consuming to recreate the traumatic situations (e.g. a therapist finding and maintaining a spider for patients with arachnophobia). Additionally, the therapist is not always able to control the order in which stimuli might or might not respond as desired (for example, the spider might stay still at one spot). Moreover, the therapist cannot ensure complete safety, which can sometimes prove to be dangerous for the therapist as well as the patient. For some phobias (such as flying), traditional ET would be not feasible.

To overcome these challenges associated with traditional therapy treatments, there has been an increase in the use of immersive technology in clinical practice. Virtual Reality Exposure Therapy (VRET) has already started to take place in clinical settings and the effectiveness of this technology has been reflected in many studies (Maples-Keller, Bunnell, Kim, & Rothbaum, 2017). Another popular technology that is still being tried out in clinical settings is Augmented Reality Exposure Therapy (ARET). Despite a large volume of studies on AR, very few studies have focused specifically on AR in terms of psychological assessment or treatment (Chicchi Giglioli, Pallavicini, Pedroli, Serino, & Riva, 2015). Both VRET and ARET create immersive environments and require headsets to interact with the simulated environments **(Figure 2)**. Further, VRET and ARET empower the therapist by giving them full control of the stimuli. Moreover, immersive media can recreate the traumatic scenarios of the patients easily without the need for therapists and patients to go anywhere. Another advantage of using VR or AR is that they can help to track exactly what the patient is looking at with the help of inbuilt eye-tracking sensors in the headsets. This can help the therapist to determine whether the patient practices any hypervigilance avoidance pattern such as the closing of eyes when confronted with spiders (Gremsl, Schwab, Höfler, & Schienle, 2018).

In the next section, I will further explain VRET and ARET studies related to arachnophobia treatments.

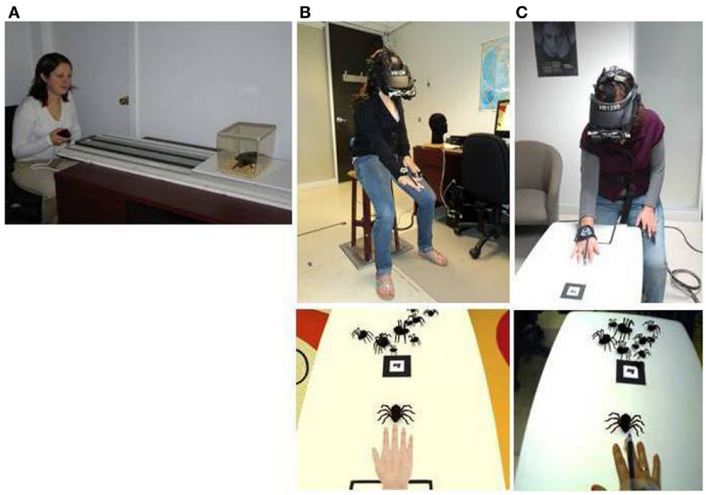


Figure 2: Three types of exposure-based methods: A. In Vivo exposure, B. Virtual Reality exposure (bottom row image shows the user's view), and C. Augmented Reality exposure (bottom row image shows the user's view). Credits: Laboratory of Cyberpsychology, Université du Québec en Outaouais (Baus & Bouchard, 2014).

A. Virtual Reality Exposure Therapy (VRET)

VRET has proved to be effective in treating specific phobias. A meta-analysis by Maples et. al (2017) suggests that, in the domain of phobias and anxiety disorders, VRET is significantly more effective than traditional therapy practices. VRET employs modern technology to simulate Exposure Therapy and to create a realistic encounter with the fear-inducing stimuli, using auditory and visual sensory channels, such that the interaction is as similar as possible to true ET. The therapist can start or stop the program at any time and can decide on the location of where to run the program, control the intensity of the encounter and stop the experience immediately if the patient becomes overwhelmed. Since the elements that the patient fears are virtual, they cannot hurt them physically, and hence, there is no physical danger to the patient or the therapist. VRET empowers the patient by giving them the ability to view a safe artificial environment in front of them, rather than only imagining the scenario in their head or having to go somewhere else to immerse themselves in a stressful environment. This is

particularly important for situations that are hard to imagine or difficult to place a patient in, such as the fear of flying. Since VRET systems can be set up anywhere, for example, in the patient's home or conducted over the Internet, it may be more appealing to people with social phobias, or other conditions that limit travel. Also, younger patients may be further persuaded into therapy because they are intrigued by Virtual Reality technology and also because VR gives an impression of being non-clinical.

Additionally, VRET is easy to access as sourcing of fear-inducing props or recreating scenarios is not needed, making it possibly less time-consuming than Exposure Therapy in vivo (in a real scenario). The principal disadvantage of VRET is the danger of cybersickness—a type of motion sickness that causes nausea and discomfort due to prolonged exposure to VR—for patients who are already going through anxiety-prone situations (Shiban, 2018). While VRET is very new and requires further research and design, it allows for innovation in the therapeutic process by introducing new technologies (Tortella-Feliu et al., 2010).

B. Augmented Reality Exposure Therapy (ARET)

ARET has some additional benefits over VRET. Augmented Reality (AR) has a greater feeling of presence (the sensation of being there) and reality judgment (judging experiences as real) than VR because the environment and the elements that the patient uses to interact with the application are real. Even the most sophisticated computers are unable to generate scenes that exactly replicates the real world. Moreover, AR users see their own hands and feet in the scene, whereas VR only simulates this experience. It also takes less time and cost to develop an AR environment as compared to VR.

In AR, the patient can align themselves spatially and have more natural interactions with their real surroundings, thereby reducing cybersickness. Even though there is strong evidence to show that AR is a superior alternative to VR, research on ARET is still limited. The following sections discuss existing research completed on ARET.

2.2.4. Existing Augmented Reality Research on Exposure Therapy

The first-ever study that used an AR system to assess and treat specific phobia was conducted by Juan et al. (2004). The study was conducted with a single patient with a phobia of cockroaches. The patient was exposed to virtual cockroaches using an AR headset and the session consisted of progressively seeing, touching, and finally killing one or more virtual cockroaches. During the treatment, the participant would hold the marker (a 2D object that acts as a visual trigger) which the camera in AR system would recognize. Once the camera recognizes the marker, the virtual elements (cockroaches) appear in front of the participant and tracks the surrounding elements **(Figure 3)**.

Figure 3: Augmented Reality Exposure Therapy using a marker (Juan et al., 2004).

The therapist controlled the number of cockroaches that were visible at a given moment, their size and if they could move. The therapist also included surprise boxes in the session which induced anxiety. After the treatment, the participant's anxiety score was evaluated using the SUDS (Subjective Units of Discomfort Scale)—a 0 to 10 scale for measuring the subjective intensity of distress experienced. The scale showed a decrease in anxiety score from 10 (depicting high anxiety) before the treatment, to 0. Thus, the study demonstrated the success of AR in treating psychological disorders for a phobia of

cockroaches. Following this, Juan et al. (2005) conducted a different, larger study to evaluate the effectiveness of an AR system, with a sample size of nine patients who had a phobia of both cockroaches and spiders. That same year, to improve the experience and assess the potential of ARET, Botella et al., (2005) added instruments like a flyswatter and a cockroach killer, along with appropriate sounds to further replicate a real scenario. The therapist trained the patient to crush spiders or cockroaches and throw them into a box **(Figure 4)**.

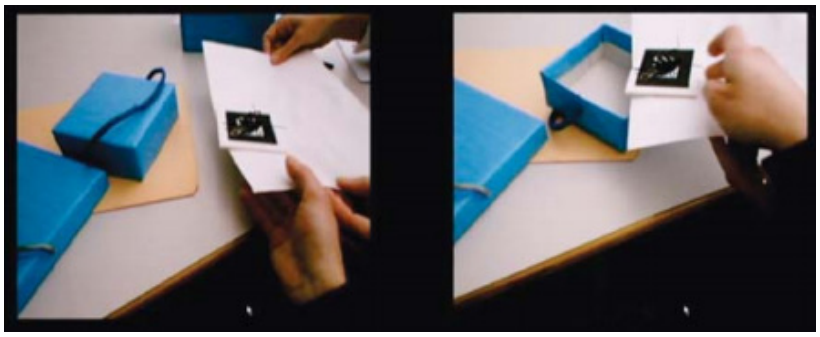


Figure 4: Patient throwing a crushed cockroach in the box. (Botella et al., 2005)

Another study by Botella et al. (2011) was conducted to evaluate the long term effect of the AR system which was tested in the short and long term with a sample size of six individuals who met the DSM-IV criteria for a specific phobia of cockroaches. The treatment was preceded by two sixty-minute assessments. Various measures of anxiety, avoidance and negative beliefs were taken pre-, per-, and post-treatment with three-, six-, and twelve-month follow-ups. This study showed that ARET can have long term benefits against a specific phobia. A single case study was carried out with a patient to enhance the patient experience and improve the clinical utility of ARET (Botella et al., 2011). The patient was required to use a serious game on a mobile phone. Advancement to different levels in serious games is not based on the cognitive skills of the player, but rather on the achievement of therapeutic goals. The primary goal of serious games is to engage users in a narrative that helps them to achieve a determined therapeutic/ educational goal that extends beyond pure entertainment (Zyda, 2005).

In the Cockroach Game application **(Figure 5)**, the user acquires puzzle pieces by interacting with the insects. Once the puzzle is complete, the user obtains a virtual trophy and a diploma. Results obtained in this study support the combination of a serious game with an ARET program to increase the patient's motivation to undertake the therapy and reduce the time for the treatment of phobia.

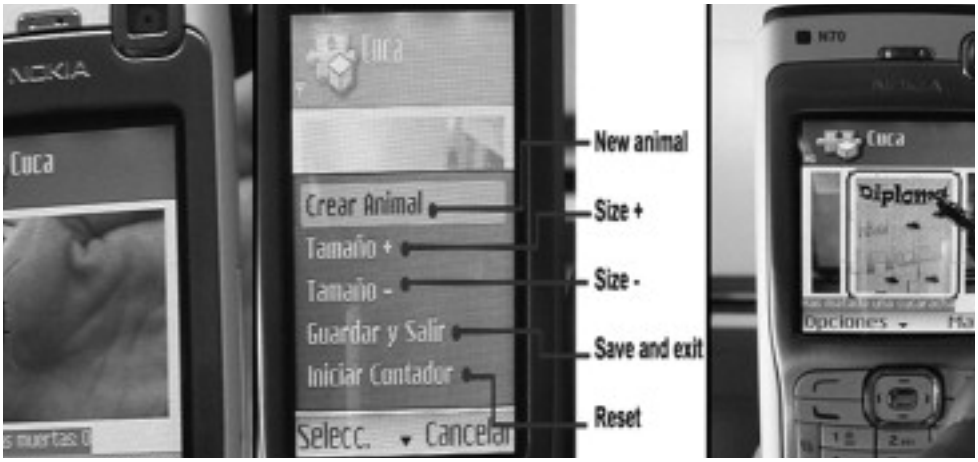


Figure 5: The Cockroach Game application (Botella et al., 2011).

Breton-Lopez et al. (2009) observed that animating virtual elements can trigger new responses in the patients. These animated elements can incite the emotion of disgust and enhance the overall immersiveness of ARET. In other ARET systems, VMARS (Visible Marker-tracking Augmented Reality System)—a two-dimensional image was used for activating AR experiences **(Figure 6)**. The presence of VMARS warns the user of the appearance of animals. To avoid this warning, Carmen Juan & Joele (2011) developed IMARS (Invisible Marker-tracking Augmented Reality System) for the treatment of small animal phobias. IMARS demonstrated two advantages: the user does not see any intruding elements in the scene, and instead, the fusion of the virtual objects with the real scene seems natural. In VMARS, users associate the marker with the appearance of virtual elements. To improve the VMARS, the markers can be designed in a more natural and less obtrusive way with an element of surprise. Wrzesien, Alcañiz, et al., (2013) developed a new display technology called Therapeutic Lamp (TL), a projection-

Figure 6: The black marker on the paper is the VMARS (Visible Marker-tracking Augmented Reality System). Copyright. Labpsitec. Universitat Jaume I. Spain.

based AR system for arachnophobia therapy **(Figure 7)**. The advantage of this system was not requiring a headset, which allowed for face-to-face therapy. The confrontation and interaction with a virtual animal in a real environment promoted more natural interaction. This tabletop projection system provides progressive therapy that allows the patient to first observe the feared animal and then interact with the animal with their hands.

Figure 7: The Therapeutic Lamp (TL), a projection-based AR system for arachnophobia therapy (Wrzesień, Bretón-López et al. 2013).

Wrzesien, Bretón-López, et al., (2013) conducted another comparative study during the same year to understand the quality of therapeutic alliance between ARET and traditional Exposure Therapy. According to Horvath and Bedi (2002, p. 44), a therapeutic alliance can be expressed as, "The quality and strength of the collaborative relationship between the patient and therapist". The analysis of the study showed that the quality of therapeutic alliance between the patient and the therapist were the same when compared between both methods of treatment, i.e., traditional ET and ARET. Thus, ARET does not act as a barrier to affect the therapist-patient relationship.

ARET also demonstrates that the AR system induces similar anxiety levels as traditional ET does within patients (Baus et al., 2014). This study shows evidence of the higher efficacy of ARET over VRET methods. ARET enhances its presence and alignment with their surroundings, which makes the ARET system more immersive. To improve the presence and reality judgment of the surroundings and therapy, another AR study (Fatharany et. al 2016) was conducted, in which everyday objects were used as a marker substitute **(Figure 8)**. The results indicate that this AR application was able to induce anxiety among patients and also increased their presence and immersiveness with the therapy.

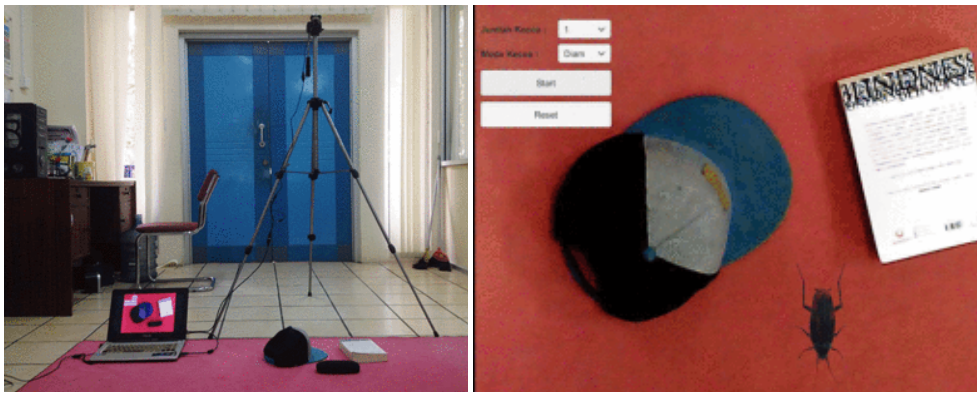


Figure 8: Everyday objects were used as a marker substitute (Fatharany et al. 2016).

Overall, ARET shows strong evidence as an alternative to VRET for supplementing traditional ET. The clinical outcomes seem to confirm that this technology does not present any danger as it does not negatively influence the patient-therapist relationship and the flexibility of AR systems allows the therapist to customize exposure exercises to fit the needs of their patient. Nonetheless, AR still faces technical challenges such as resolution, cost of hardware, power usage, calibration, etc. (van Krevelen & Poelman, 2010). These fundamental issues must be addressed before AR is widely adopted (Hughes et. al 2005).

Despite these concerns, the possibilities and the acceptance of AR is growing in terms of both software, hardware, and a plethora of new applications. Building knowledge for an AR-based therapy application and the effect on the clinical outcomes is key to defining their true role in care. However, to ensure positive effects are realized, we also need to consider how best to design and implement them for patients with mental health conditions. To do this, a greater understanding of the user experience (UX) of mental health apps is needed.

2.3. Mental Health Applications

The potential advantages of smartphone-based mental health apps (MHapps) to expand the availability and quality of mental health treatment have been recognized by many public health organizations such as the U.K. National Health Services (NHS) and the U.S. National Institute of Mental Health (NIMH) (Batra et al., 2017; Chandrashekar, 2018). The global mHealth (mobile health) market is predicted to reach nearly 100 billion U.S. dollars in 2021 (Mikulic, 2016). The demand for MHapps in a recent public survey found that 76% of 525 respondents would be interested in using their mobile phones for self-management and self-monitoring of mental health (Proudfoot et al., 2010).

Users also prefer self-help support materials if they are delivered via a familiar medium (Stoll, Pina, Gary, & Amresh, 2017). NIMH classifies mental health apps into six categories based on functionality: self-management, cognition improvement, learning skills, social

support, symptom tracking and passive data collection (NIMH » Technology and the Future of Mental Health Treatment, 2019).

MHapps can play an important part in mental healthcare by making mental health support more accessible and reducing the barriers to seek help (Simon & Ludman, 2009; Watts & Andrews, 2014). These applications have reduced the contact time required by therapists to treat individual patients, thus offering time-efficient and cost savings solutions as compared to traditional treatments procedures (Doherty, Coyle, & Matthews, 2010). MHapps can provide increased support in primary care settings by reducing the need for referral to further expensive services. They also offer immediate crisis intervention to supplement in-person therapy and post-treatment condition management (Price et al., 2013).

Mental health apps span all stages of clinical care provision and are beneficial for psychological treatment delivery compared to other platforms due to ease of habit, greater flexibility, low effort expectancy, and motivation (Yuan, Ma, Kanthawala, & Peng, 2015). MHapps continue to proliferate but studies indicate that users rarely use mental health apps post-download and only open the app a few times (Torous, Nicholas, Larsen, Firth, & Christensen, 2018) before they abandon it. Usability is considered one of the barriers impacting the use and adoption of mobile health apps (Alqahtani & Orji, 2019).

User experience design practices have played an important role in Human-Computer Interaction (HCI), with usability inspection methods on heuristics in widespread use (Nielsen, 1993). User experience (UX) design is defined as the process of creating products that provide meaningful and relevant experiences to users. It encompasses all aspects of the end-users interaction, a user's perceptions and responses that result from the use or anticipated use of a product, system or service. The design process includes aspects of branding, design, usability, and function (The Interaction Design Foundation, 2019). UX in Exposure Therapy can help to focus on having a deep understanding of patients and therapists, what they need, what they value, their abilities, and also their limitations. It also takes into account the therapeutic goals required to manage anxiety.

UX practices promote improving the quality of the patient's interaction with Augmented Reality technology. User experience highlights the experiential, affective, meaningful and valuable aspects of human-computer interaction (HCI) and product ownership, but it also covers the practical aspects such as utility, ease of use and efficiency of the system.

For mental health intervention to be effective, it is essential to better understand the strengths and challenges surrounding the development of mental health apps. However, to ensure positive effects are realized of mental health apps, it is important to understand how to design and implement them for patients with mental health conditions. To do this, a greater understanding of the user experience (UX) of mental health apps is needed. The next section provides recommended design guidelines for the development of MHapps.

2.3.1. Design Recommendations for Mental Health Applications

Research has demonstrated mobile interventions are successful in improving anxiety symptoms in adults (McCrone et al., 2004) and also hold value for therapy (Watts et al., 2013). Understanding of UX concerning mental health services is still emerging. Healthcare professionals have started realizing the potential of MHapps to enhance the delivery and impact of mental healthcare in many ways. Assessing and applying knowledge about UX to apps is a fundamental part of this, and a key step in exploring and defining their role in mental healthcare. However, there are no fixed guidelines for the development of an evidence-based MHapps. As a result, the section below presents the design approaches and recommendations based on a review of existing literature. The design recommendations for MHapp are as follows:

a. Developing a Framework and Identifying Goals

While design processes must be adapted to the specific needs of each development project, a broad framework can help to consider possible design goals and planning to achieve the desired outcome. Existing frameworks in related areas such as Learner Centered Design (LCD) (Soloway, Guzdial, & Hay,

1994) or Information System Research (ISR) (Schnall et al., 2016) provide a useful starting point. The LCD process has direct analogues with the development of therapeutic systems with a variety of Participatory Design (PD) (Schuler & Aki Namioka, 1993) techniques which can be leveraged for involving therapists. The ISR framework guides the implementation of user-centred human-computer interaction research methods to build a product. Identifying these goals and desired outcomes can help in establishing a design rationale for a project and can provide the metrics against which the success of systems may be measured.

b. Design in Collaboration with Healthcare Professionals

Healthcare settings place several constraints and limitations on non-clinical professionals (such as designers), particularly concerning access to end-users and evaluation involving users with mental health difficulties (Groeneveld, Dekkers, Boon, & D'Olivo, 2018). Access constraints affect all stages of a system's development process and have direct implications for approaches such as user-centred and participatory design (Boyd-Graber et al., 2006). Collaboration with healthcare professionals is critical for developing a successful design system for mental healthcare. Clinicians should be fully aware of the motivations and methodologies of the design process. Interviews with therapists can help the designer to better understand the theoretical background, ethics and day-to-day practice of mental health professionals. Designers should be involved in all stages of product development, such as the preclinical theory phase, the modelling phase, exploratory trial, randomised controlled trial and long term implementation. While input from healthcare professionals is necessary, allowing for balanced input from each member on a design team is another essential element of a successful collaborative design process (Doherty, Coyle, & Matthews, 2010). The use of techniques such as role-playing (Burns, Dishman, Verplank, & Lassiter, 1994) and future-workshops can contribute to this process. Visiting end-users' workspaces can be referenced and can also provide insight into the patient group, their interests, background and challenges facing them in

their daily lives (Muller et al., 1995). Surveys can supplement interview studies; they are non-invasive, involve relatively low overhead and can be used to build up a broad picture of the domain and identify trends.

c. Design for End Users

To enhance the effects of MHapps a variety of factors should be considered including a collaborative relationship between therapist and patient (Persons, 2012). Empirical studies have found that the single largest contributory factor in determining the success of any mental health interventions is identifying factors that empower users (therapists or patients) and identifying the resources available in the client's environment (Adler & Cook-Nobles, 2010). Clinical evaluation completed by Coyle and Doherty (2009) highlights the importance of socio-cultural issues which affect mental health including gender, social class, educational level, religious or secular assumptions, race and ethnicity. Thus, the design content of the system should match the background and experiences of patients. Designers should aim to reduce mental illness stigma by adopting non-judgemental, non-diagnostic and non-clinical approaches and branding it as psychological well-being (Corrigan, 2007) which would increase help-seeking for mental health problems (Herrman, 2001). The non-clinical population highlights the importance of accessibility, that it must be easy to use and economical (Kenny, Dooley, & Fitzgerald, 2014) as well as creating awareness to increase the social acceptability and consequently engagement among users (Campbell & Robards, 2013).

d. Design for the Therapist

In healthcare, professionals are often uncomfortable to find themselves in the role of computer novice (Gosbee & Ritchie, 1997). Many therapists face the challenge of how to incorporate technological interventions into their current practice, along with significant concerns regarding issues on privacy, added responsibility, the security of information and the need for technical training.

Building MHapps on existing therapy methods and translation of the therapy process in new mediums can help the therapists to build trust and use the application in their practice (Doherty, Coyle, & Matthews, 2010). For instance, the therapist knows how Exposure Therapy (ET) is practised and translating traditional ET in Virtual Reality (VR) or Augmented Reality (AR) can help the therapist to adapt the AR/VR system in their practice. "The solution to such issues may lie in practice rather than the design of the technology" (Doherty, Coyle, & Matthews, 2010, p. 247). Carl Roger (1957) posited that the healing effects of therapy occur through patient's experiencing an empathic, non-judgemental, genuine relationship that helps them to achieve self-acceptance and congruence. Systems should help to establish this relationship through therapeutic contracts which are made visible and represented through an understanding between the therapist and patient, for instance, using CBT based models for therapy (Asay & Lambert, 1999). Building systems on accepted theoretical models and adhering to ethical requirements can help therapists to trust and adopt these systems (Coyle, Doherty, Matthews, & Sharry, 2007).

e. Adding Self-Monitoring Techniques

Self-monitoring is a suitable intervention that aims to change behaviour (Todd & Mullan, 2013) and helps in boosting overall Emotional Self-Awareness (ESA)—the ability to recognize and understand one's own emotions that affect behaviour, decisions, and performance (Hill & Updegraff, 2012). Reporting of thoughts, feelings, tracking moods or behaviours can help patients to reflect on their actions and exercise self-monitoring (O'Donohue, Fisher, & Hayes, 2004). Linking recommended activities such as exercise, daily meditation and mindfulness practices in MHapps can reduce anxiety and improve psychological well being (Anderson & Shivakumar, 2013). A self-monitoring technique involves Behavioral Activation in which patients are encouraged to plan their activities and set goals on their own to develop skills and promote positive feelings of self-worth (Beck, 2011). For example, the patient can set their goal of 10,000 steps per day in the

mobile app. Habit formation can be an effective way of promoting repeated engagement with the MHapp which leads to mental health benefits (Nir Eyal & Hoover, 2014).

Psychoeducation, the process of providing education and information to those seeking or receiving mental health services, is integral to boost mental health literacy (Bakker, Kazantzis, Rickwood, & Rickard, 2016; Jorm, 2012). Psychoeducation presents patients with mental health information, coping-skill training and teaches them about their psychological processes which are causing distress. MHapps can tailor and engage users with a range of multimedia and audio tools to aid their understanding of mental health concepts. Furthermore, including links to crisis support can help troubled individuals to seek attention to their situation and help overcome existing barriers (World Health Organization, 2014). Psychological disorders are highly comorbid—the presence of one or more additional conditions co-occurring with a primary condition. For example, a patient who is suffering from anxiety has a high possibility of having depression as well (Gorman, 1996). MHapps should have the ability to address comorbid conditions to treat symptoms shared among disorders. Since interventions for comorbid disorders are typically similar in delivery and content, MHapps can increase patient engagement and treatment efficacy by reducing the commitment needed to interact with multiple apps for comorbid disorders.

f. Building Adaptable and Secure Systems

Data storage and data security are a major priority when designing healthcare systems. Following ethical guidelines on encryption, security codes, non-identifying username, opt-ins, user consent, privacy terms and discrete symbols can help patients control their data which helps increase confidence in these systems. To broaden the patient base, the delivery system should be adaptable so that the therapist can tailor the support system to meet the needs of each patient (Doherty, Coyle, & Matthews, 2010). Providing flexibility in the delivery of

support is a key consideration for a designer. Tangible artefacts or improvements can help patients further reflection and conversation with the therapist. Incorporating social platforms with MHapps can give a sense of belonging and connection but the system should have measures to protect its users (Kenny, Dooley, & Fitzgerald, 2014). Through clear consent, automated monitoring to leverage behavioural data through social media can help therapists to model mental health predictions and can detangle conflicting findings around their social behaviour (Rickard, Arjmand, Bakker, & Seabrook, 2016).Individualized feedback regarding their submitted responses can guide their emotional functioning and lead to positive behavioural changes (Rickard, Arjmand, Bakker, & Seabrook, 2016).

g. Enhancing User Engagement

> Designing for engagement in the mental healthcare domain must place the emphasis on engagement with the treatment, rather than on engagement with the technology (Doherty, Coyle, & Matthews, 2010, p. 246).

Evidence from the literature suggests that patient participation can be improved through real-time engagement, usage reminders and gamified interactions (Bakker, Kazantzis, Rickwood, & Rickard, 2016). Virtual Reality interventions acknowledge the benefits of engaging with patients in a real-world context in real-time (Opriş et al., 2011). Real-time engagement with homework assignments during therapy opens opportunities for learning and coping strategies in ecologically valid contexts (Chacko, Isham, Cleek, & McKay, 2016). Gamification can help to counteract problems with motivation and yield well-being outcomes (Mcgonigal, 2011). It also helps to break larger, more abstract goals into tangible tasks and users can reflect on their competency and build resilience which ultimately aids self-efficacy (Bakker, Kazantzis, Rickwood, & Rickard, 2016). Researchers in interaction design have highlighted the need for designing meaningful and playful learning applications (Soloway, Guzdial, & Hay, 1994). The

user interface (UI) plays an important role to reduce cognitive load and increases capacity for learning (Patel & Kushniruk, 1998). A study completed by Kenny, Dooley, and Fitzgerald (2014) with patients notes that to increase engagement the content should be made illustrative, fun, interactive and use non-clinical language that helps patients to organize and visualize their health stories. Many reported a desire to use MHapps to interact socially with peers to share and learn from others experiences. Anonymous forums or the prospect of users being 'matched' to chat based on their interests or problems was also suggested. Framing reminders to satisfy commitment and consistency can increase adherence and reduce dropout from self-help interventions (Cavanagh, 2010). MHapps should also encourage non-technology or real-world activities that help them to foster the environmentally valid application of skills (Bakker, Kazantzis, Rickwood, & Rickard, 2016).

h. Evaluating the System

A major shortcoming of currently available MHapps is the lack of randomized controlled trials (RCT) in clinical settings to test their efficacy (Donker et. al, 2013). Requiring inputs from mental health professionals can be difficult and time-consuming. Nonetheless, it is of utmost importance to evaluate the intervention. Using licensed and valid assessment tools to evaluate before and after usage of the MHapps can help to better understand the strengths and weakness within the app. Before RCT or clinical trial usability, client factors and interaction principles can be tested with a target user group (Doherty, Coyle, & Matthews, 2010). App usage data can be used for ongoing monitoring of client data to analyze user behaviour, time-spent, program adherence and improve overall app functionality (Bakker et. al, 2016). Exploring the decline and unsuccessful cases can help to evaluate the client's perception (both therapist and patient) and anticipate gaps for countering the impact of such factors in design.

2.4. Serious Games for Psychotherapy

Clark Abt proposed the term "Serious Games" (SGs) in 1970, long before the introduction of computers and electronic devices to the general population. A serious game is an application using computer game technology and game design principles to engage users in a purpose and help to achieve a determined goal that extends beyond pure entertainment (Zyda, 2005). One of the main categories of serious games are games for health. According to Kato (2010), digital interactive games have a positive effect on people's physical and mental health. For example, Hoffman et al., (2008) developed the first VR serious game called SnowWorld, in which cognitive distraction is used to distract burn victims from their pain. In SnowWorld, patients are immersed in a virtual winter landscape where they can interact with snowmen, penguins, and woolly mammoths by throwing snowballs. This game showed reduced pain ratings and pain-related brain activity. Psychotherapy is an area in which the innovative use of computers in the form of psychotherapeutic games may enhance patient cooperation and offer new forms of treatment. The limited literature on the use of games in psychology suggests that they can help young patients become more cooperative and enthusiastic about therapy (Baranowski, Buday, Thompson, & Baranowski, 2008; Ceranoglu, 2010; Wilkinson, Ang, & Goh, 2008). Games may facilitate relations with a therapist, improve cognitive skills (e.g. memory, motor and planning skills, frustration, tolerance, etc.) and elaborate on and clarify problems during the therapy process.

In literature, we can also find serious games used in phobia treatment (Emmelkamp et al., 2001; Botella et al., 2005). Research has demonstrated that patients who practised serious game training have better results than patients only experiencing traditional learning processes (Buttussi et al., 2013) and also that the serious game approach increases skill retention after three months. The main aim of these games is to improve cognitive and motor skills of patients during the rehabilitation process by making the exercises easier and more fun compared to the traditional methods through using simulation and Virtual Reality (VR) environments.

2.4.1. Guidelines for Designing Serious Games

An emerging line of research on SGs has been developed to support psychotherapeutic treatment for patients with emotional problems using cognitive behaviour therapy principles (Brezinka, 2007; Brezinka & Hovestadt, 2007). Because SGs can change behaviour, it is worthwhile to investigate whether they can help people treat phobias. However, clinical patients with mental disorders should only use games that meet strict conditions consistent with Exposure Therapy as applied in a therapeutic context. As previously mentioned, Exposure Therapy is the most effective technique for treating anxiety disorder. To facilitate change, it is important to understand how SGs for Exposure Therapy can be designed. Clinical guidelines for serious games for the treatment of specific phobia are limited and hence guidelines were adapted from a general understanding of how SGs are designed across different psychological therapies. The main guidelines for designing a psychology serious game are presented below. One of the key aspects of serious game design is the integration of the characterizing goal within the game content. Participation in the game should be a challenge for the player, the difficulty level must correspond to the skills and capabilities of players. Players may not be interested in gameplay where the educational goals are too obvious. The educational component should be discreetly integrated into the game along with play and the learning that needs to be (Dörner, Göbel, Effelsberg & Wiemeyer, 2016).

A well-designed game should result in a so-called flow experience—when a player is so interested and absorbed in a game that performance arising from it is not for the reward, but with excitement flowing from the action. In good moment-by-moment gameplay, each action or decision tends to naturally lead to the next action or decision, putting the player in a psychological state of flow (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2014). Selection of therapeutic techniques that can be implemented in the game depends on the condition. Serious games based on cognitive behavioural techniques can provide interesting tasks where practising skills are needed. CBT helps to better understand the nature and causes of unpleasant feelings and attempts to replace these feelings with pleasant emotions and to cope with new and difficult situations in a more appropriate

way. To achieve the above objectives they must have certain formal characteristics of computer games, which dictate their attractiveness. According to James Paul Glee (2005), the learning mechanics for a game design depends on three areas: empowered learners, problem solving and understanding. It should focus on player-centred design techniques so that the users feel like active agents and not just consumers of what the game designer has placed before them. The user should feel their actions and decisions create the game experience. Games should offer users identities whose traits they can determine making them create deep connections with the character. When creating characters it is also worth taking into account the age of recipients, the resemblance between the hero and the player can help in the identification process, and thus promotes internalization of behaviour. Games should provide the user with the ability to manipulate the game environment objects and this adds to the user's goal.

Well-ordered problems should be designed for the early stages so that the user can understand how to proceed to harder problems. Feedback should be given to guide the user in the right direction towards success. Games should support repeated cycles of learning to master and new challenges should be created to extend those practices. Skills built during each session can be used as a strategy to accomplish goals and they can apply to the real context or larger systems. There are two aspects of gameplay: engaging users moment by moment and relating current game actions to future objectives. James Paul Glee (2005) notes,

> Humans do not usually think through general definitions and logical principles. Rather, they think through experiences they have had and imaginative reconstructions of experience. (p. 14)

Philosophical points or meanings that need to be conveyed can be through game narratives which the player realizes through these experiences. For example, the Star Wars games communicate the idea of freedom fighters and ideologies of freedom. Playing a serious game should be fun and if it is not fun, maybe the so-called game is

not a game (Dörner, Göbel, Effelsberg & Wiemeyer 2016). The fun element helps maintain learner interest, positive attitude and promotes intrinsic motivation. To facilitate change, it is also important to enhance the patient's perception of self-efficacy when confronting the feared situation, context or object (Bandura, 1977) and to incorporate humour into the therapeutic process (Frankl, 1960). SGs must provoke interest and stimulate the imagination in the process of inventing tasks through therapeutic techniques, and methods.

For example, a game called Treasure Hunt uses fantasy storytelling which invokes emotions as an active part of problem-solving, which offers cognitive behaviour modification. The main components of game design are mechanics, storytelling and interaction. Game mechanics design focuses on the logic of the actions in the game, rules, and functionality. Storytelling design involves the dramaturgy of the game. The goal of storytelling is to understand the game world, rules, goals and game characters. The mission of storytelling is to get users interested in the game. Interaction design focuses on how players would interact with the game (Dörner, Göbel, Effelsberg & Wiemeyer, 2016; Ijäs & Viitala, 2017.) Serious games have shown potential as learning material, but currently are often not very engaging.

One reason why games are considered to be fun is their ability to provide us with an interesting fantasy world to explore and play in, but this seems at odds with the more serious nature of formal training (van der Spek, Sidorenkova, Porskamp, & Rauterberg, 2014). Narratives inform us about our world and imaginary worlds. They also tell us about what people go through and make us realize what the world is really about. Narratives are used as a form of important lessons. For example: 'the boy who cried wolf', this story teaches children about the importance of not lying. Narratives confirm people's perspectives on subjects and assist readers to situate themselves in certain situations.

2.5. Summary

Augmented Reality has demonstrated remarkable growth and progress in recent years, with current AR devices able to make 3D virtual objects have a seemingly physical presence and appear to coexist with real elements in the actual world. To explore the potential of AR in phobia therapy, it is necessary to first better understand the current state of research completed in this field. AR can provide additional advantages over traditional treatments of Exposure Therapy. ET occurs in a real environment, where the patient's fears are also real and might not behave as the therapist desires. The therapist does not have full control over the stimuli and cannot ensure complete safety during the treatment.

With AR, the therapist can control the stimuli and the environment.
The augmented elements are not real, so there is no real physical danger to the patients. Not only this, but AR can also be cost-efficient as Exposure Therapy is expensive and requires multiple sessions. To design AR experiences for arachnophobia therapy, it was essential to better understand existing recommendations to create a mental health app and how the patient's engagement with these applications can be improved. Serious gaming guidelines can help to motivate the patient to complete therapy and build a positive relationship with the therapist.

3. Qualitative Analysis

> What people say, what people do, and what people say they do are entirely different things—Margaret Mead, American cultural anthropologist

Qualitative analysis is the analysis of qualitative data (e.g. text data from interviews) which is dependent on the researcher's analytical and integrative skills and personal knowledge of the social context to better understand the phenomenon (Braun & Cupchik, 2001). User experience (UX) is present in any setting in which human beings interact with technology. Recently the increased adoption of technology in medical records has brought the topic of user experience into focus for the healthcare industry. This has opened the discussion for integrating user-centred design principles into other healthcare industry processes, products and workflows. To adopt a user-centric approach, two research methods were used to collect primary data for this study.

First, semi-structured interviews were conducted to explore and discover connections between different fields such as Augmented Reality/Virtual Reality (AR/VR) therapy, traditional phobia therapy and user experience design. Second, an analysis of existing AR/VR mobile apps and VR headset apps for arachnophobia Exposure Therapy was completed to better understand what has been completed in the field so far (including the experience, the design, and the support mechanisms). Through this research, I am able to better understand the issues, motivations, frustrations and intentions surrounding the use of Augmented Reality applications for arachnophobia therapy. In this chapter, I summarize my findings from expert interviews and the qualitative analysis of these applications.

3.1. Semi-Structured Interviews

According to Gill et al. (2008), semi-structured interviews allow for flexibility and helps the interviewer to discover information that they may not have previously thought of asking. Semi-structured interviews helped me to:

- Understand different approaches to arachnophobia therapy
- Consider future possibilities for using immersive media in healthcare
- Explore links between psychology and user experience design
- Learn about the expert interviewees' thoughts and feelings
- Identify methods to improve the user experience for arachnophobia therapy

I conducted semi-structured interviews with seven participants working as user experience designers in healthcare and AR/VR; and, psychologists practising Exposure Therapy for arachnophobia. Interviewees were recruited by email, the interviews were one-on-one, lasted 30 to 60 minutes, most were conducted through face-to-face online video calls and audio recorded, with notes written on my laptop. I divided the expert interviewees into two categories, i.e., psychologists and user experience designers.

- ***Psychologists (n=3)***: Dr. Crys Brown practices traditional Exposure Therapy, Dr. Joel Roos uses VR for Exposure Therapy in his practice and Dr. Stéphane Bouchard uses both AR and VR for Exposure Therapy in his practice. They were asked a wide range of questions about their perspectives on using AR/VR in their therapeutic practices, the process of Exposure Therapy, the importance of patient experience and their collaborations with other fields.
- ***User Experience Designers (n=4)***: Two of these designers are working with immersive technologies in collaboration with developers and the other two are working on design projects in collaboration with healthcare professionals. Interviewing user experience designers gave me the opportunity to better understand the technical aspects of designing AR/VR applications, their roles within the AR/VR space, their design processes, and the challenges they face when collaborating with healthcare professionals and developers.

The interview analysis included the following steps:

- Interview audio/transcripts were reviewed iteratively for generating broad concepts and an overall understanding of the content
- Key points were extracted from each interview
- Links were identified between and across these key points and grouped together

3.1.1. Interview Analysis

The following key points have been identified from the interviews and have been divided into two categories of professionals.

A. Interview Analysis: Psychologists

a. The Process of Exposure Therapy

> Treatment guidelines aren't written in stone for psychology or for medicine or for most helping professionals working with mental or physical health. Usually, what we look at are things like best practices or it depends on government offering funding for certain treatment—Dr. Joel Roos, psychologist and a clinical doctor at Cultivate.

In Exposure Therapy, the first session follows the standard principles of Cognitive Behaviour Therapy (CBT), which includes various questions surrounding the patient's experience with a phobia. This session is important to build a bond between the therapist and the patient. A patient is asked to rate their anxiety response levels to different scenarios on a scale of 0 to 100. Fear of Spiders Questionnaire (FSQ), a questionnaire assessing spider phobia, or the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria are used to diagnose a phobia. Based on this assessment, the therapist creates exposure hierarchies—a list of anxiety-producing scenarios, graded from the least anxiety-producing to the most

anxiety-producing stimuli. The interviewees recommended that the next step after diagnosis is a psychoeducation session, where the patient is provided with information and strategies to manage their condition.

For VR therapy, a brief orientation is given to the patient on how to use the gear and controllers and what they can expect to see in the headsets. Following that, the patient is exposed to different grades of exposure of their fear-inducing stimuli. The therapist ends the treatment when the patient—even when exposed to the most fear-stimulating exposure scenarios—is able to manage their anxiety independently, stop displaying the symptoms of phobia (see chapter 2.2.1.), restore their physiological functions and replace any negative thoughts with rational decisions. Dr. Joel Roos, a registered psychologist and clinical doctor at Cultivate, a clinic for mental health services in Calgary, Alberta, said that currently, the cost for a single session is set at $200 an hour by the College of Alberta Psychologists, the regulatory body for the profession of psychology in the province of Alberta. Depending on the patient, several sessions might be required and this can quickly become very expensive. Exposure Therapy, although a successful treatment for phobias, presents some challenges. First, in order to be effective, it forces the patient to encounter and interact with anxiety-inducing stimulus and thus, it can be difficult to motivate the patient to participate in something that they might perceive as threatening.

Dr. Crys Brown, a registered psychologist—running her own private practice in Edmonton, Canada, notes that a challenge exists because when the therapist is creating exposure hierarchies, sometimes, patients are unable to grade their anxiety levels properly which can create confusion in understanding when to move to the next levels. She notes that the same problem is observed in self-guided Exposure Therapy apps where the grading of anxiety levels is not personalized to each user. When patients are facing their fear-inducing stimuli,

Dr. Crys Brown asserts,

> When someone's nervous system is telling them they're in a lot of danger, the support of a therapist can mean the difference between success and failure with exposure. I think the biggest risk to the patient is if there is no one there to help them, coach them, then there is a chance that the patient will become overstimulated and then abandon the exposure.

Other shortcomings for traditional Exposure Therapy include difficulties in recreating real-life scenarios and in ensuring that these scenarios are safe and cost-effective (for example, if the patient is scared of flying, it is challenging and expensive to simulate).

b. Coping Strategies for Exposure Therapy

Patients are taught to calm themselves by using methods (e.g. breathing techniques, self-motivational talk, muscle relaxation exercises, etc.) which can be used as coping strategies during Exposure Therapy to prevent fainting or changes in blood pressure. Dr. Joel Roos trains his patients in relaxation techniques, while Dr. Crys Brown uses motivating conversational cues to calm her patients when they feel overwhelmed during therapy. However, Dr. Stéphane Bouchard suggests that coping strategies are not necessarily required for Exposure Therapy to work, he notes,

> Oftentimes, [therapists] would teach relaxation or would be tempted to talk to their patients [during the therapy] to reassure them. This is only needed when the therapist [is] going too fast. Because the point is, when I see a spider, I don't relax all the time. I just see it and I don't mind. You want them to do exactly the same in real life or in the virtual situation so you don't want to do relaxation or talk or use self-reassurance or positive thoughts, as all of these things may lead to avoidance. So you need to adjust your pace. So they actually just fully experience what they're afraid of.

c. Patient Experience of the Exposure Therapy

Dr. Crys Brown, who practices traditional Exposure Therapy, says that for arachnophobia, treatment starts by having a conversation with the patient about situations that triggered anxiety in the past. After this, the patient is exposed to situations that induce different levels of fear. The first level includes looking at cartoon images of the spider, followed by looking at photographs. Next, the patient watches videos, looks at close-up shots of spiders and interacts with props. For the final stage—depending on the budget and availability of resources—the patient is taken to the feared location or the feared situations are recreated. The therapist provides on-the-spot guidance to help the patient manage their anxiety in real-life scenarios. For arachnophobia, Dr. Crys Brown takes her patients for a visit to the zoo or a museum with live-spiders, while Dr. Stéphane Bouchard uses a real spider for patients to interact with. For VR therapy, Dr. Joel Roos uses HTC Vive or Oculus Rift, which are popular VR headsets to expose his patients to a range of virtual spiders (small to large), while Dr. Stéphane Bouchard uses Hololens, an AR headset.

In Exposure Therapy, objective tests use markers of physiological functioning (e.g. heart rate, blood pressure, etc.) to measure unconscious cognitive processing—such as the perception of and response to the fear-inducing stimuli. For instance, in arachnophobia, the objective test would measure how the patient responds to a real spider (stimulus). Based on these assessments, the therapist determines the exposure scenario for each therapy session.
Dr. Stéphane Bouchard mentions that In order for a patient to manage their anxiety, they need to eliminate existing associations of fear with the stimuli by forming new ones. Immersive technology can help to create safe environments which aid the patient in building these associations quickly as the therapist can control the stimulus and the patient is aware that there is no actual threat. AR/VR can also help in recreating the patient's traumatic situations easily. The visual narratives in VR therapy simulate real environments and are similar to those

used in traditional Exposure Therapy. Dr. Stéphane Bouchard adds that the graphic renders in AR/VR visuals do not need to be realistic because as soon as we see an eight-legged structure on the floor, our brains think of a spider. Dr. Stéphane Bouchard notes,

> If the immersive scene seems sufficiently realistic, but mostly with the fact that when you move around, your brain follows the information and the information that goes into your brain is consistent. We call this multisensory integration. You see, you hear, your head movement, your proprioception—it all matches to tell your brain that what you're going through is right, is real—which is a really good illusion. And so, when this is sufficiently powerful, the brain sees the virtual spiders that you're afraid of as potentially being the real thing.

d. Perspectives Regarding Mental Health Applications

Interviewed psychologists believe that mobile apps can aid future treatments for mental health problems, but currently, there are many challenges that need to be addressed. The biggest challenge is that it is hard to identify which apps are safe to use since there are no established regulatory standards. Dr. Stéphane Bouchard uses mental health applications such as MindShift and PTSD Coach which help him to track his patients' anxiety levels as well as help patients to access self-guided therapeutic techniques. He recommends these apps as they are created by Canadian government healthcare organizations. He notes that patients are becoming more and more comfortable in using these applications. On the other hand, Dr. Crys Brown adds that even though some apps are really important for certain therapies, the patient's adherence to the therapy protocol facilitated by these apps is unsatisfactory as they often stop using them after a few weeks. Dr. Crys Brown believes that the reason for this might be that the apps are not visually appealing, "not super user-friendly", are too complex and are not tailored to the patient's needs. Dr. Crys Brown asserts,

> My dream mental health app would allow the psychologist to set up what the [patient] needs to do in the app. So if the psychologist could say you need to track your medication and your sleep compliance and you need to do these three exercises where you look at spider pictures for the first week and communicate your results to me in the app... that would be brilliant. But so far I don't know of anything set up like that. [Patients] don't want to look at 20 different things that they don't need for the one thing they do need, right?

e. Role of the Therapist and the Patient

According to the interviewed psychologists, the most important part of Exposure Therapy is for patients to understand how the therapy works for reducing anxiety—the relationship between avoidance and threat. The therapist creates an exposure hierarchy of tasks with less feared triggers to more fearful situations with the patient and monitors the pace of the patient going through Exposure Therapy. Dr. Stéphane Bouchard states,

> The patient's role is actually to [agree] to engage in this crazy idea of facing what you're afraid of and that would raise emotions in them so they need to be able to tolerate these emotions until they go through the end of the experience.

The sense of achievement that comes from successfully completing each exposure levels, can motivate the patient to continue with the therapy. Dr. Crys Brown states,

> The first [exposure level], you want the person to be 100% successful. You might take an [exposure] that's even a little too easy so you know that the person can tolerate and they gain confidence.

The patient tries to keep their attention as much as possible on the stimulus that triggers fear and not distract themselves by adopting safety behaviours—behaviours that people might engage in to neutralize their fear. The role of the

therapist is to ensure that there is no avoidance (e.g. the patient does not close their eyes), they act as a coach to encourage the patient, but does not reassure them by saying "it's not scary or it isn't real". They draw the patient's attention back to the stimulus to make sure that they are emotionally engaged in the situation. Dr. Stéphane Bouchard notes that there shouldn't be any talking or breathing exercises involved during the session as talking can act as a distraction for the patient. He also says,

> It's not the time to do relaxation because if you relax you're distracting. You want to let the anxiety completely rise on its own so that the person can observe that they don't have to do anything to make the anxiety come down that it will come down on its own.

For post-therapy, the patient is recommended exercises/homework in between sessions since the therapist believes that a small number of sessions is not sufficient for overcoming their fear. The goal of the therapy is for the patient to manage their anxiety level in real life outside the controlled environment of the therapist's office. Interviewees mentioned cost constraints for equipment and technology. The patient makes notes about their anxiety levels when they are not in session—which is then used by the therapist to monitor the patient's self-sufficient management of anxiety in the real world. For VR therapy, the therapist conducts a short orientation with their clients about the VR equipment and what they can expect in these virtual environments.

f. Perspectives of Interviewed Psychologists on AR/VR Therapy

The adoption of VR in healthcare systems has recently become more widely accepted among healthcare professionals (Riva, 2002). Cost for hardware has decreased with affordable and popular HTC products and the Samsung Gear VR. Dr. Joel Roos and Dr. Stéphane Bouchard state that using VR in their patient's therapy routine accelerates the treatment timeline for Exposure Therapy compared to the traditional therapy and amplifies the patient's engagement.

Positive feedback from the patients has reinforced their trust in using this technology. Dr. Joel Roos notes,

> [Patients responded to VR therapy] amazingly well. Patients love it. They're surprised to see that, they get so emotional or frightened, but it works, works well and they like the fact that you can use technology. They think it's gonna be easier.

Dr. Joel Roos thinks VR acts as a hook for younger patients as they have familiarity with the technology which appeals to them to engage in this mode of therapy and thus, increases their comfort level. VR enables the therapist to create a safe and controlled environment and gives the ability to create a more personalized experience for the patients. Currently, AR therapy is still at the research and early implementation stage. Dr. Stéphane Bouchard says, "AR is essentially, in my mind, at the point that VR was probably 10 years ago." Even though AR has become very popular in the entertainment and commercial industries—in clinical practice for phobias, AR is still limited. Although it is very promising, there is little adoption in practice because the technology is not fully developed yet.

The therapists that were interviewed believe that immersive media's future seems to be positive with growing attention in the area of pain reduction, for example, patients immerse themselves in a peaceful snow world VR context when receiving open wound dressing changes (Hoffman et al., 2008). Immersive media can aid telemedicine where patients (especially patients who have limited mobility or have a social phobia) would be able to communicate with the therapist naturally within the comfort of their own home (Riva & Gamberini, 2000). It could also be beneficial as a curriculum substitution and to enhance education (Mantovani, Castelnuovo, Gaggioli, & Riva, 2003). On the contrary, there are still challenges faced with using VR for therapy. The biggest challenge recognized is the stigma around new technology. Dr. Joel Roos notes that the

patients who have tried this technology for entertainment or gaming purposes could build a placebo effect of VR not working for them. In addition, Dr. Stéphane Bouchard mentions,

> [What] I'm struggling against is that I think people should not call [it] Virtual Reality Exposure Therapy (VRET). I think it's a problem because it's like the therapy is not because you're exposed to VR but because you're exposed to what you're afraid of.

Patients still need motivation and are required to create a relationship with their therapist. The therapist needs to tailor the treatment to the patient's specific needs. Even though the cost of hardware is decreasing, the cost of software can be prohibitive for practitioners. Dr. Stéphane Bouchard suggests that if more software companies work in this area, with increased competition, there will be a reduction in the cost of software, thereby increasing therapist adoption of AR/VR technologies. Another concern is that the majority of therapists still need to get better acquainted with using technology in therapy. Dr. Stéphane Bouchard notes, "Psychologist or psychiatrist, they don't want to be engineers. They want to help people. So they now need to see that if you use VR it's not that complicated." Dr. Crys Brown acknowledges that VR shows large potential with phobias but notes that more research evidence is needed on its effectiveness in other areas.

g. Collaboration with Designers and Developers

From the interviews, there seems to be little collaboration between therapists and designers. Many therapists are individual practitioners and have limited resources, they have budgetary constraints which restrict them from employing larger teams that may not involve designers. Therapists who have larger practices and research labs tend to work with design professionals with expertise in the field of game theory, game design and 3D artists instead of user experience designers. These workplaces come with certain challenges such as

the team members have different backgrounds and different aims.
Dr. Stéphane Bouchard asserts,

> We're facing programmers [who] want to do good code and complicated code. Psychologists can't use computer things because they're not good at tech. Artists want to create because they're artists. They want to create something nice and complicated [...] Psychotherapists don't want something nice, we want something that has the right ingredients to help patients deal with their fears.

There is a large gap between industrial development and research labs for VR therapy. Dr. Stéphane Bouchard expresses frustration regarding startup companies who claim false innovation in this field and recommends that

> [We should] stop reinventing the wheel, look at the science. Because I see so many startup companies saying, oh yes, we could do that, or we've discovered this when actually, there's been decades of research on this topic. People like to say that they're the first doing this and doing that, but it's been done already and we know why and why it doesn't work. So I think developers need to focus on what's known, what's already there.

He believes that the focus should never be the technology but what can be achieved with it.

B. Interview Analysis: User Experience Designers

a. Perspectives on the Future Possibilities of Immersive Media

> I think we would be surprised by how this will be used in the future.
> —Alexia Bucklet, User Experience Designer at Minsar

Augmented Reality and Virtual Reality both have proved stronger use cases in areas of entertainment, construction, retail, training and are now gaining attention within healthcare. Thanks to the decreasing hardware costs, the

adoption of these technologies is expanding. To better understand the future possibilities of AR/VR, user experience designer interviews have been analyzed under two distinct categories—perspectives on AR/VR mobile applications and perspectives on AR/VR head-mounted displays. As smartphone adoption is high, AR for mobile can reach a wider range of the public without additional investment. The barrier for entry is inherently lower compared to Virtual Reality where you need a headset. Tyler Wilson, a San Francisco based user experience designer at Vineti Personalized Therapy Management (PTM) platform—believes that AR has a stronger consumer use than VR as

> Augmented Reality is, by its nature, a more shared theory because you are not taken out of context, you can still see the world around you. So it's easier to collaborate.

Krista Jäntti, a user experience designer in Finland for Varjo—a human-eye resolution immersive technology headset manufacturer— feels that the future of AR belongs to AR-prescribed eyeglass lenses. AR/VR will create new forms of collaboration between people from different countries where they can interact in real-time, save the cost of travel, and improve teamwork efficiency. Interviewed designers said that the use of VR for pain relief and pain management is expanding. Nonetheless, the general public is still slow to adopt new technologies in immersive media, remarks Krista Jäntti. She believes one of the main reasons for this is the lack of inclusion of user experience in these technologies. She notes,

> For example, currently, to set up a VR device, it is especially cumbersome to fit in your room and if you move one sensor, then you have to do it all again. It's really annoying and this is one of the reasons why people don't use it very well right now... Once the devices meet [the entire public's] expectations, and not [just those of] the early adopters, one can understand the possibilities of these technologies beyond just games.

Interviewed designers also believe that there is significant potential for immersive media in healthcare. Applications using VR for psychotherapy, surgical training, physiotherapy, and pain management are being developed more frequently. Hands-on training for performing medical procedures is crucial but relies upon the availability of cadaver samples to practice on. Before assisting in live surgery, medical trainees can practice using immersive media. The technology can also help surgical teams to simulate complex procedures before performing actual surgeries, for example, in cases where several surgeons need to work together to plan the sequence of operative protocols in advance. Designer Tyler Wilson stated that he would also like to see tech pioneers, such as Google and Facebook, invest in immersive technology for healthcare and raise awareness among healthcare professionals of the value that these technologies can offer. He notes,

> There should be dedicated healthcare professionals within these companies and my worry is that if these big companies don't find it useful to funnel money into healthcare, the whole conversation is going to be dominated by these other frivolous or impermanent industries and healthcare is an industry that we all need to focus on.

b. Immersive Media Influences Cognitive Senses and Behaviour

Interviewed designers believe that immersive media can produce changes in one's behaviour, as users tend to forget the real world and act naturally as they would in the real environment. Alexia Bucklet, a French user experience designer at Minsar—a platform that allows creative professionals to build AR/VR experiences—made references to her VR research where they are trying to reduce racism and gender biases. She describes her own research on VR social scenarios, through which it was revealed that female participants showed signs of discomfort (such as recoiling physically) when someone's avatar would come too close to them as if reacting to a real-life invasion of personal space.

This shows that immersive media has the power to probe into people's perceptions, attitudes, reactions, and learnt behaviours—and possibly influence or change them—in many ways. Tyler Wilson presents a different perspective in that immersive media might even help people to appreciate the real world more. He encourages us,

> Not to be afraid to embrace having slightly lower fidelity experiences because ... the real world is still useful. The real world is always going to be there. So we should use immersive reality to let us appreciate the real world and not as a replacement for the real world.

c. Immersive Media Reinvents User Experience design

Immersive media is changing our understanding of—and relationship with—physical surroundings. Until now, designers have designed—and users have interacted—primarily with 2D digital interfaces (mobile phones, films, computers). Immersive media is forcing both designers and users to think in 360 degrees and to better understand the interplay between digital applications and the real world. Tyler Wilson remarks, "Currently, for the 2D application, the real world is more of a hindrance than something that you really have to interact with." For Mobile Augmented Reality (MAR) applications, the user interface (UI) still follows principles and conventions from traditional 2D mobile design communities. Currently, most apps take a 2D experience (ie. flat) and then adds depth and real-world context to that experience. When designing immersive experiences for mobile, interviewees noted that the viewing canvas is the size of the phone screen, and hence, the scope of user interactions and the app's UI is constrained; designers must also consider the user's physical limitations (e.g. holding up a phone for long periods can be tiring).

The immersive experience should provide enough visual cues so that the users can use the app without audio as well. Using established and already familiar interactions such as swipe, pinch etc., can aid the adoption of AR/VR, rather

than introducing new interactions such as Air Tap, a tapping gesture with the handheld upright, similar to a mouse click for the Hololens AR headset. Regardless, AR for mobile is limited due to both current hardware and software capabilities. Interviewees say that headsets can help to realise the potential of AR as they do not have a physical screen to interact with, and therefore, involves learning new ways to interact with the immersive experiences and interfaces. Alexia Bucklet notes,

> It's really different in HMDs [Head Mounted Displays]. You don't have the same integration, you don't have the same way to present information. You are in 360° and so the information can be behind you. It's really different and it's quite hard to think of all possible scenarios that can happen, and some different scenarios like, what to do if they are looking somewhere else during your information showcase? What if someone comes in the room and they start talking to them, what do you do? The rules change because when someone takes the chair and moves, you have a lot of different things to think about!

Virtual reality, on the other hand, is 100% immersive which means the user cannot see or hear others around them. It is the designer's responsibility to make sure that the user feels safe and that there is a way to get out of the experience. "Using binaural sounds as cues and eye tracking can enhance the experience," suggests Alexia Bucklet. She believes that eye tracking will reinvent the way we interact with information. Since our eyes are continually responding to the displayed information, designers need to understand eye tracking to determine when the user pays attention and to what. According to Tyler Wilson, teaching people to do small interactions can be both cumbersome and the stability of the headsets may not be precise. Speaking of complex gestures like the Air Tap in the Hololens AR device, Tyler Wilson asserts,

> We had to spend so much time teaching people how to do that gesture rather than having them [use the actual] application. So whenever you introduce that new type of interaction, there is a huge amount of overhead that goes into teaching people what it is. It's the same thing with the iPhone. Nobody knew how to scroll or use a pinch to zoom. And a lot of those interactions that Don Norman (a UX pioneer) tried to simplify are just kind of taken for granted. So yes, there is a huge kind of learning curve in any type of new interaction that you make, in terms of a head-mounted display.

Alexia Bucklet believes that the adoption of AR is slow because there is a lack of content being developed. Another barrier to solving this problem is that there are not many options to prototype AR environments within a short period of time. For designers to enter this field they encounter a steep learning curve in acquiring new software and coding skills to design AR environments. As a result, the user experience suffers.

d. Designing for Immersive Media

Tyler Wilson propose, "Empathy is the most important skill for anybody but especially for a UX or product designer." The user experience of digital platforms should be so intuitive that even a child is able to use the interface easily. According to Thomas Jeffery, a user experience designer and educational material designer at Academic Technologies at the University of Alberta, designers should continually ask themselves 'why' in order to ensure that their decisions are always guided by a clear rationale. Alexia Bucklet, a designer with a background in cognitive psychology, noted differences in the role of a designer vs. the role of a psychologist, she said,

> Both the roles that I follow are quite the same. The two experiences are mirrored. But there are lots of ways to become a UX designer which does not meet the accreditation standards as compared to becoming a psychologist.

She suggests learning about psychology and understanding human behaviour can help designers in conducting research with less bias. In another comment, Thomas Jeffery noted that good design automatically overlaps with and borrows from other disciplines. For example, he says that when he was designing the Retain game for training healthcare professionals in resuscitation techniques, his design principles overlapped with James Paul Gee's gaming principles.
All interviewed designers agreed that research is the most important step for identifying gaps and exploring new ideas. To begin prototyping for AR environments, the first step is to decide which device they are designing for, as there are different mechanisms through which the user might interact with the AR environment that that particular device might facilitate. After conducting the research, narrative creation involves drawing multi-perspective storyboards. This suggests where the user is going to be positioned in relation to the placement and size of all environmental assets.

Pasting the sketches at eye level on the walls of a room imitates the 360-degree environment and visualizes the field of view of the user. In order to be as accurate as possible, measuring tape and a sliding bevel are used to determine the sizes of the assets and the depth of field. Placing themselves in the shoes of the user, helps the designer to better understand the sequence in which the user might navigate (known as user flow). After that, perspective drawings are made on paper from the user's point of view. Alternatively, Tilt Brush, a VR application for drawing in 3D spaces may be used. Wireframes are created in Unity, a game engine or Google Blocks, a software to create models in VR. Scenes are evaluated and shared with clients and team members using Vizor.io, a free platform to view 360° scenes. Once approved, designers collaborate with developers and 3D artists to code and model the experience. The evaluation of the experiences is done by UX researchers and through A/B testing. User testing is the ideal goal but this depends on the timeframe and budget. Tyler Wilson suggests that UX designers consider some additional questions:

> How long of a journey do I have to take to get through the environment? Is it a quick thing where I can just stand in one place and spin around? Does it require me to actually physically move around? How easy is it for me as a user to navigate the environment without a map? How easily does the augmented environment blend with my actual physical environment? Is it meant to be separate from? How well is that distinction made?

e. Collaboration of Designers with Developers and Healthcare Professionals

> Some of the developers would think they are better designers than you because they know the tool—Alexia Bucklet, User Experience Designer at Minsar

One of the challenges designers face when working with other disciplines is the difference in terminologies used. Krista Jäntti says,

> When working with developers, I don't know the limitations of the game engines, it's hard for me to understand which features take a lot of time and which are easy to make. Sometimes, it's hard to communicate how important the fine-tuning of the visuals is.

Establishing a common language understood by all can help professionals across various disciplines to collaborate. In the ideal world, designers are a part of the process from the very beginning of the project to the end. Thomas Jeffery thinks that designers are trained to break surface relationships and can provide real value in obtaining information from content experts or healthcare professionals. He states,

> Designers seem to act almost as project managers and that they sort of have to coordinate with everyone's thoughts and effort and put it into and translate it into whatever the design will be.

Thomas Jeffery claims that many medical user interfaces—like data input or

patient charts—are "absolutely terrible." Yet, making the necessary changes is difficult because the healthcare industry, whether within a single organization or across the health system, is a very restrictive space. He mentions,

> The medicine system exists in a weird space. There is so much old that hangs around because the decision-making that was [made] long back still continues to exist and [healthcare organizations] are stuck up about it.

He believes that the landscape of medicine is split between people who realize the importance of design and those who haven't discovered design yet. It is really beneficial once healthcare professionals realized that it is more of a collaboration with designers and about them working through a problem together and "less about them telling [designers] what to do". Another major challenge UX designers face is the perception that their job is purely for the purpose of aesthetics. Alexia Bucklet claims that, currently, companies often think, "Oh, now we want some assets, or now we want something pretty, let's find some designers!" Part of this problem may have to do with the ambiguity of—and overlap in—the roles, job duties, and professional titles that designers are identified by. Tyler Wilson feels that the title, UX designer, will eventually become meaningless. He thinks that the title has become a blanket term for many different things. For example, a UX designer could be someone who creates wireframes, prototypes, designs, codes or does project management. He says,

> There is far too much variability in what we have tried to shove under the UX designer umbrella that eventually we might need to go back to more specific terms for what pieces of the process people do and that can help to define clear goals.

Thomas Jeffery expresses his thoughts on design's future,

> I heard a podcast which talked about where design is moving. It talked about the three different generations of design. The first generation is the design

> department. The second generation is where the designer has a seat at the table as part of the larger group which makes decisions. So you're not secondary but you're actually part of the main decision-making process. The third generation, which is coming now, is that design is actually throughout the entire company—throughout the communication, it's throughout the engineering, it's through every single thing—ingrained in all of those different departments. So it's not at all separate. It's actually [embedded] within everything.

3.2. Analysis of Existing Arachnophobia Therapy Applications

The qualitative analysis of current arachnophobia therapy applications seeks to find established design patterns and uncover existing Exposure Therapy models. The analysis helped to identify industry examples and articulate relevantly, required, missing, not-working and nice-to-have content and design patterns. This method helped to determine the user experience flow and to create a visual framework. I evaluated four mental health applications, of these, two- are mobile apps and two of them are Virtual Reality apps (requiring headsets). Augmented Reality headset experiences for arachnophobia seem not to be available for public access and hence only VR experiences are evaluated here. The applications were selected on the basis of their content to treat arachnophobia, three of the apps had a cost and one app was free. Selection criteria for these apps were based on the content and their listing as recommended applications on the App Store, Google Store, Oculus or Steam. I created my own framework—informed by Chapter 2 and analysis of expert interviews—to help me evaluate the apps as there was not any single framework that can be used to evaluate the user experience for AR/VR mental health apps. The initial framework I created is combined with The Questionnaire for User Interaction Satisfaction (QUIS) a tool developed by the Human-Computer Interaction Lab (HCIL) at the University of Maryland (Harper & Norman, 1993). The QUIS is designed to assess users' subjective satisfaction across different human-computer interfaces. The framework can be seen in **Appendix 1**.

The four applications are:

A. Phobia Free by Thrive Therapeutic Software Ltd, 2013

Mobile Augmented Reality

Phobia Free was released in June 2013 and last updated in 2016. It is created by Thrive Therapeutic Software Ltd, a UK-based start-up **(Figure 9)**. The company is owned by Andres Fonseca, who has trained as a psychiatrist and worked for the National Health Service, the national healthcare system for the United Kingdom. The app has been nominated for the TIGA Games Industry Awards nomination in the category of serious games, and uses games and mobile Augmented Reality to help people with a fear of spiders. The app costs 9.99 USD, it can only be accessed on iPhones and iPads and there is no subscription required and can be used offline. The app can be used by anyone above 12 years and is only available in the English language.

Figure 9: Phobia Free Mobile Interface (Thrive Therapeutic Software Ltd, 2014)

B. Spider Phobia Cardboard by Alterego Games, 2019

Mobile Virtual Reality

Developed by Alterego Games, a game studio based out of the Netherlands. The app is available on Google Playstore and App Store for both Android and Apple devices with their last update in 2018 **(Figure 10)**. It requires Google Cardboard to experience mobile VR Exposure Therapy. The user appears to sit in a room behind a desk and

are gradually exposed to spiders. The aim is to create an affordable and low-level entrance for users to start practising while on a waiting list, to shorten therapy or, for those with lower levels of phobia. The app is available in English and Dutch languages and requires no subscriptions or access to the internet.

Figure 10: Spider Phobia Cardboard, Virtual Reality Environment (Alterego Games, 2018)

C. Arachnophobia by IgnisVR 2014

Virtual Reality HMD app

Arachnophobia is a VR health application available on Steam, a video game digital distribution platform. It costs 3.39 CAD and is compatible with HTC Vive or Oculus Rift VR headsets. It is developed by IgnisVR, a start-up based out of the USA. It is accessible to the general public and was last updated in 2016. It is a self-controlled implementation of a Virtual Reality Exposure Therapy session, where one gradually exposes themselves to spiders.

In this VR experience, the user is seated at a table in a small apartment. By looking at specific spots on a piece of paper in front of you, you are able to control the amount of exposure to virtual spiders. You can increase or decrease the number of spiders in the room yourself and you are not able to move your virtual arms in the experience, following the rubber hand illusion. According to Rohde, Di Luca, & Ernst, (2011),

> Rubber Hand Illusion (RHI) is a tantalizing illusion, where the feeling that a rubber hand belongs to one's body (feeling of ownership) is brought about by stroking a visible rubber hand synchronously to the participant's own occluded hand. (p.1)

For this experience, the user is required to sit in front of a table and keep their hands still and flat. Wearing the VR headset, the VR replicates the sitting position giving an illusion that the virtual hands are of the users **(Figure 11)**.

Figure 11: Arachnophobia, Virtual Reality Environment using Rubber Hand Illusion for the therapy (IgnisVR, 2016).

D. ItsyVR by Mimerse 2019

Virtual Reality Head Mount Display Application

Sweden-based company Mimerse developed ItsyVR. Mimerse is developing gamified psychological treatment tools for VR for the mass market in partnership with the Swedish Government, Samsung and Stockholm University. Mimerse is the only app within this selection that has conducted a randomized controlled study (Miloff et al., 2016) which compares traditional Exposure Therapy with therapists and real spiders to the gamified VR Exposure Therapy with virtual therapists and spiders. Mimerse

claims that the results are proven to be just as effective as traditional Exposure Therapy which offers immense value to individuals with phobias globally at a lower cost. ItsyVR is an Exposure Therapy game intended to reduce the fear of spiders **(Figure 12)**. The player interacts with spiders by completing novel tasks, collecting points and completing stages while getting coaching from a virtual therapist. Starting with a cartoon spider, the intensity gradually increases with game progression.
It costs 3.49 CAD and is only available on the Oculus Website. It is compatible with Oculus, Samsung GearVR Headsets and can be accessed in English as well as Swedish.

Figure 12: ItsyVR, virtual reality serious game. (Mimerse, 2016)

3.2.1. Discussion

Table 1 shows the comparisons of user experience for the four applications which is divided into three parts ie. mental health, usability and immersive game principles. The analysis helped to better understand the strengths and weaknesses to approach designing for arachnophobia treatment experiences. The following themes were identified under user experience:

Mental Health Assessment	Phobia Free by Thrive	Arachnophobia by IgnisVR	Spider Phobia Cardboard by Alterego Games	Itsy VR by Mimerse
Therapy Purpose	Mental Health Application	Mental Health Application	Mental Health Application	Mental Health Application
Therapy Model	Exposure Therapy, Serious Games	Exposure Therapy, Rubber Hand Illusion	Exposure Therapy, Rubber Hand Illusion	Exposure Therapy, Serious Games
Symptom Management	Anxiety	Anxiety	Anxiety	Anxiety
Designed with Medical Professionals	Yes	No	No	Yes
Content Verified	Yes	No	No	Yes
Supportive Resources	Yes	No	No	Yes
Safety Measures	Yes	No	No	No
Privacy & Security Measures	No	No	No	No
Advisory	Yes	No	No	Yes
Support Comorbidity	No	No	No	No
Comparison of Behaviour	Anxiety Level Graph Statistics	No	No	Anxiety Level Graph Statistics
Goals and Planning	No	No	No	No
Real-Time Expert Involvement	No	No	No	No
Randomized Controlled Trials	No	No	No	Yes
Knowledge Libraries	Yes	Yes	Yes	Yes
Avoiding Medical Jargons	No	Yes	Yes	No
Consistent Terminology	Yes	Yes	No	Yes
Number of Levels	19 Exposure Levels	5 Exposure Levels	15 Exposure Levels	8 Exposure Levels
Duration of Session	5 Mins	No Timer	No Timer	No Timer
Access to History	Yes	No	No	Yes
Diagnosis Methods	No	No	No	No
Ability to Communicate	No	No	No	No
Monitoring of Actions	No	No	No	No
Relaxation Techniques	Yes	No	No	No

Table 1: Part I, Analysis of Existing Arachnophobia Therapy Applications: Mental Health

Usability Assessment	Phobia Free by Thrive	Arachnophobia by IgnisVR	Spider Phobia Cardboard by Alterego Games	Itsy VR by Mimerse
Able to Use Offline	Yes	Yes	Yes	Yes
Minimum Size	670 Mb	350 Mb	158.5 Mb	1.02 Gb
Ability to Export Report	No	No	No	No
Good App Performance	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Ease of Use and Navigate	No	Yes	Yes	No
System Speed	Fast	Fast	Fast	Fast
Automated Data Entry	Yes	No	No	Yes
Reminders	No	No	No	No
Well Determined User Flow	No	Yes	Yes	Yes
Clear Legibility	No	Yes	No	Yes
Clear Information Hierarchy	No	Yes	Yes	Yes
Clear Prompts for Input	Yes	Yes	No	Yes
Helpful Error Messages	No	No	No	No
Minimum Learning Curve	No	Yes	Yes	No
Performing Task Straightforward	No	Yes	Yes	No
Uniform Colour Palette	No	Yes	Yes	No
High Quality of Graphics	Yes	No	No	Yes
Quick Access to Instructions	No	No	No	Yes
System Feedback	No	No	No	No
Flexible System	No	No	No	No
App Availability	App Store	Steam	App Store, Google Play Store	Oculus, Samsung Gear VR
Device Compatibility	iPhone, iPad	HTC Vive, Oculus Rift	Google Cardboard	Oculus Samsung Gear VR
Language	English	English	English, Dutch	English, Swedish
Disability Accessibility	No	No	No	No
Technical Support	No	No	No	No
Tutorials	Yes	No	No	Yes

Table 1: Part II, Analysis of Existing Arachnophobia Therapy Applications: Usability

Immersive Game	Phobia Free by Thrive	Arachnophobia by IgnisVR	Spider Phobia Cardboard by Alterego Games	Itsy VR by Mimerse
Technology	Mobile Augmented Reality: Marker AR	Virtual Reality	Mobile Virtual Reality	Virtual Reality
Input Interaction	Screen Touch	Eye Tracking	Eye Tracking	Eye Tracking
Narrative Type	Fictional	Non-fictional	Non-fictional	Non-fictional
Narrative Style	Therapist Character Guided	Self Guided	Self Guided	Virtual Therapist Voiceover
The Goal of the Narrative	Individual goals for each level	No goals	No goals	Individual goals for each level
Inclusion of Reward Mechanism	Yes	No	No	Yes
Character Style	Illustrative Towards Realism	Realistic	Realistic	Illustrative Towards Realism
Inclusion of Storyline	No	No	No	No
Visual & Audio Cues	Yes	No	No	Yes
Retention of the Action	Not applicable	No	No	Yes
Spatial Audio	Yes	No	No	Yes
Pleasing Audio	No	No	Yes	No
Players	Single Player	Single Player	Single Player	Single Player
Strong Immersiveness Effect	No	Yes	Partial	Yes
Cybersickness	No	Yes	No	Yes
User's Mobility	Yes	No	No	No
Comfort	Yes	Yes	No	Yes
Inclusion of Breaks	No	No	No	No
Well-paced Speed of the Narratives	Yes	Yes	Yes	No
Render Quality	Satisfactory	Low	Low	Satisfactory
Interaction Lag	No	No	No	Yes
Stimulating Experience	Yes	No	No	Yes
Good Accuracy	No	Yes	Yes	No
Ability to Repeat	Yes	Yes	Yes	Yes
Natural Engagement	No	No	No	No
Haptic Feedback	No	No	No	No
Element of Joy	Yes	No	No	Yes

Table 1: Part III, Analysis of Existing Arachnophobia Therapy Applications: Immersive Game

a. Narratives

All the apps were based on Exposure Therapy for arachnophobia. Serious gaming principles and Rubber Hand Illusions were the most common theories added to Exposure Therapy. The Rubber Hand Illusion experience involved sitting on a table in a room and looking at the spiders. The spiders were rendered realistically and initially placed inside a glass jar next to the virtual hand. As the exposure levels increase, the spiders would start crawling on your virtual hand. Besides looking, there were no other interactions involved. The narratives for serious games involved the rendering of a cartoon spider to realism as the level advances. The game narratives mostly involved stories like saving the spider from rain, dancing with the spider, helping the spider to climb and others. Game points were given as a reward mechanism. The game narratives that were made did not connect with real scenarios which while lessening the anxiety does not train the user when they face spiders in reality. The game narratives for Phobia Free and ItsyVR are guided by a virtual therapist character. The other apps are mostly self-guided with the help of visual cues. Using serious games for therapy enhances the experience and stimulate the senses, for example, graphs representing the comparison of anxiety levels can motivate the user and help them keep a record of their behaviours. All the apps were oriented for single players which can sometimes be lonely and could induce anxiety.

b. User Interface

All four apps had strong ideas implemented although there was a consistent lack of stimulation throughout. Games that involve spiders help in enhancing the experience as they are not monotonous and have a variety of environments. The navigation for all the applications was rigid, the user has to start from the beginning every time, even if their anxiety scale is low. Additionally, the user cannot exit or end the experience until it is complete or they remove the

headsets. Generally, the applications were easy to use and the user flow was linear and simple, except Phobia Free by Thrive which had too many options for a navigation menu and the user could get lost in the app. For most, the instructions were confusing and the learning curve for these apps mostly high. There were clear prompts for input but no helpful error messages to aid the user if stuck or if they made a mistake. ItsyVR used audio cues in which repetitive beeping sounds kept on playing when you looked at the spider which could be annoying. Spatial audio worked really well with immersiveness.

The organization of information was clear for most and was shown at the same consistent place. Legibility was lost when there was too much information being presented to the user at the same time. Medical jargon was kept to a minimum making it user-friendly for the general public. The apps were comfortable to use as either they are a seated experience or on the phone except for ItsyVR which used mobility which can cause cybersickness if used for a long time. The duration for the experiences for the rubber-hand illusion is customizable and for the spider games, it is 2 to 5 mins per game. The graphic quality of all the apps is low and none of the levels have a consistent theme. The rendering of realistic spiders is relatively much better than the cartoon or illustrative ones. The character development of the cartoon spiders is very basic and not appealing. The colour palettes do not follow any theme and also have colour errors such as the pink-coloured lake in a realistic yard scene when playing ItsyVR.

c. System Design

All the application performance levels were satisfactory with no glitches. Applications that involved headsets created an immersive environment which used eye-tracking as input interactions and no controllers thereby, increasing the efficiency of tasks performed. Automated data entry can ease the workload for the user and help them to track their anxiety levels more accurately, but the systems only generated automatic anxiety level graphs. None of the applications

supported the exporting of data making them unable to share with therapists. Real-time expert involvement can help the user gain confidence and build a better patient-therapist relationship, something that was absent from all the applications. The apps (ItsyVR and Phobia Free) which we developed with medical professionals had stronger content, advisory links, and supportive resources. Safety measures were missing from all the applications and the only way to feel safe was to exit the experience completely. Planning of goals, monitoring of their interactions, reminders and getting feedback from the system was all absent from the applications. None of the apps had privacy and security terms and measures inside the applications.

The privacy terms were only mentioned on the website, before downloading the applications. For ItsyVR, when inputting data for anxiety levels there were some interaction lags and this could frustrate the user. ItsyVR added the feature of telling spider oriented facts as a narration, which may or may not distract the user from the exposure. The Phobia Free mobile app used screen touch for performing tasks, and there were exposure levels varying from 5 to 19 different levels. Phobia Free uses meditation, hypnosis, etc. as a measure to reduce anxiety and is only introduced after the level 1 stages are completed.

In this analysis, the data reveals that all the applications were seeking to help people with arachnophobia and achieve success in different ways. This analysis also provides evidence that immersive media for therapy is growing professionally with the importance of employing serious gaming for engagement. There are still a number of limitations with the analysis, most of which reflect the nature of the sample selection being small and evaluation through an individual perspective. On the other hand, this research is being used as a moodboard and direction for developing a visual design and a greater qualitative understanding of Exposure Therapy using immersive media.

3.3. Summary

To improve patient experience and to make healthcare systems more effective, it is important for therapists to collaborate with user experience designers when creating immersive media environments. The qualitative analysis of interviews and existing arachnophobia therapy applications in this chapter provides detailed approaches to incorporate user experience design practices in AR-based platforms for arachnophobia therapy. To create engaging immersive experiences the importance of narratives and visual play an important role. The design opportunities identified from this analysis are discussed and built upon in the next chapter.

4. Design Outcome

This chapter describes the design process for Boo, an Augmented Reality (AR) based platform that can be used by therapists in conjunction with Exposure Therapy to treat arachnophobia. The chapter begins by addressing the design opportunities found from the analysis of the interviews and existing AR/VR applications (see Chapter 3). The focus of the designed outcome is to enhance the user experience for both the patients and therapists following the recommendations from the designing MHapp and serious gaming principles developed from the literature review. The design process is divided into two parts: the therapist experience and the patient experience. The chapter presents my design concept and the design decisions that were made.

4.1. Design Opportunities

The following design opportunities are identified from the analysis of the interviews and existing AR/VR applications from Chapter 3:

a. Limitations of Traditional Exposure Therapy (ET)

In traditional Exposure Therapy, the therapist does not have full control over the fear-inducing stimulus. For instance, the therapist cannot ensure that the spider would not bite the patient. Thus, the therapist cannot always create a safe environment and the patient might feel unsafe. Another challenge is the limitation of resources to recreate the feared situation. For instance, not all therapists have access to spiders or the ability to take the patient to a zoo. Recreating a personalized situation for each patient is limited in ET. Another concern with Exposure Therapy is that it can be challenging to motivate and engage patients.

b. Benefits of AR/VR Exposure Therapy (ARET/VRET)

Immersive media creates a virtual environment that can help the therapist to increase the safety of the patient. A safe environment is important for the

patient to create new associations with the fear-inducing stimulus. ARET and VRET provide the therapist control of the actions of the virtual spider (stay still, move, size, etc.) and environment, thus conducting ET is easier and empowers the therapist. These technologies can help to re-create the fear-inducing situations according to the patient's requirements easily without the need to travel, saving cost and time. AR/VR technologies may attract younger patients and reduce the stigma of seeking therapy. Another benefit of using AR/VR for Exposure Therapy can help the therapist to track where the patient is looking at through the eye-tracking technology present in the headsets. This way, the patient can keep their attention on the stimulus that triggers fear and not distract themselves by adopting safety behaviours (e.g. looking away from the stimulus).

c. Benefits of ARET Over VRET

Currently, most ARET studies are conducted within research lab settings, and hence, the adoption of AR in clinical settings is lesser than that of VR but ARET shows numerous advantages over VR. Prolonged use of VR can induce cybersickness, a type of motion sickness that causes nausea and discomfort. VR environments are also unable to create high fidelity realistic renders, which often makes the patient feel disconnected from their surroundings. AR, on the other hand, lets the patient still see and interact with their real surroundings and provides the patient with an alignment with space, giving them a greater feeling of presence and validity of the experience. The cost and time taken to develop an AR environment are also less compared to VR as you are not required to create the entire 3D environment. In AR, the patients can see their surroundings and the therapist through the headset, unlike VR where it disconnects the user from their surroundings and hence, AR compromises less on the therapist-patient relationship.

d. Limitations of AR/VR Exposure Therapy

The adoption of AR/VR technologies for ET is low. This may be due to the limited options of clinically validated software as well as the price of the software, especially for therapists who are individual practitioners. Dr. Stéphane Bouchard believes that if there are more companies investing in building therapeutic software, then competition will reduce the cost of the software. Another factor is that therapists may find it challenging to use technology in their practice; the applications are not user-friendly, lack visual appeal and are complex. To overcome the limitations of this technology for therapy, further collaboration between therapists, UX designers, game designers, patients and developers is required.

e. Enhancing the Patient Experience

Quin et al. (2010) reported that serious game users indicate that game-based interfaces increased their interest in learning. Games provide engaging environments with motivational features such as entertainment value, outcome measurement objectivity, and personalized treatment. Game engines help to develop rapid, efficient technologies for creating high-fidelity, interactive environments within a healthcare context. Serious games can enhance the experience and improve learning skills, helping both the patient and the therapist to achieve their goals faster. Serious games for arachnophobia should help the patient to learn skills, manage their anxiety and help to create an emotional bond with the spiders. Each and every level should be connected and follow a storyline that should be challenging for the patient. The initial level of the game should be easy and achievable so that the patient can gain confidence and build intrinsic motivation to complete the therapy. Many Exposure Therapy applications that are accessible to the public are self-guided and this can worsen the patient's symptoms; as, in self-guided Exposure Therapy apps, the grading of anxiety levels is not personalised to each user. This creates confusion in understanding when the patient should move to the next level of the game.

f. AR/VR Exposure Therapy Narratives

Narratives help to capture attitudes, change perceptions, build connections and enhance learning. Currently, most ARET or VRET narratives for arachnophobia therapy apps train the patient to kill the spider and do not address the emotions of disgust towards spiders. Applications that address emotions by using fantasy-based narratives (such as dancing with a spider) fail to train the patient on how to manage their anxiety. A balance between fantasy and realism should be maintained so that the patient is able to manage their anxiety as well as eliminate existing associations of fear with the stimuli by forming new emotional associations. Furthermore, the use of serious games for arachnophobia therapy is limited. The game narratives for therapy follow and replicates traditional Exposure Therapy **(Figure 13)**. Each game starts with seeing cartoon spiders on a table and as the level advances, the spider graphic gets more realistic. There is no storyline to the game and the patient's role is to only see the spider and advance to the next levels. The patient cannot interact with the environment elements and this makes it a dull experience.

Figure 13: Fearless VR, application for arachnophobia therapy (Fearlessvr, n.d.)

g. Interaction Recommendations

To enhance the user experience and improve the efficiency of the application, simple interactions and the clear display of information should be used. Interviewees suggest that the best mode of interaction for immersive media is eye-tracking as the learning curve for new users is lower. Animating virtual objects, using sound, and elements of surprise can enhance the overall immersiveness for patients. Visualization of emotions and feelings of the patient can help them to communicate more efficiently with the therapist. Designers must also consider the user's physical limitations and space in which the therapist and the patient would use this technology.

The designed outcome Boo addresses the above design opportunities and helped to create the prototype for an AR-based platform for arachnophobia therapy. To enhance the user experience of the AR platform, the design process follows the recommendations found in the literature review (section 2.3.1) for designing a mental health application. **Table 2** shows the response to the recommendations.

4.2. Design Process

User experience (UX) encompasses all aspects of the end-users, interactions with a company's services and products. User experience design involves the design of the entire process of acquiring information that integrates with the product, including aspects of branding, usability and function. My design process follows *The Elements of User Experience* (2010) framework which was developed by Jesse James Garrett to describe a holistic view of UX. *The Elements of User Experience* studies all the actions users can make when interacting with a product to gain conceptual understanding on the basis of user decisions. Thus, enhancing this experience of interaction, and satisfying user needs motivates people to use and interact with the product. There are five dependent layers, each level builds on the level before it, starting with an abstract level at the bottom moving up to more concrete ones **(Figure 14)**.

Mental Health Application Recommendation	**Design Response**
Selecting a framework	Using *The Elements of User Experience* as the design framework, incorporating serious gaming principles to design the AR-based therapy platform.
Identifying goals	The goal of the project is to enhance the user experience, both therapist and patient, of the AR Exposure Therapy.
Design in collaboration with mental health care professionals	Interviews with psychologists who practice traditional Exposure Therapy and use AR/VR for Exposure Therapy to better understand the process, gaps and opportunities.
The content should match the experiences of the users	The game narratives of the patient experience combine a real-life scenario (such as camping) with a fantasy story.
Adopting non–judgemental, and non-clinical approaches	The game uses fantasy-based narratives which uses a non-clinical language.
Easy to use, install and navigate	The initial levels of the patient experience used to teach interactions and the therapist interface has guided tutorials and walkthrough with easy access to technical support.
Design for a therapist: building on accepted theoretical models	The game is based on exposure to therapeutic intervention and uses serious gaming principles.
Build a positive therapist-patient relationship	AR headsets allow patients to see their surroundings and the therapist can add real-time narration to the game, to promote clear communication and to build a positive relationship between the therapist and the patient.
Adhering to ethical requirements and building a secure system	All the patient data will be encrypted and the access would require passwords. Ethical and security terms is accessible to the therapist at all times.
Evidence-based recommendations for MHapps	The design of the therapy is based on existing credible published research which shows the benefits of AR therapy and serious games.
Automatic tailoring	The therapist has control over all the elements in a narrative that can be adjusted according to the patient's anxiety response.
Self-monitoring techniques: reporting of thoughts, feelings, tracking moods etc.	Pre- and post-therapy session biofeedback sensors track patient's anxiety level, heart rate and body temperature. Patients use visual sheets to mark their physical sensations and their mood.
Use of audio	Spatial audio is used to create the mood and audio cues are used to instruct the patient.
Habit formation	The game narratives train the patient on how to manage their anxiety and what tasks to perform if they face a spider in reality.
Enhancing user experience through real-time engagement and gamification	AR-based therapy is a real-time experience and uses serious gaming principles to design the game narratives for arachnophobia therapy.
Visualize health stories, patient data	Drawing sheets for understanding the patient's perspectives of spiders, anxiety graphs, mood trackers, physical attributes are visual data of the patient.
Encourage non-technology or real-world activities that help to foster the environmentally valid application of skills	Drawing the image of spider on paper and using everyday objects such as a glass and paper to capture the spider to learn skills that can be applied in real scenarios.

Table 2: Inclusion of Mental Health Design Recommendations

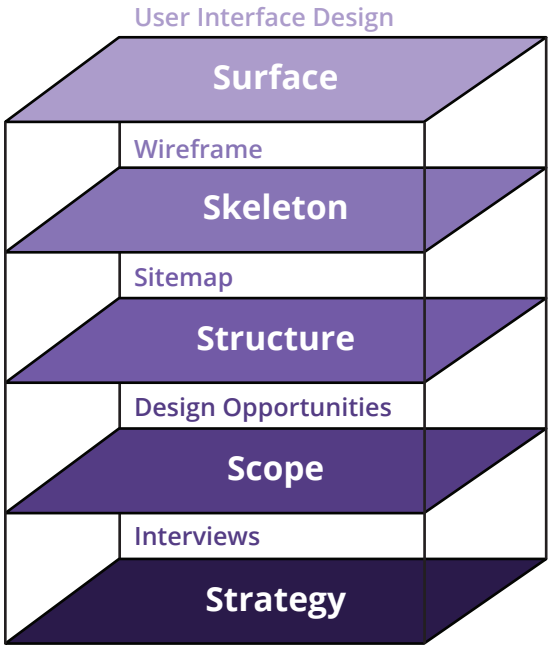


Figure 14: Five Elements of User Experience Design Framework

a. Strategy

The reason for the product or application, why we create it, who are we doing this for, why people are willing to use it, and why they need it. The goal is to define the user needs, identify gaps and define opportunities through divergent and convergent thinking. Interviews with therapists, UX designers and a review of existing literature helped to acquire new knowledge, establish guidelines and adapt conceptual frameworks to approach user-centric design outcomes.

b. Scope

Defines functional and content requirements. What are the features and the content contained in the application or product? The requirements should fulfil and be aligned with strategic goals. The analysis of existing arachnophobic therapy applications shows the functions, how features work with each other, and

how they interrelate with each other. These features are what the user needs to reach the objectives.

c. Structure

Defines how users interact with the product, how systems behave when the user interacts, how it is organized and prioritized. The sitemap (discussed below) is created to organize content and functionality. Structure defines how the user can interact with the product, and how the system behaves in response to the user interactions. It includes the arrangement of content elements (such as text, images, audio, videos,etc.), how they are organized to facilitate human understanding.

d. Skeleton

Skeleton determines the visual form on the screen, the presentation and arrangement of all elements that we interact with. Additionally how the user moves through the information, and how information is presented to make it effective and clear. Wireframes (discussed below) are created to represent a visual format of the product, including content, navigation and ways for interactions.

e. Surface

The sum total of all the work and decisions made. It determines how the product will look including choosing the layout, typography, colours, etc. In Surface, a visual design system is created concerning the appearance of content, controls, which gives a clue of what users can do, and how to interact with them. It makes things easier to understand and increases cognitive ability to absorb what users see on the screens.

4.3. Design Decisions and Prototyping

This section explains the design decisions taken to create the prototype for an AR-based platform for arachnophobic therapy. A prototype is an early sample or representation of a final product that is built to test a concept or evaluate the process. There are two user groups that are identified in my research. The first group is of therapists who practice Exposure Therapy for arachnophobia and the other group is of patients who have been diagnosed with arachnophobia. The prototype shows two interfaces for the platform, the therapist interface and the patient experience.

4.3.1. Logo Design

The logo is the basic mark of brand identity **(Figure 15)** and the foundation of establishing a connection with the target audience. Boo is an AR platform that helps therapists to conduct Exposure Therapy for arachnophobia. The platform uses fantasy-based narratives with serious gaming principles to enhance the user experience of the therapy. Boo is a slang word that has been used since the 19th century to scare or startle someone (Wickman, 2011). The design outcome treats phobias through a playful narrative which makes the name Boo apt for this platform. The logo of the platform uses expressive typography and the design principle of repetition. The logo reads the word Boo as well as shows the medium of the therapy ie. immersive media. The soft corners and circles suggest an empathetic and approachable method for therapy for phobia. The logo communicates the meaning—an AR platform for overcoming fears through playful narratives. According to colour psychology (Artitudes Design, 2018), the colour purple can have calming effects, it can be uplifting, can trigger creativity, and it is often associated with magic and power.

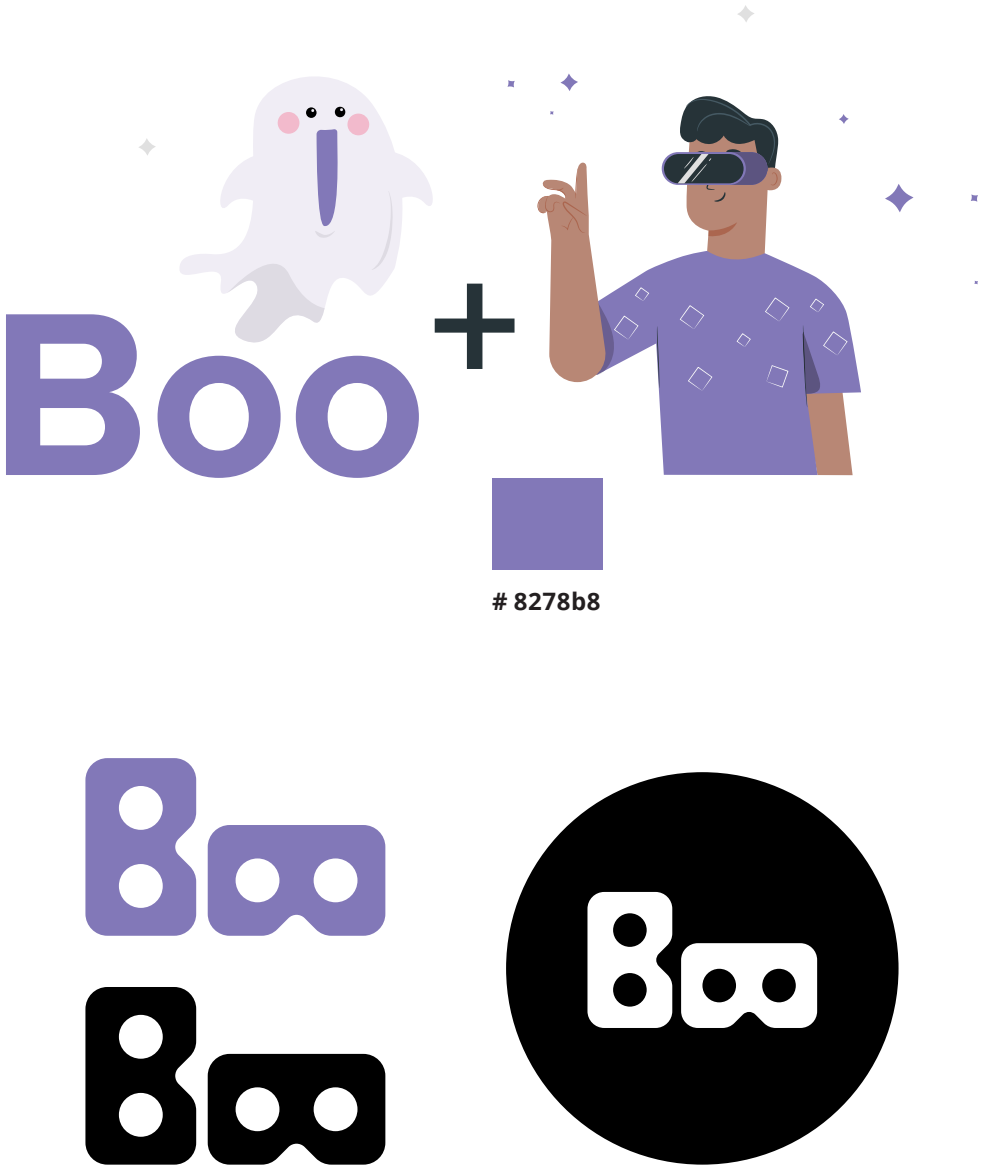


Figure 15: Logo Design for the AR platform, Boo

4.3.2. Therapist Interface

Boo's therapist platform is created to help therapists to conduct immersive Exposure Therapy for arachnophobia in conjunction with traditional Exposure Therapy. This software will only be available to a registered therapist ie. psychiatrists, psychologists and certified psychotherapists or counsellors for Exposure Therapy. This ensures the software will not be held accountable for legal issues and to further ensure the safety of the patient. Another reason is that the platform is a clinical tool and this requires a certified therapist. The access to this platform would be based on a subscription model—which would include an AR headset, biosensors and the software that can be used on any device such as an iPad or desktop. This AR kit can reduce the overall cost of the therapy and would not require the therapist to locate the correct technical hardware. The tool is meant to be used in the therapist's office space during the therapy session. The process of designing this prototype—along with why certain design decisions were taken—are explained in detail below.

A. Sitemap

Sitemaps are created to understand the relationship between all types of data that demonstrate what is being represented on an interface. **Figure 16** shows the sitemaps of the therapist platform that maps out the functionalities required by the therapist and how they can navigate through this platform. After the therapist has calibrated the AR device and biosensors with the Boo software installed on their device (computer/iPad), they log in to the application. If it is the first time the therapist is using the platform, they will be guided through a series of tutorials (which they can also access later if required) and will land on the Homepage.

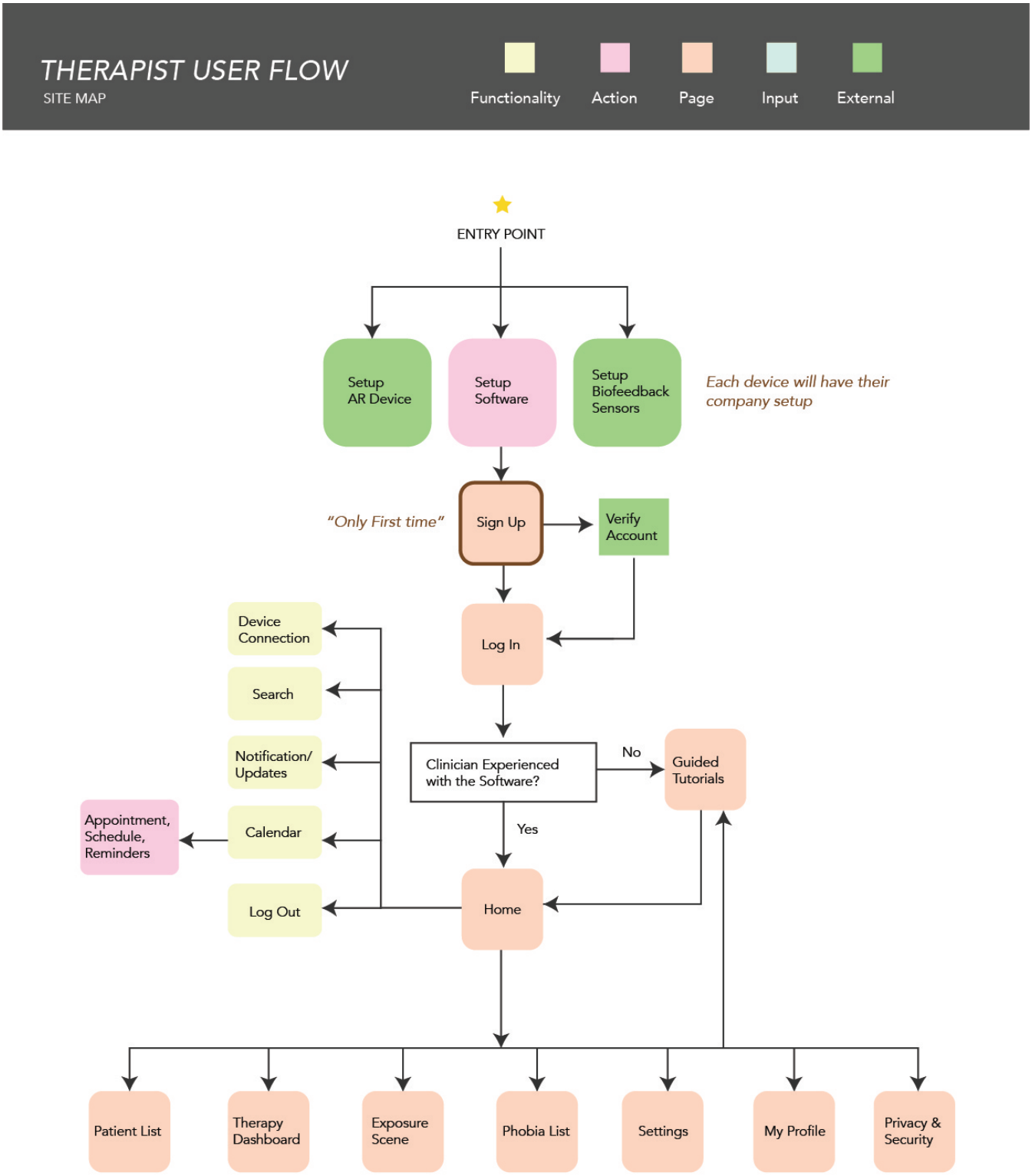


Figure 16: Part I, Sitemap of the Therapist Platform

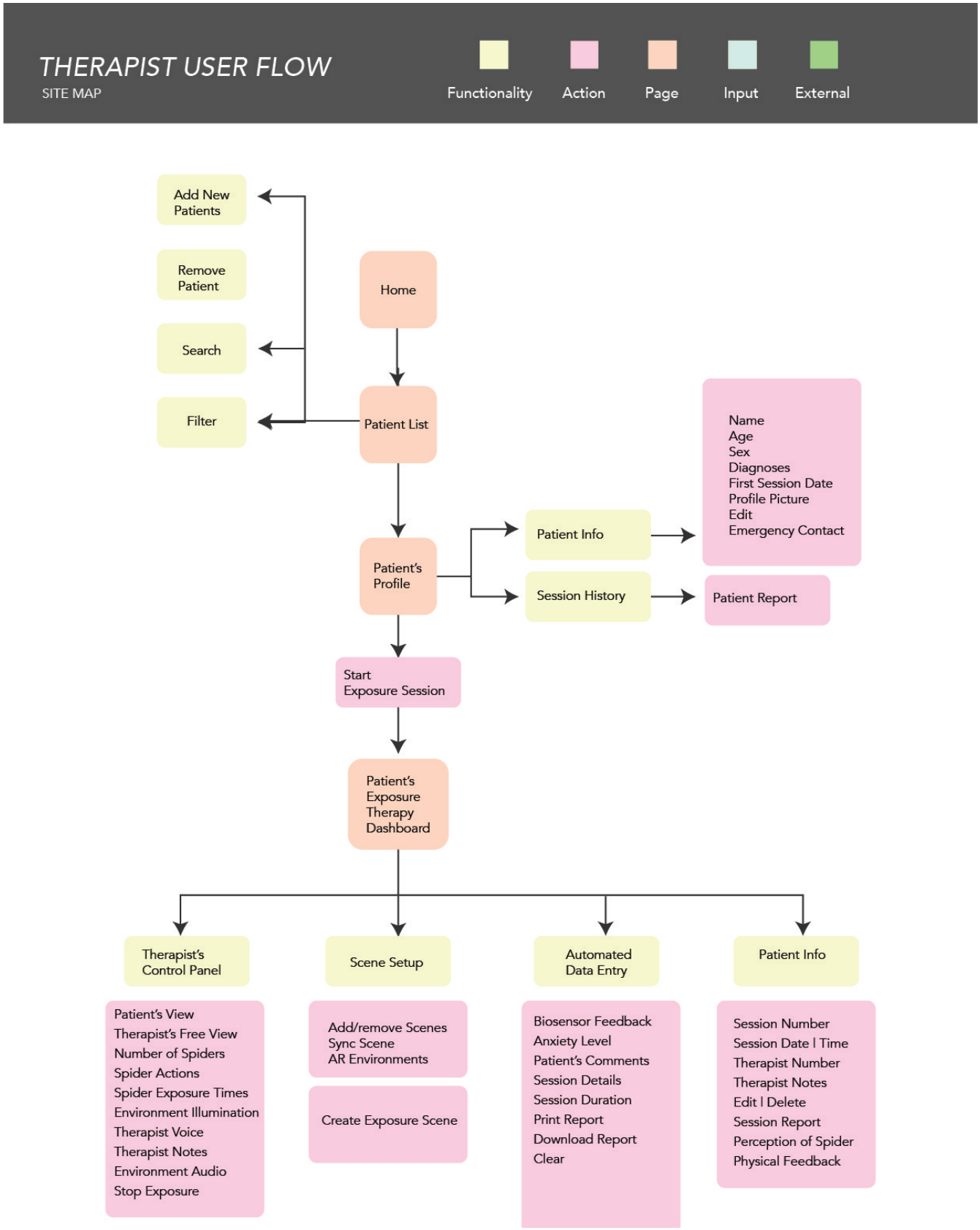


Figure 16: Part II, Sitemap of the Therapist Platform

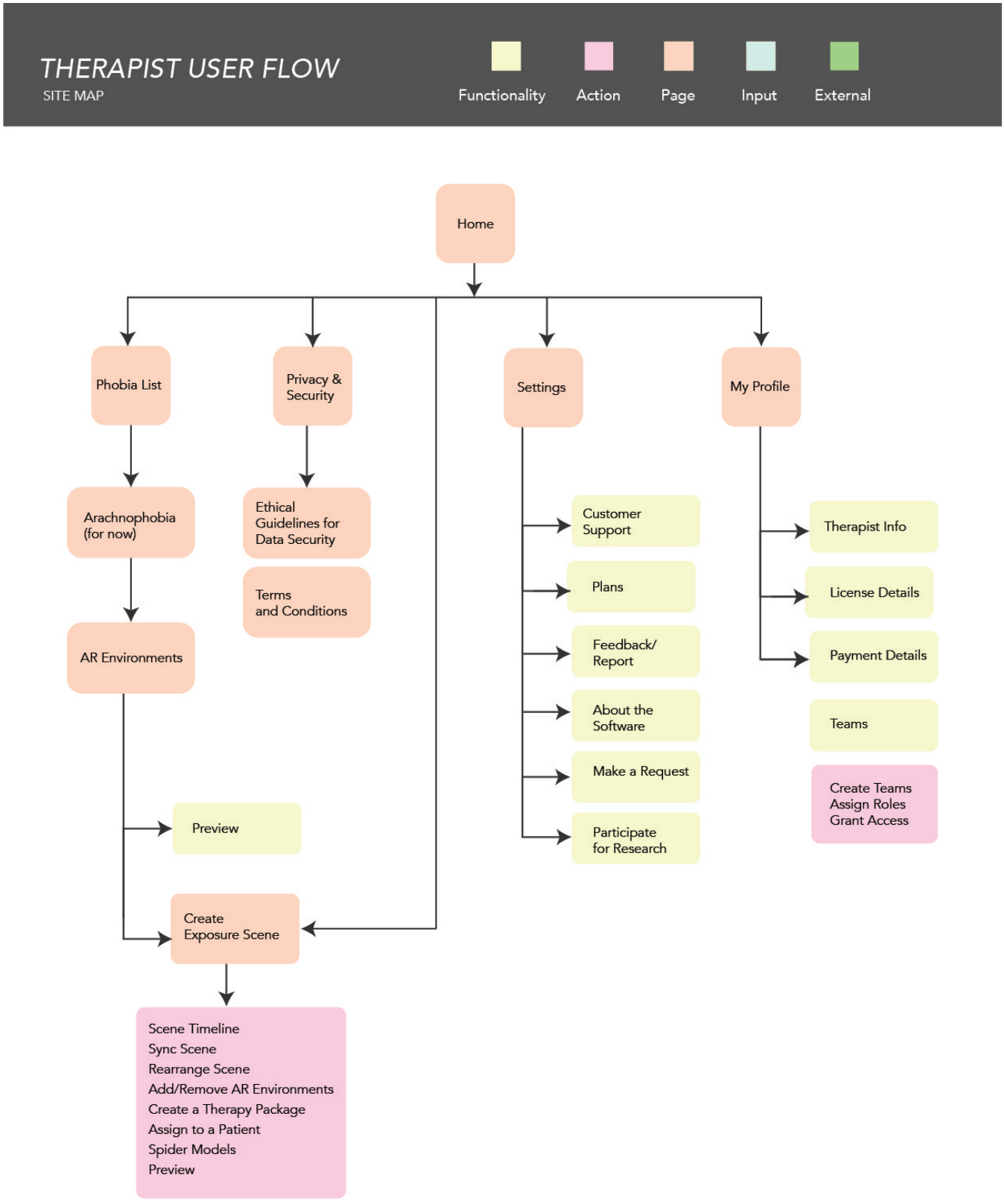


Figure 16: Part III, Sitemap of the Therapist Platform

The Homepage has eight different sections. The sections are:

a. Patient List

The Patient List is an alphabetical list of all the therapist's patients. The therapist can filter this list by phobia type, date, name and add or remove new patients from it. From the patient list, the therapist can access each patient's profile, which will show patient information including session history, reports, etc. If there are any scheduled Exposure Therapy session for the patient, the platform will prompt the therapist to start the exposure session, which will open the Exposure Therapy Dashboard.

b. Therapy Dashboard

The Therapy Dashboard consists of various panels which can be moved around or hidden according to the needs of the therapist. The panels let the therapist control the stimuli (spiders) and the elements of the AR environment and record the session details.

c. Exposure Scene

The Exposure Scene helps the therapist to create gradual exposure levels. The therapist will be provided with multiple narratives of AR environments and they can decide the grading level, rearrange the scenes and assign to specific patients. This functionality is helpful for independent therapists as this gives them the flexibility to create narratives and lessens the dependency on employing a larger team of developers or designers.

d. Phobia List

This page will show the list of all the phobias that can be treated through this platform, such as fear of flying, social anxiety, etc. Currently, due to the scope of the research, this list only has arachnophobia which includes all the AR game narratives available for the therapy. They can preview the narratives, read the description, see the difficulty level, duration and can assign it to their patients.

e. Settings

The settings page will include the therapist's account details, information about the software and subscription plans. The therapist can change their subscription model from here and can contact customer service for technical support. They can also send feedback on the platform, suggest improvements, make a request for a custom narrative, report on scenarios that do not work well or participate in research for the improvement of the overall system—bridging the gap and promoting collaboration between the therapist, developers and designers.

f. Guided Tutorials

This section trains the therapist on how to use the platform and what each feature can help them to achieve. The tutorials will be 2D screen videos or Augmented Reality-based as well as include step by step walkthroughs of the software.

g. My Profile

This is the therapist's profile which will include their bio, license or certification validation, payment details and calendar to schedule appointments with patients. All these details will be encrypted and only the therapist can access them. If the platform is being used by a clinic with numerous therapists, the clinic admin can create teams, assign roles and grant or limit access of features according to the requirements of the organization.

h. Privacy & Security

This section informs the therapist of the terms and conditions, ethical concerns, and measures taken to protect the patient data, where it is being stored, who has access to the data, etc. The aim of this platform is to be transparent and have well-informed users to build trust.

The Sitemap shows the overview of all the features and functionality of the AR-based platform. The next step for the design process is creating Wireframes that define the information and content shown on each page and how each content is placed under a hierarchy of importance. The next section describes the Wireframes.

B. Wireframes

Wireframes are used early in the development process to establish the basic structure of the page before visual design and content are added. A Wireframe is a blueprint of the designed artefact to define the hierarchy of items on a screen and communicate what the items on that page should be based on user needs. I have created the wireframes of the main pages, i.e., homepage, patient list, phobia list, exposure dashboard, to explain the flow and structure of these pages.

Figure 17 shows the wireframe of the Therapy Dashboard. Wireframes of other screens can be seen in **Appendix 3 (7.3.3.)**

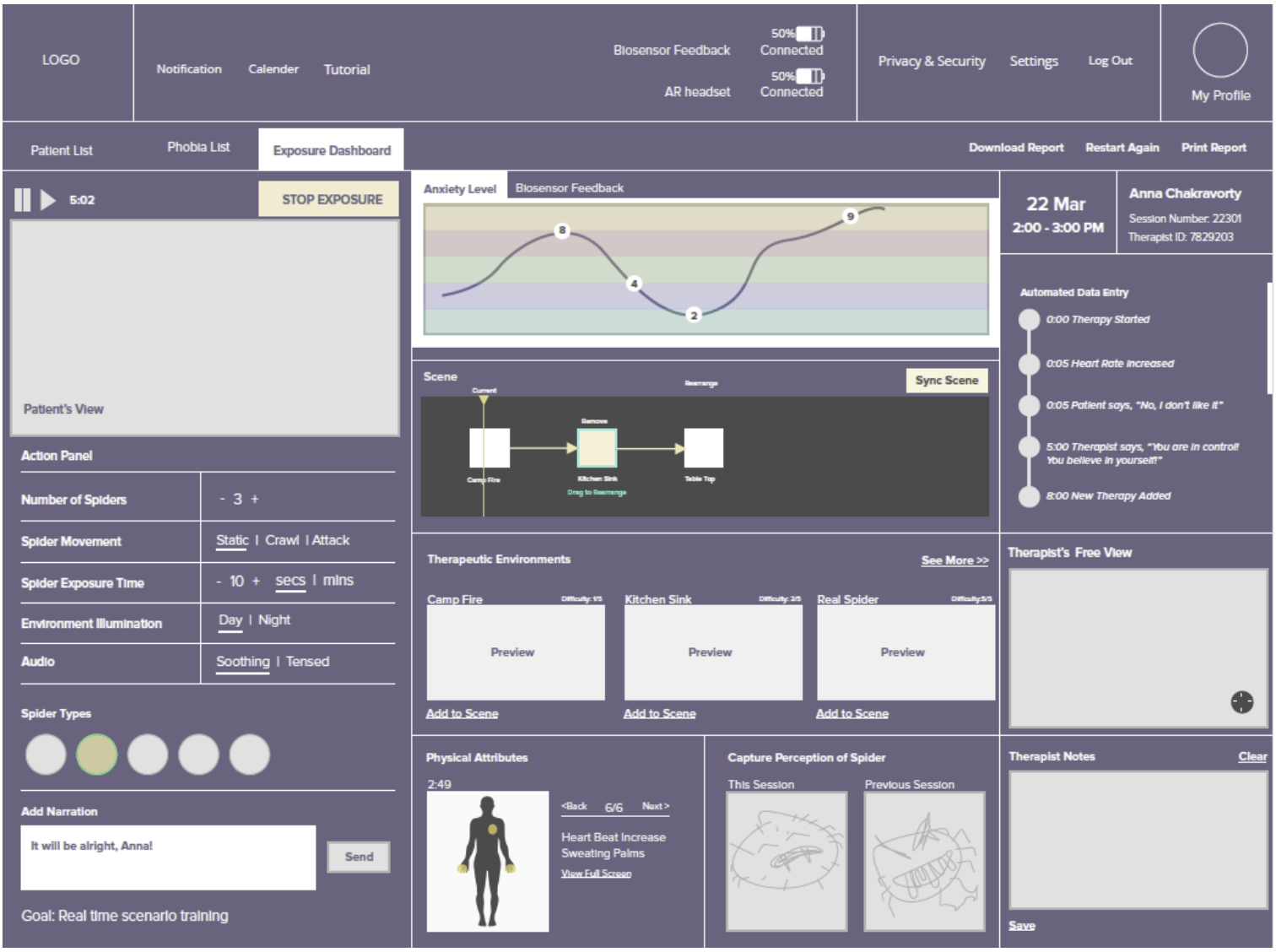


Figure 17: Wireframe of the Therapy Dashboard.

C. User Interface Design (UI) of the Therapy Dashboard

A moodboard was created to influence the art direction and inspiration for designing the user interface. It was difficult to find examples of interface design examples for immersive media Exposure Therapy as most VRET companies do not make accessible to the public the therapist's interface. Hence, the gathered inspirational material for interface design for the therapist interface is limited and only screenshots of the available material are collected.

Two moodboards were made, **Figure 18** shows examples of VRET interface design and **Figure 19** consists of examples of UI dashboard design. After evaluating the moodboards, the UI design of the Therapy dashboard of the Boo platform was created. The UI design decisions are made in response to the needs of the therapist and the hierarchy of content. A light-coloured interface is designed to maximize readability and reduce cognitive load. The icon-based navigation is designed for optimal use of the limited screen space. The therapist can hide/move the blocks in the dashboard according to their personal preference. **Figure 20** shows the UI design for the Therapy Dashboard. The functionality of each section is discussed next.

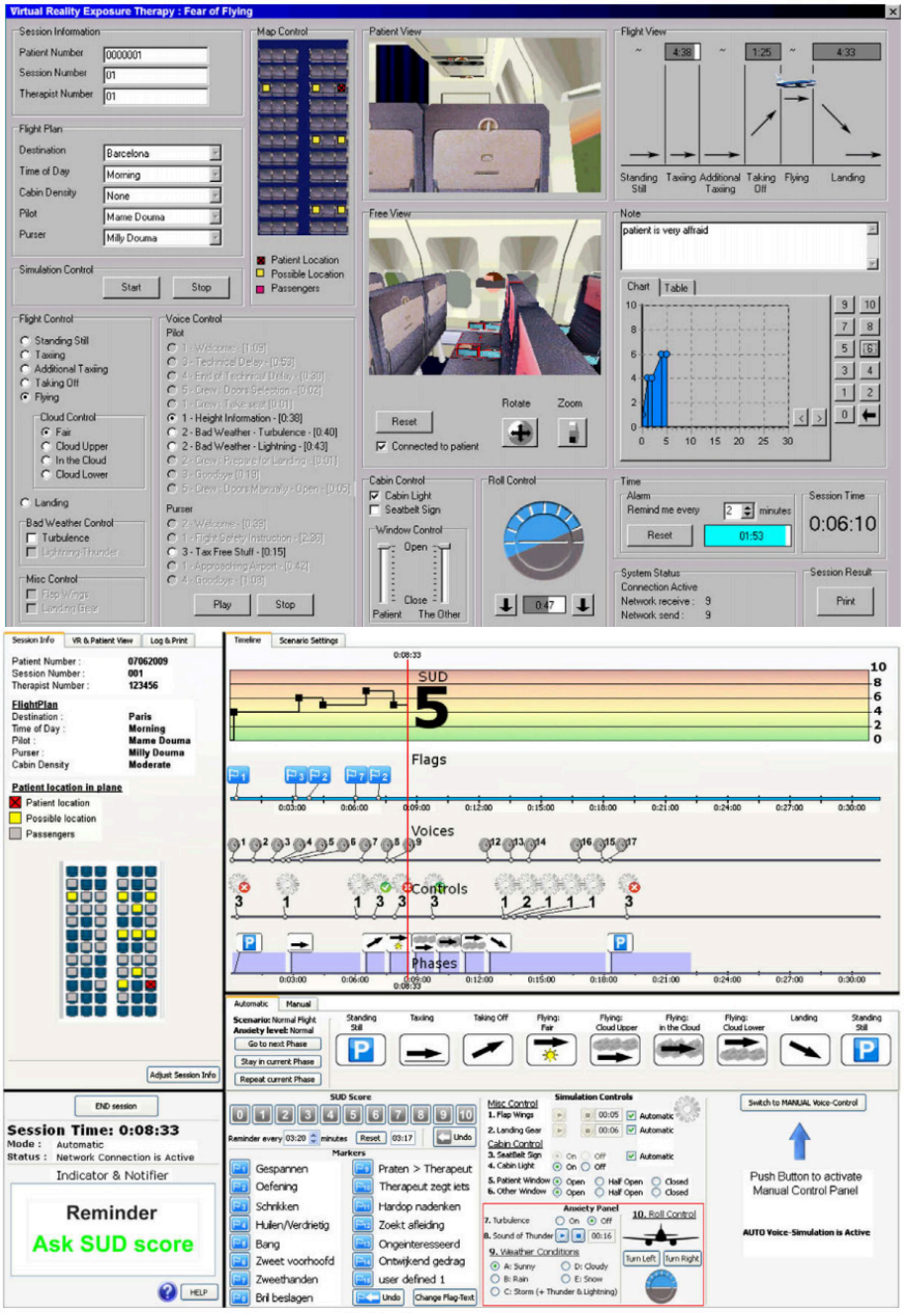


Figure 18: Existing Virtual Reality Exposure Therapy for Flying, Therapist Interface (Brinkman, Mast, Sandino, Gunawan, & Emmelkamp, 2010)

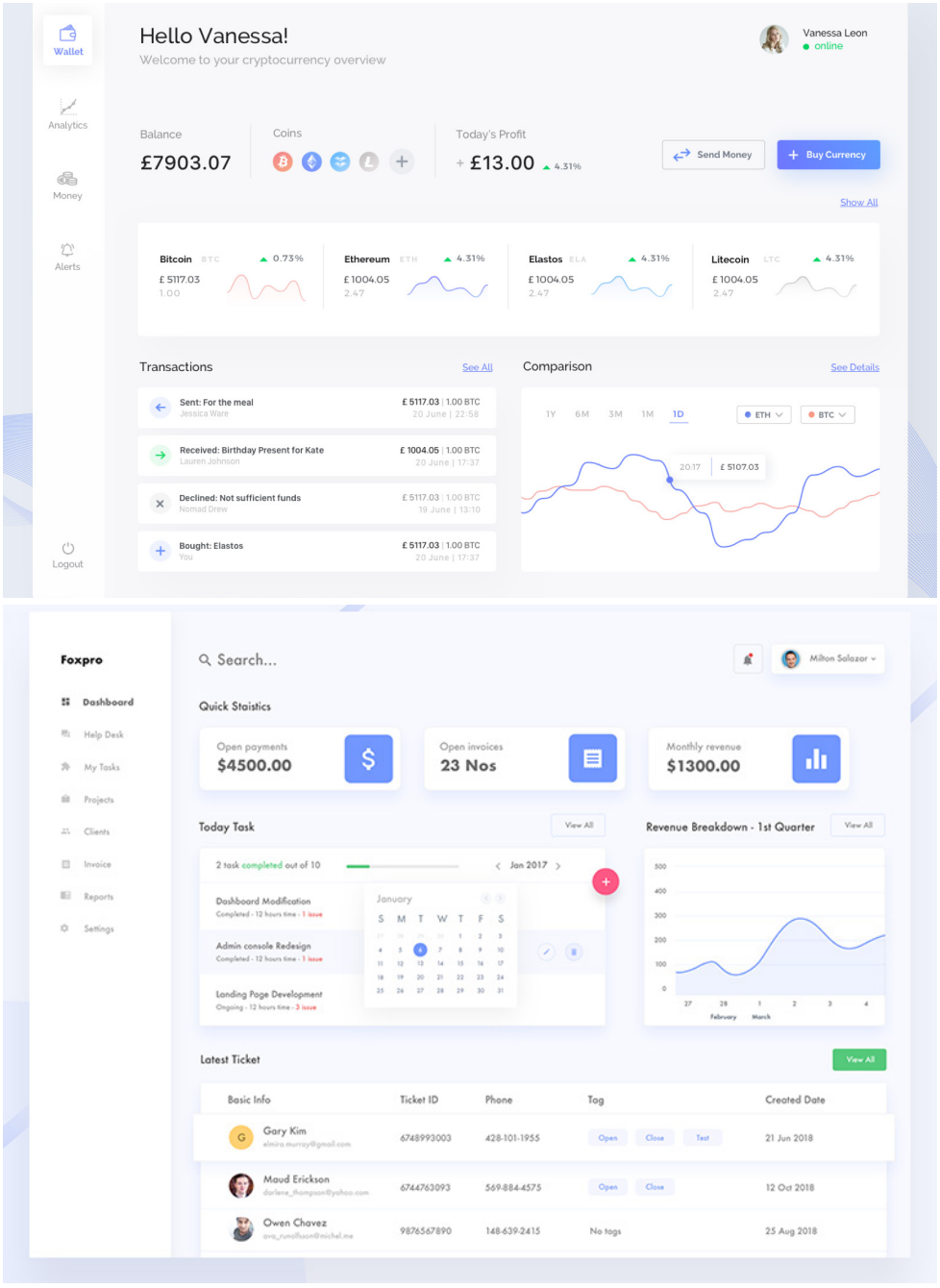


Figure 19: Inspiration for Art Direction of User Interface Design for Therapist Dashboard (Jakubiak, 2018)(top); (Raj, 2018) (bottom)

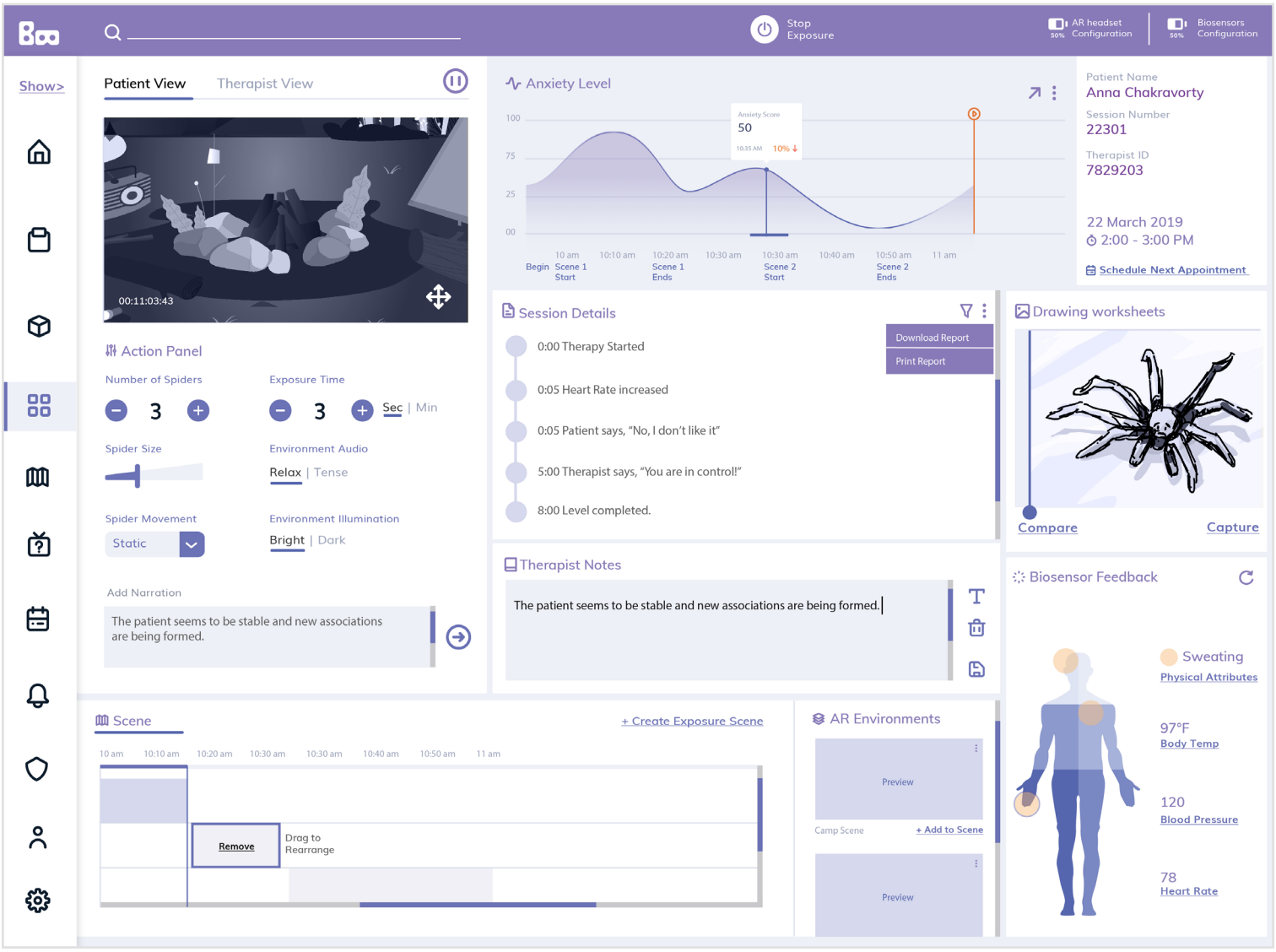


Figure 20: Therapy Dashboard proposed User Interface Design

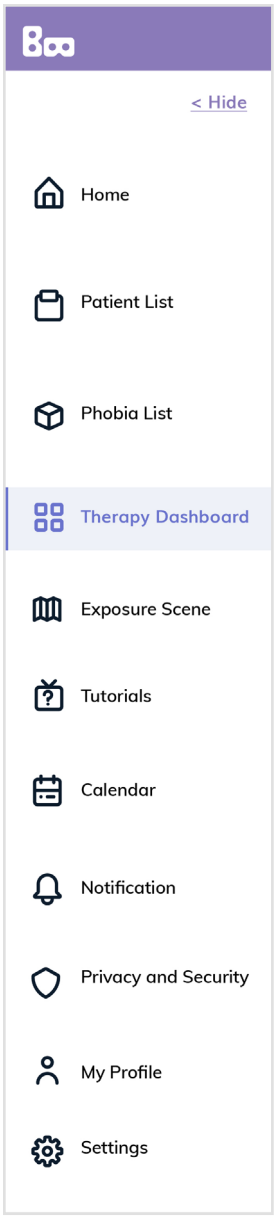


Figure 21: Side Navigation Menu

Figure 22: Part I, Top Navigation Menu, Search Bar

Figure 22: Part II, AR and Biosensor Configuration status

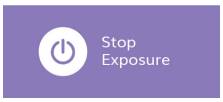


Figure 22: Part III, Emergency Stop Exposure Button

a. Navigation Menu

The side navigation bar **(Figure 21)** provides access to different pages such as the patient list, phobia list, therapy dashboard, exposure scene, tutorials, calendar, notification, privacy and security terms, therapist profile and settings. The side navigation bar uses icons for optimal use of space and can be expanded.

The top navigation bar **(Figure 22)** has a search function and allows access to the calibration settings for the AR headset and biosensors. The main Stop Exposure button is placed on the top navigation bar for quick access in case of an emergency.

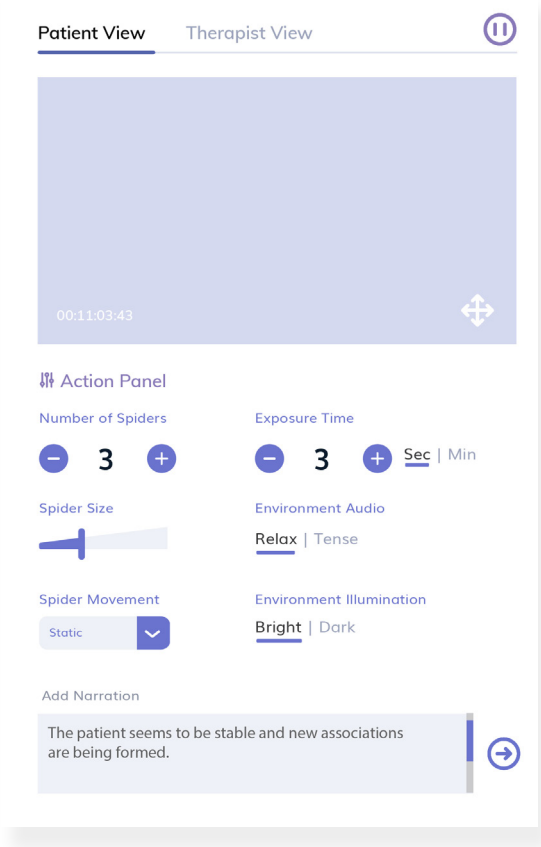


Figure 23: Action Panel

b. Action Panel

Figure 23 is the control panel through which the therapist can view the experience and see what the patient is looking at. Another view, called the Therapist View, helps the therapist to freely move through the AR environment without affecting the patient view. The action panel lets the therapist control the number, size and movement of the spiders and set custom exposure time—the duration for which the patient will see the spider. The therapist can also change the environment settings, such as audio and illumination, and add narration to the experience—helping them to personalize the experience. The therapist can type the narration in the Action Panel and the character Boo would include the text into the narrative. Boo is both the name of the software and the character that the therapist plays in the patient's experience. Boo plays as a support system and acts as a friend to guide the patient through the game.

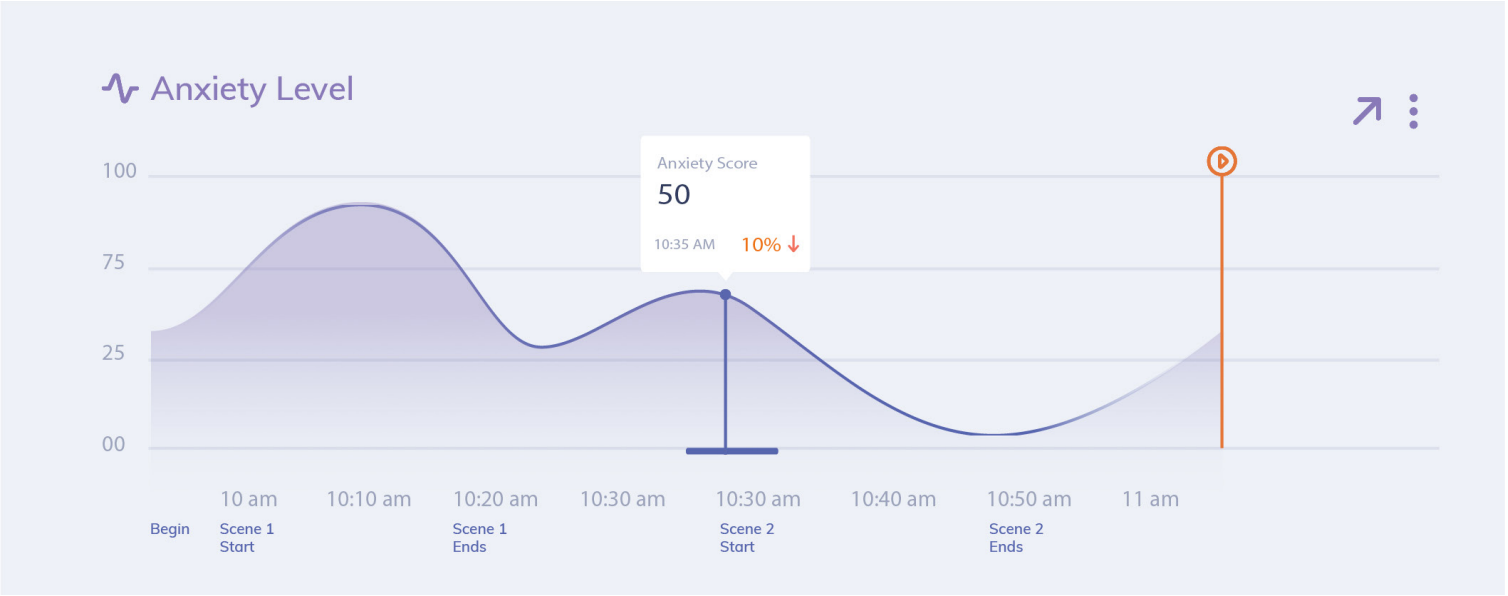


Figure 24: Anxiety Graph

c. Anxiety Graph and Biosensor Feedback

Biosensors are wearable medical devices attached to the human body to detect and monitor changes and capture physiological data. These devices are usually non-invasive devices that function autonomously. Biofeedback gives the opportunity to view one's physiological responses to stress. When a person becomes anxious changes occur including in heart rate, breathing, skin temperature, muscle tension, EEG showing higher activity for hi-beta waves in the brain and loss of metabolic activity in the frontal lobe (Iworx, 2019). The biosensor feedback records these physiological changes and creates a subjective graph that shows the anxiety level of the patient and gives a subjective anxiety score (with 0 as no anxiety and 100 as high anxiety). The graph **(Figure 24)** helps the therapist to track the effect of each exposure by showing an anxiety score related to the session. This graph can be shared or exported into an Excel format with timestamps for later reference if required.

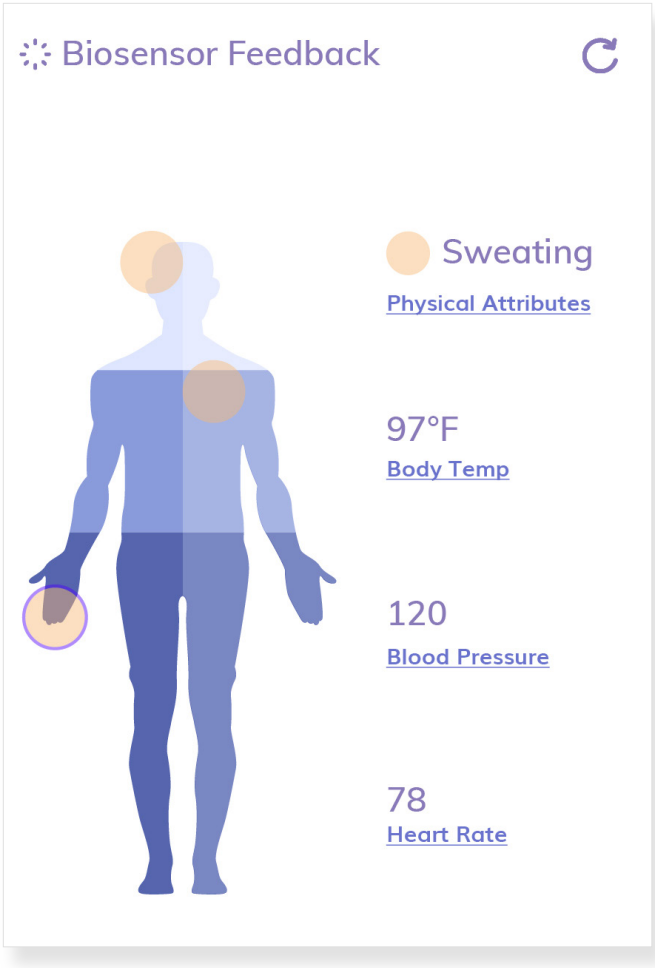


Figure 25: Biosensor Feedback Monitoring

After each exposure level, the patient views an image of the human body, on which they circle the areas and mention how their body is feeling (sweaty palms, cold chills down the spine, etc.), noting additional details that biosensors are unable to track. This activity helps the patient to communicate their physical condition to the therapist by structuring the conversation around this visual artefact **(Figure 25)**. It also helps the therapist to see what is happening with the patient.

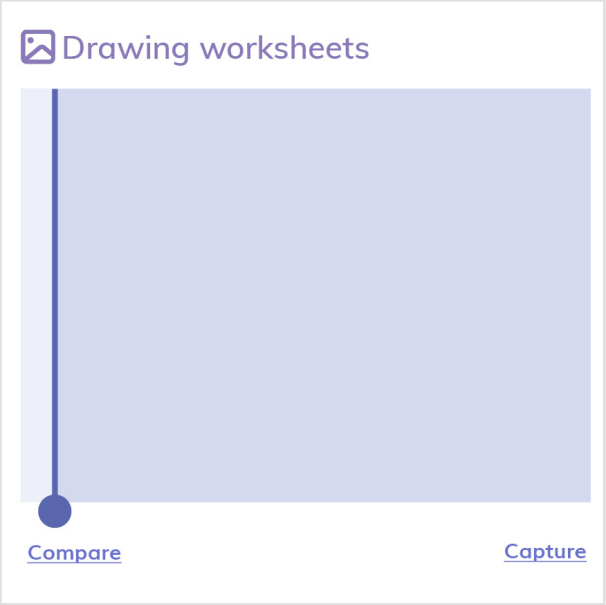


Figure 26: Drawing Worksheets

d. Drawing Worksheets

A research study by Cheung et. al (2016) revealed that patients' drawings of their health condition reveal new knowledge about their perceptions, beliefs and experiences. The drawings are associated with clinical and psychological markers of health. To better understand the emotional perspectives of patients towards spiders, digital drawing sheets are provided to the patient after every session.

The patients are asked to draw how they imagine spiders look, what features of the spider makes them anxious, etc. Once the drawings are finished the patient can share it with the therapist by clicking a picture through the button prompt seen in their headsets. The therapist can monitor the changes in drawings over time and better understand any changing perspective patients have of spiders **(Figure 26)**.

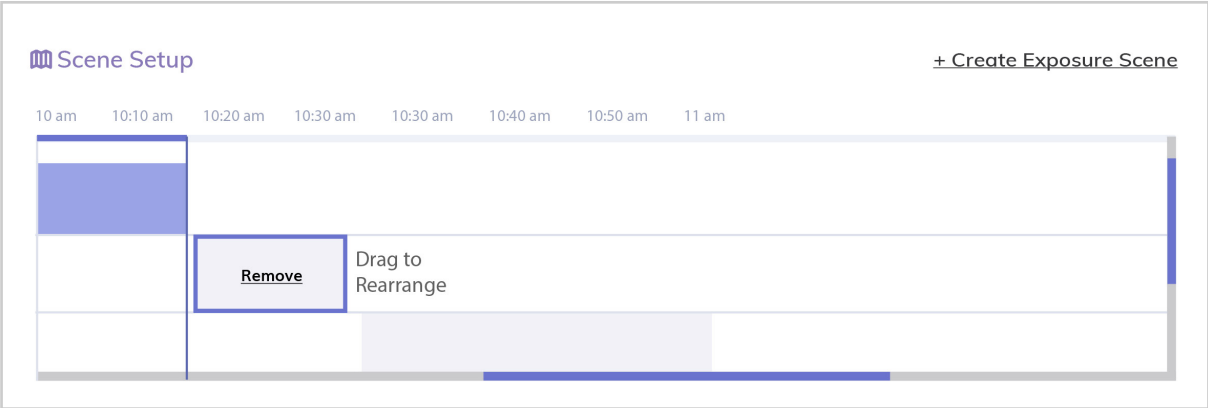


Figure 27: Exposure Scene panel

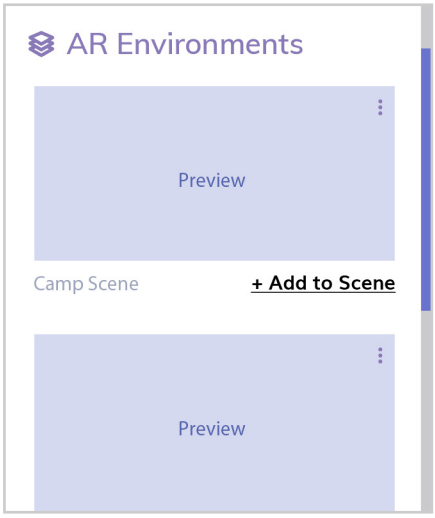


Figure 28: List of Augmented Reality Game Environments

e. Scene Setup and AR Environments

Figure 27 shows a panel in the compact version of what the Exposure Scene from the menu has to offer. The panel shows a timeline to which the therapist can add AR environments and rearrange them.

This helps the therapist to create a graded level of exposure and change according to the patient's response. The AR environments **(Figure 28)** can be previewed and added to the scene's timeline and can be synced in real-time with the patient's experience.

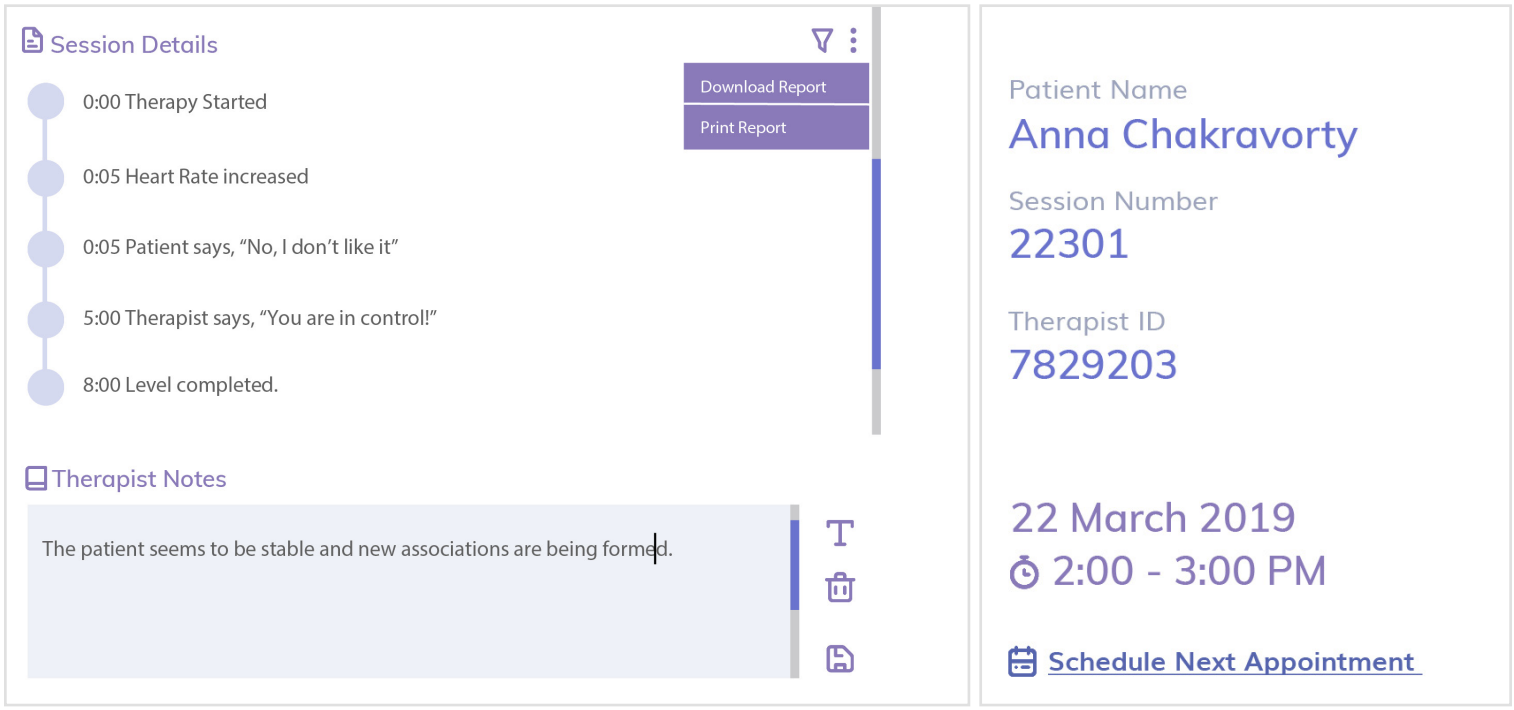


Figure 29: Session Details, Therapist Notes (Left) and Patient Information (Right)

f. Session Details, Therapist Notes and Patient Info

The Session Details panel shown in **Figure 29 (Left)** automatically records and displays all the actions performed in the session along with time stamps. The platform records the anxiety level, biofeedback sensor output, therapist notes, changes made in narratives, the patient's voice and responses as Session Details. These Session Details create a report which can be exported as a PDF or Excel Sheet and printed. Another feature is the Therapist Notes section, where the therapist can write personal notes during/after the therapy session and save them in the report. **Figure 29 (Right)** panel displays the patient's information such as name, session number, therapist ID, date and time of the therapy session.
The therapist can also schedule the next appointment for the patient.

4.3.3. Patient Experience

The goal of the Boo platform is to motivate the patient and increase their engagement with the therapy through user experience design practices. The design recommendation for the patient experience addresses the design opportunities, the user flow of the patient, the game narrative style for the therapy and how these narratives incorporate the serious gaming principles. The main mode of interaction for the patient with the AR experience would be through eye-tracking, voice commands and hand-tracking gestures. To select objects or buttons, the patient looks at the specific object until the loader gets completed. The microphone icon appears when the patient's voice is being recorded. Hand-tracking is used to interact with the spiders such as touching, holding or petting. All the dialogue and questions will use audio along with visual cues to assist the patient. If the patient feels uneasy they can ask the therapist to pause the experience. Finally, an example of the visual style and the interface of the initial level is explained below. The visual style is illustrated on an equirectangular projection **(Figure30)** which is the grid used for 360 experience.

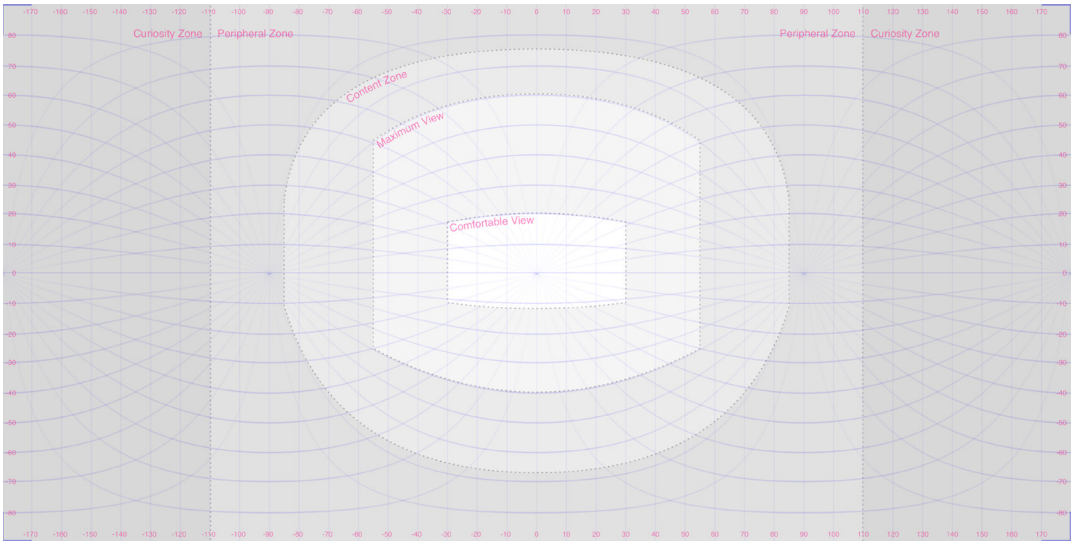


Figure 30: Equirectangular Projection grid (Albers, 2018)

A. User Flow

Figure 31 shows the Patient User Flow chart—the step by step path that the user follows across the product to complete a task—after the therapist has discussed with the patient all the information regarding the therapy. To begin the application, the patient would be seated in a chair wearing the biofeedback sensors and the AR headset such as Hololense or Magic Leap which are connected to the therapist's platform. The patient then calibrates the AR headset according to their own preferences. The exposure session's duration depends on the patient's speed on completing the assigned task by the therapist. The AR experience starts with a welcome screen for the Boo platform. The device makes the patient go through different interactions such as eye-tracking, voice commands and hand-tracking to teach how these interactions work.

Once the patient goes through the instructions, the game begins with an intro animation of the storyline for the therapy and starts with the level that the therapist has assigned. The patient is then required to perform some tasks (e.g., hold the spider for 10 seconds) which are assigned by the therapist. During the gameplay, the patients can ask for instructions or for help from the therapist. If the patient feels uncomfortable the therapist can stop/pause the experience. Once the patient finishes all the assigned tasks successfully, the game would end. After each exposure level, the patient will see an image of the human body, on which they circle the areas and mention how their body is feeling (sweaty palms, cold chills down the spine etc.), record their mood and draw their perspectives on how they visualize spiders on a physical paper. This process will be repeated again to proceed to the next level.

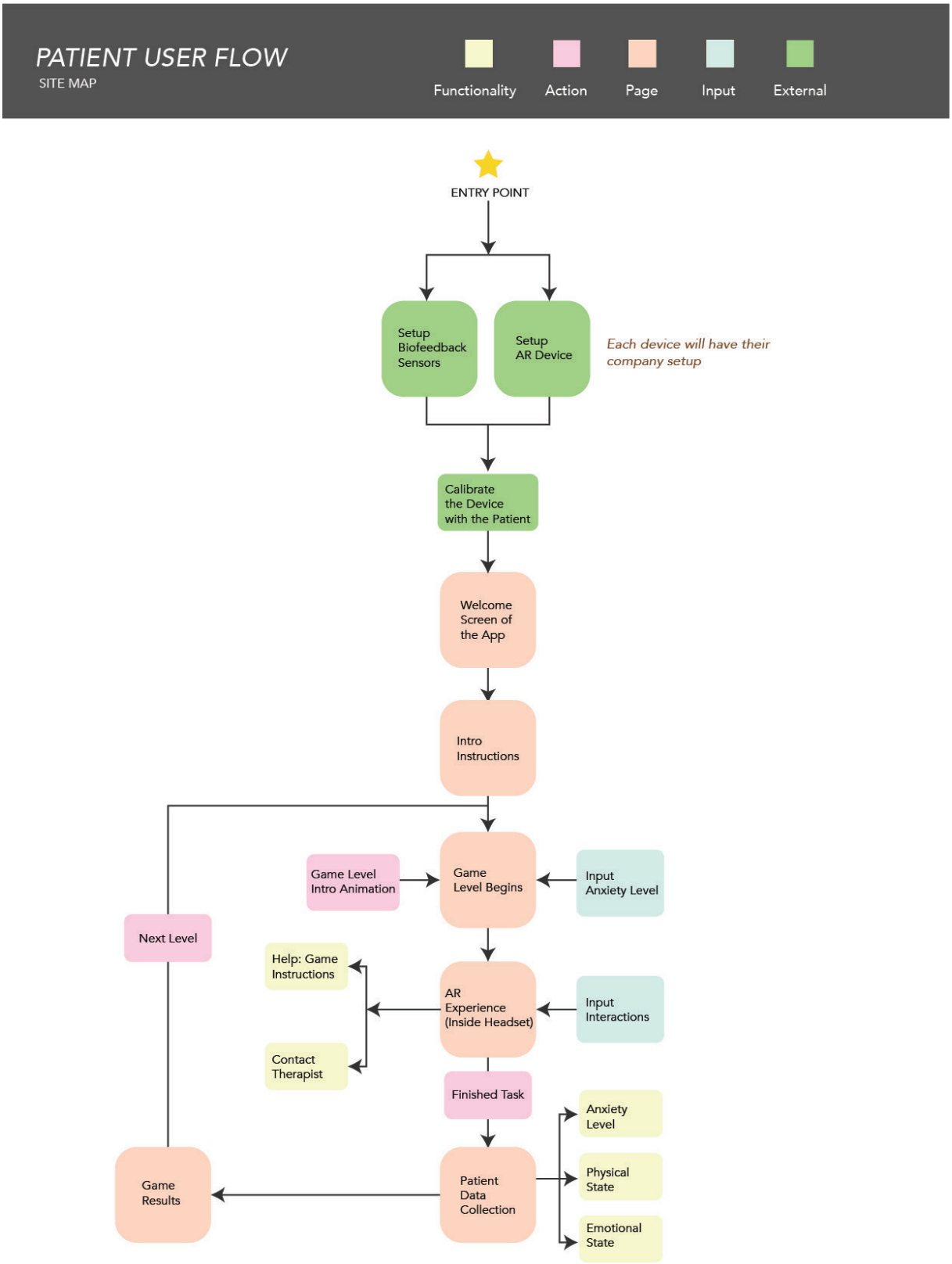


Figure 31: User Flow of the Patient Experience

B. Fantasy Narratives in Serious Games

Stories are told to engage and entertain and help to learn about the world around them, they give meaning to our life and experiences (Corson-Knowles, 2018). “Stories are a powerful and compelling way to transfer knowledge and information in a memorable way” (Storytelling and Leadership: The Importance of Narrative, 2014). The advantage of video games is that, unlike with other types of narratives, the player is part of the story. A video game’s storyline is an important aspect that adds a degree of depth which makes the player feel more involved, shares the successes and setbacks of the characters in the game and in general, is immersed in the experience. Video gaming is no longer a hobby exclusively enjoyed by the young. 40 percent of video game players belong to the 18 to 35 age demographic and 21 percent are 50 years and older (Gough, 2019). The Cambridge Dictionary (2019) defines fantasy as:

> A story or type of literature that describes situations that are very different from real life, usually involving magic.

Fantasy is constructed through imagination. Fantasy stories appear in novels, comics, films, television shows, video games, and other creative works that describe situations that are very different from real life, usually involving mysterious or supernatural forces. Popular fantasy-based games include Final Fantasy, The World of Warcraft series, The Legend of Zelda, and EverQuest. The World of Warcraft series has 9 million active subscribers with the average player’s age to be 28 years old. (Yee, 2009). Kate Forsyth, an Australian author who writes historical fiction notes,

> Fantasy fiction does not deny or diminish the existence of sorrow and pain, as so many people seem to think. The possibility of failure is absolutely necessary for the “piercing sense of joy” one feels when victory is finally and with difficulty won. Like a candle-flame, fantasy casts a shadow at the same time that it illuminates. Yet it is the illumination that is important. Fairy-tales all offer the hope that a happy ending is possible and we need to believe this.

> Fantasy denies ultimate despair. It holds out the hope for a better world and signposts the way. (Fantasy: Why is it so Popular, 2010)

She also notes that fantasy can help in passing on the accumulated wisdom of our ancestors, mapping the boundaries of behaviour, and challenging the preconceptions of what is right and true. It promotes the development of creative problem-solving skills and the formulation of healthy coping skills for intense emotions (Seiter, 2018). Game designers understand that games involving strong and interesting fantasies are more compelling than those with less emotional constructs which is key to the player's immediate decision whether to play or not to play (Granic, Lobel, & Rutger, 2014).

Stories that are fantasy-based may enable individuals to attend to information that otherwise might be too emotionally difficult to process (Tian et al., 2014). Fantasy games also add an element of fun and an aspect of intrinsic motivation, enhancing behaviour change (Baranowski, Buday, Thompson, & Baranowski, 2008). On the subject of why fantasy is relevant in today's world, Kate Forsyth states,

> One of the oldest and most enduring forms of literature in all languages is fantasy. We need metaphors of magic and monsters to understand the human condition. It's only in modern times that we have suddenly decided this narrative language isn't serious, that it's for children; grown-ups don't believe these things. (Fantasy: Why is it so Popular, 2010)

An example of such a story is Squire's Quest! (SQ!), a 10-session video game (Baranowski et al., 2003). The story's idea is that eating more fruits and vegetables gives strength to resist dangerous characters. SQ! used a variation of a common medieval story involving a king, queen, knights, invaders, and a struggle. Invaders were destroying a kingdom and the king didn't have enough knights to fight off the invaders, so each player was asked to become a squire, a person in training to become a knight. As per medieval lore, squires must face and overcome challenges to become knights. The challenges in this game requires that the squires eat more fruits and

vegetables, and this challenge resulted in an increase of 0.9 serving/day in fruit and vegetable intake amongst players. Thus, SQ! used a story to engage players, maintain their interest and model the desired behaviours **(Figure 32)**.

Figure 32: Squire's Quest Fantasy narrative based Serious Game (Baranowski et al., 2003)

Research has long supported the notion that the more intrinsically the learning content is coupled with the fantasy context of the game, the more of the content will actually be remembered (Gillis, 2003). Because the learner-player believes that the content is important to them as it is needed to solve a problem (i.e., move on to another level), hence they are willing to invest in learning that content. Making a serious game requires the proper integration of information that is to be learned in the fantasy construct that is emotionally appealing, can motivate and engage and can lead to greater learning. To create effective fantasy learning games, Asgari & Kaufma (2004) suggest the following guidelines:

- use fantasy to reinforce instructional goals, not compete with them;
- provide appropriate metaphors and analogies for learning;
- provide imaginary characters that are still familiar to the learner;
- accommodate gender differences in fantasies; and
- relate the fantasy to the content to be learned.

Nonetheless, fantasy alone is not powerful enough to keep a player-learner motivated and engaged long enough for learning to take place. When designing serious games, a balance between the fantasy and the learning outcomes should be maintained. Since phobic patients already have a heightened amount of anxiety and have a tendency to avoid getting into fear-inducing situations, a fantasy-based game narrative can help to break this avoidance cycle. Since the Boo narrative progresses from an animated fantasy-based scenario to a more realistic scenario the patient would see realistic renders of the spiders. This way it helps the patient to gradually engage with their fears and trains them along the way on how to manage a difficult situation.

C. Incorporating Serious Gaming principles

The narratives are based on the practice of Exposure Therapy where the patient is initially exposed to an animated scenario and gradually to more realistic scenarios. The game narratives are designed around common scenarios which the phobic patient often avoids in real life such as camping, cleaning the garage or going to the attic. The four main objectives of the game narrative are:

- To train the patient to manage their anxiety through looking, touching, holding or petting the spiders;
- To tackle the emotion of disgust by creating a bond with the spiders;
- To apply the learned skills in a real context; and,
- To enhance the patient experience through interactive storytelling.

To fulfil these objectives serious gaming principles have been used by the recommendation found in the literature review. **Table 3** shows how serious gaming principles have been incorporated into the narrative.

Serious Gaming (SG) Principles	Incorporation in the Design Process
Each action or decision should put the player in a psychological state of flow.	To advance to higher levels, the patient is required to collect and team up with spider through interactions which put the patient in a dilemma and question their perspectives.
Games created for psychology must also be fun for the player and give pleasure. Their educational power is based on learning by experience as well as emotionally engaging.	The game narrative engages the patient in a fantasy-based story which helps the patient to manage their anxiety and creates an emotional bond with the spiders.
Focus on player-centred design-users: The user should feel their actions and decisions create the game experience.	The patient makes decisions on how they can create a bond with the spiders and all the interactions are initiated by the patient itself.
The users should be able to customize the gameplay according to their learning and playing styles.	The playtime for each game narrative depends on the time taken by the patient to complete the assigned task.
Games should include the user's identities so that the user can create deep connections with the character.	The game focuses on the patient and hence each patient uses their own identity to play the game. The side character Boo (therapist) plays as a support system and acts as a friend to guide the patient through the game. The patient is to create a bond with spiders to help them to advance to higher levels.
Games should provide the user with the ability to manipulate the game environment objects that adds to the user's goal.	The patient can interact with the surrounding elements that can help them to relax and helps the therapist to track if the patient is practising any avoidance behaviour.
Well-ordered problems should be designed for early stages so that the user is able to understand how to proceed to harder problems.	The therapist creates the level of the game narrative depending on the patient's anxiety level and as the patient proceeds the skills learnt in initial levels are used again at a higher level. Eg: looking at spiders for 5 secs (initial level) and 15 secs (higher levels).
Feedback should be given to guide the user in the right direction towards success.	Visual and audio cues are given as feedback to the patient to guide them through the game along with the voiceover of the therapist.
Games should support repeated cycles of learning to master that practice and new challenges should be created to extend those practices.	Depending on the performance of the patient for each level, the therapist can create and rearrange the game levels.

Table 3: Part I, Incorporating Serious Gaming Principles into the Patient Experience

Serious Gaming (SG) Principles	Incorporation in the Design Process
Giving play Information is best when the user can put the information to some use or when they feel they need the information.	The patient can seek help or guidance whenever they require by looking or asking the Boo character.
Initial stages of the game should act like tutorials, stressing on a few key variables such as interactions or building relationship with the system.	The initial levels help the patient to get comfortable with the AR environment and gain confidence for the therapy.
Skills built during each session can be used as a strategy to accomplish goals.	The skills learnt in each level can be used once the levels get difficult. (Eg: touching the back of the spider helps to create trust with the spider).
Philosophical points or meanings that need to be conveyed can be done through game narratives which the player realizes through these experiences.	The use of a fantasy-based narrative encourages the patient to create bonds rather than killing spiders. The narratives also try to tackle the emotion of disgust through cute cartoon renders of spiders.
Playing of the serious game should be fun and if it is not fun, maybe the so-called game is not a game.	Fantasy-based narratives create an environment of imagination which helps the patient to learn in a more fun and engaging way compared to traditional clinical therapy.
Enhance the patient's perception of self-efficacy and motivation when confronting the feared situation, context or object.	The game rewards the patient with points when they complete a task successfully which helps create an intrinsic motivation to complete and win the game.
Designers need to think about the situation where the game will be played.	The game is played in a room and is a seated experience.
SGs must provoke interest and stimulate the imagination in the process of inventing tasks that are therapeutic programs, techniques and methods.	Most SGs for arachnophobia are based on realistic situations and miss the fun component. Fantasy-based narratives induce imagination and creativity which helps patients to engage willingly in an exposure therapy which requires a high amount of motivation.
Designers also need to think about the game, such that it can be played many times.	Since the SG is going to be played repeatedly, a fantasy-based narrative keeps it engaging compared to realistic scenarios but also the therapist can change the order of the levels or manipulate the environment settings which provides a flexible system.
Skills learnt should be able to apply to real contexts or world	The actions and behaviour learnt through the game can be applied to the real world. The game trains the patient on how to capture the spiders and release them without killing.

Table 3: Part II, Incorporating Serious Gaming Principles into the Patient Experience

D. Game Narrative, Inspiration and Storyboarding

The word arachnophobia comes from two roots, arachnid, “spider,” from the Greek Arachne, and phobia, “fear,” from the Greek Phobos. In Greek mythology, Arachne was a talented mortal weaver who challenged Athena, the Goddess of Wisdom and Crafts, to a weaving contest, where Arachne chose to weave the scenes that depicted the infidelities and misdemeanours of the mighty Gods. This hubris and mockery of the Gods enraged Athena, who cursed Arachne and her offspring, transforming them to spiders. On the other hand, Phobos, in Greek mythology, is the God of Fear whose powers are used in wars by Gods to create fear among the opposing party thus, weakening their will to fight. The game narrative is written using these Greek stories as inspiration. The story unfolds as,

> Phobos, the God of Fear has captured the player (the patient) in an unnatural realm where they are faced with the challenge of surviving on a mystical land with Boo, their sidekick (therapist and narrator) who knows the secrets of this land. The goal of the game is to escape this realm, defeat Phobos and get back home (Earth). To go back home, there are different levels of barriers created by Phobos. To advance through these levels, the player is required to collect spiders. Arachne, who is also cursed and trapped in this realm by Athena, agrees to help the patient to defeat the Gods. She tells the player about the power that spiders pose (spider facts) such as that they can weave powerful web networks that create portals to different dimensions. The player can use these portals to escape and go back home. The player encounters different types of spiders which changes from cute cartoon-like graphics to realistic models of spiders. They are required to collect the spiders in order to advance to the next level, but merely collecting spiders will not open the portal to the next level. In order to advance, the player needs to create a bond with the spiders which depends on how the player interacts with them.
>
> Once the player is able to create the bond, the spiders agree to help the player. As the player moves through richly illustrated scenes of these mystical lands,

completing the assigned tasks, the power of Phobos also decreases (which is related to the decrease in the anxiety level of the patient), ultimately defeating Phobos. Once Phobos is defeated, the player is asked to decide whether to reverse the curse Arachne poses and live on earth or take her back to the unnatural realm! (This is to see if the bond still exists).

A storyboard for the initial introduction to the serious game is created to give the patient a context of the experience **(Figure 33).**The storyline of the game is narrated to the patient before starting the therapy. The patient can choose to skip or watch later. The full storyboard can be seen in **Appendix 2 (7.3.2)**.

Figure 33: Storyboarding of the Intro animation for the serious game.

E. Visual Design: Moodboard

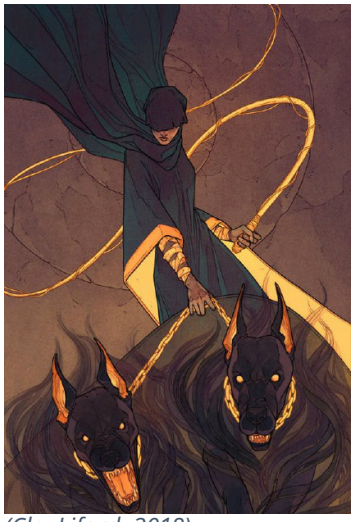
Moodboards are created to understand and visualise the style for the game narratives. The visual style of the story follows a fantasy theme which progresses to realism as the level advances. The fantasy storyline adopts a stylized character drawing style which exaggerates features. Since the storyline moves from fantasy to realistic scenarios, multiple illustration styles can be used, making the system flexible and allowing for different illustrators to contribute.

Figure 34 shows the moodboard for the visual style. The images for the moodboard are taken from animated fantasy movies with fictional themes such as Kubo, Wall-E, Mune, Story of the Sea. The design elements should relate to the experience along with the theoretical model of Exposure Therapy (gradual desensitization).

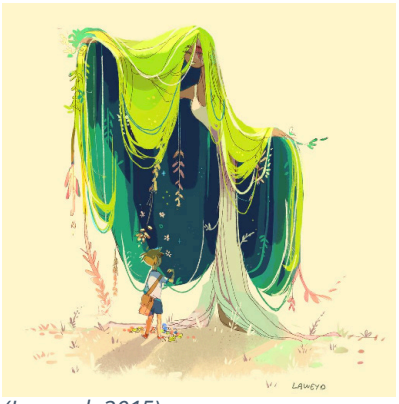
Figure 35 shows the character style of the spiders and how its form and shape would change from cartoon spider to realistic spider.

(Chou, 2016)

(Song of the Sea, 2014)



(ClayLiford, 2018)

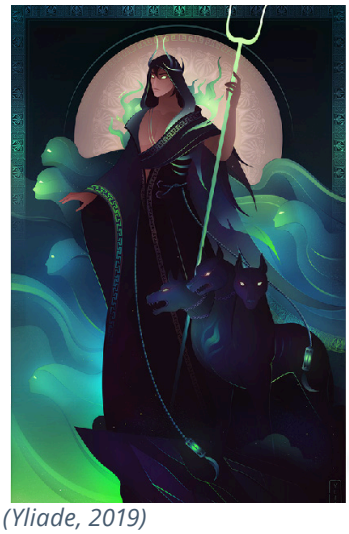


(Laweyd, 2015)

(Lowenthal, 2018)

(Yuliandress, 2014)

(Stinchcombe, 2016)



(Yliade, 2019)

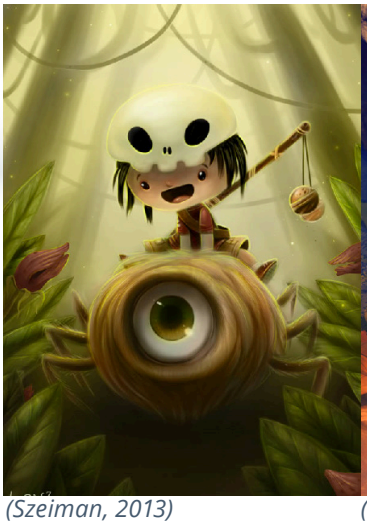
(Pascal, 2015)

(Philippon, 2015)

Figure 34: Moodboard of the visual design for the Augmented Reality Game Experience

(Slice, 2017)

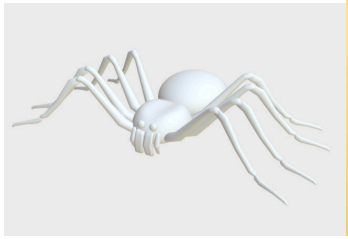
(Ryniak, 2018)



(Szeiman, 2013)

(Cyr, 2011)

(Frogbillgo, 2016)



(Milanese, 2016)

(Brant, 2018)

(Lochmann, 2015)

(Casamasso, 2018)

Figure 35: Moodboard of Character style of the spiders

F. Prototype

This section documents how the design opportunities, serious gaming principles (discussed earlier) can be incorporated with the game narrative through a specific example. Each level will start with an animation which connects to the main narrative. The prototype shows an example of the first level and final level for AR arachnophobia therapy.

The initial level of the game starts with a camping scene **(Figure 36, Part I)** in a whimsical forest which is inhabited by forest nymphs and magical creatures. The motive of the initial level of the game is for the patient to understand the story, learn the modes of interaction and familiarize themselves with the technology. The patient is required to build a campfire by collecting woods, stones etc., **(Figure 36, Part III)** which is guided by the Boo character (therapist) **(Figure 36, Part II)**. While completing these actions, cartoon-styled spiders appear and the patient is required to capture it by looking at the spider (eye-tracking) until the timer finishes which is the exposure time **(Figure 36, Part IV)**. The patient can interact with the surroundings through eye-tracking, gestures or voice. For instance, if the patient looks at the radio, music will start playing and if they want to change the music, they can give a voice command and say change song. Each and every element in the surrounding animates when looked at, this is because if the patient tries to avoid looking at the spider, the system can track exactly where they are looking which helps the therapist to ensure the patient does not practice safety behaviours. Once the level's tasks are completed **(Figure 36, Part V)**, the patient is required to answer questions regarding their mood which is voice recorded **(Figure Part VI)**. The patient also sees an image of the human body, on which they circle the areas and mention how their body is feeling (sweaty palms, cold chills down the spine, etc.) **(Figure 36, Part VII)**. In the end the patient is provided with a notepad to draw their perception of spiders. When completed, the patient can capture a picture of their drawings through the headset **(Figure 36, Part VIII)**.

For the final level, the patient is exposed to a the most realistic render of the spider **(Figure 36, Part IX)**. The headset tracks the position of hands and accordingly places virtual spiders in the view. The patient is required to interact with the spider as they would naturally in the real world. The tasks are assigned through voice narration with visual cues. Everyday objects are added to the therapy to build tactile memory for the patient. For instance, a transparent glass jar and a paper sheet are used to train the patient how to capture the virtual spider **(Figure 36, Part X)**. The glass jar and the sheet of paper also connect to the narrative by acting as "dimensional key" which glows when the patient is able to capture the spider using the glass jar and paper. This way, the patient is connected to the narrative of the therapy and can also use these learned skills in real life. The game ends when the patient is able to capture and release the spider without feeling anxious. **Figure 36 (Parts I-X)** shows the prototype of the game below:

Figure 36: Part I, Prototype of the first level of patient experience. The level trains the patient for the camping scenario.

Figure 36: Part II, The Boo character that guides the patient through the game narrative. The character adds the narration from the therapist.

Figure 36: Part III, Boo guides the patient to build a campfire by collecting materials. The materials are selected through eye tracking. Highlights and visual cues prompts the patient to follow the step by step procedure.

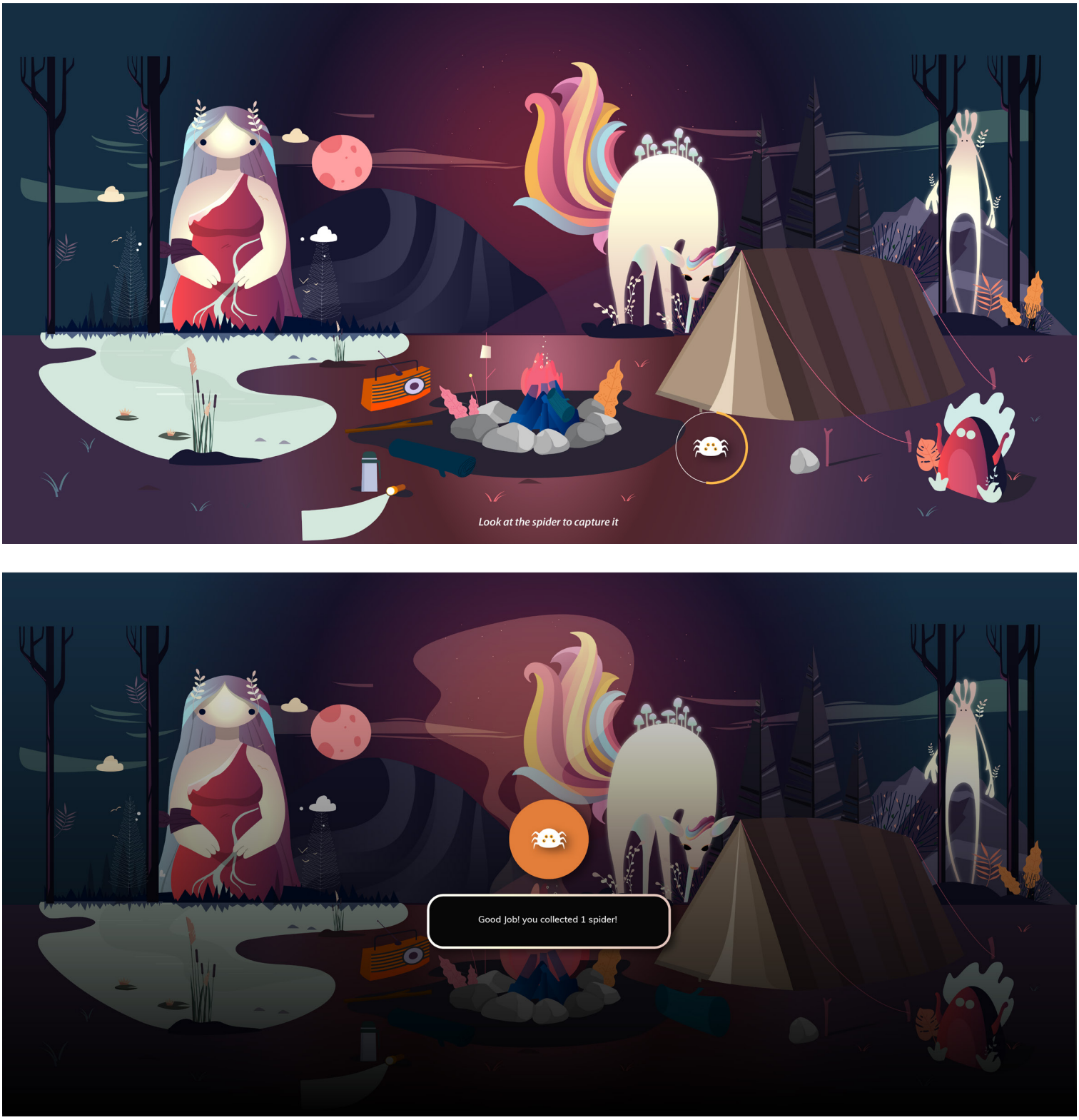


Figure 36: Part IV, The patient captures the spiders by looking at the spider for a given exposure time which is set by the therapist. If the patient looks away, the timer starts again.

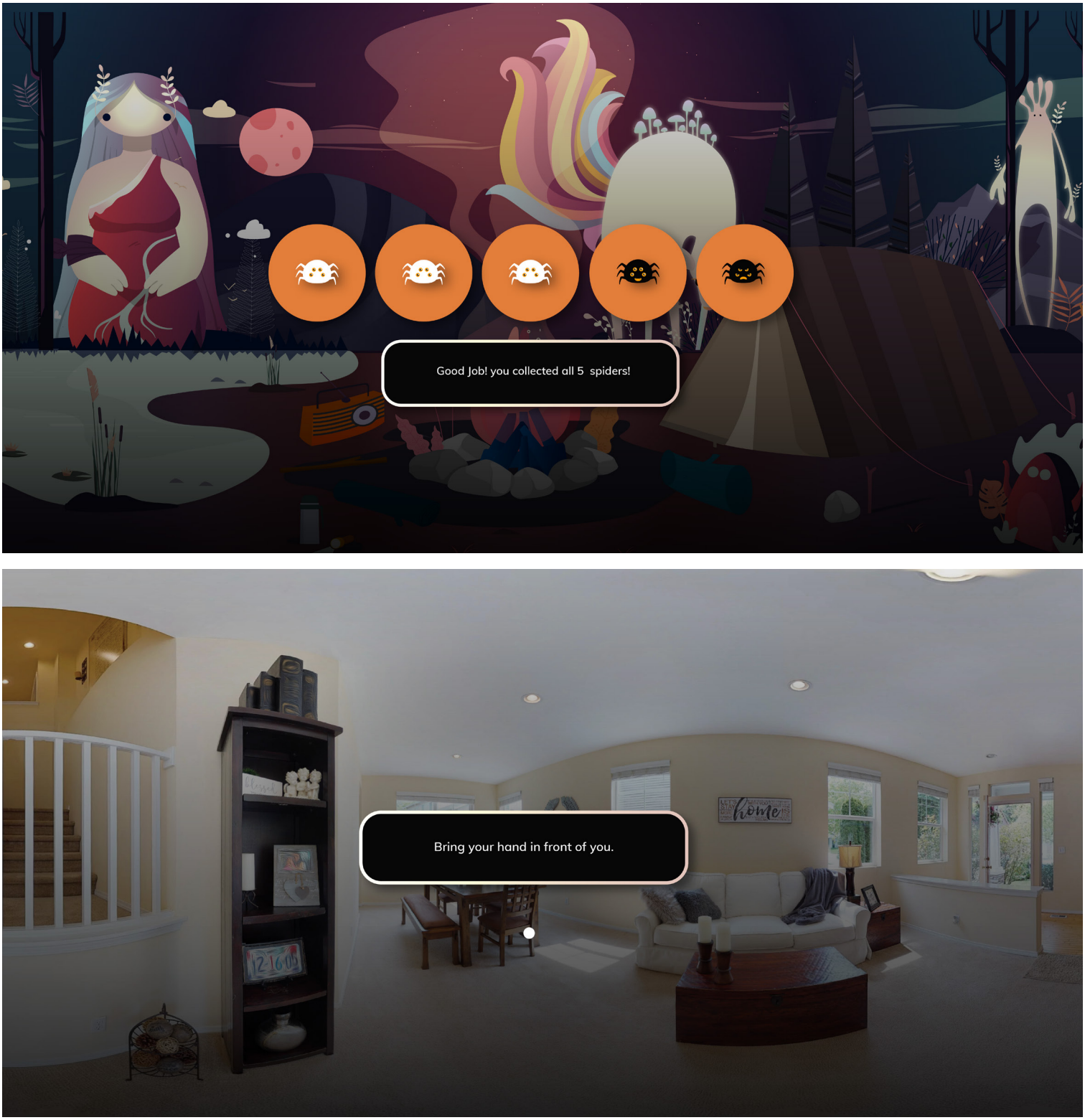


Figure 36: Part V,The level completes when the assigned task (here it is collecting of all the spiders) is finished. For clear legibility the text is placed on a background to separate it from the real surroundings.

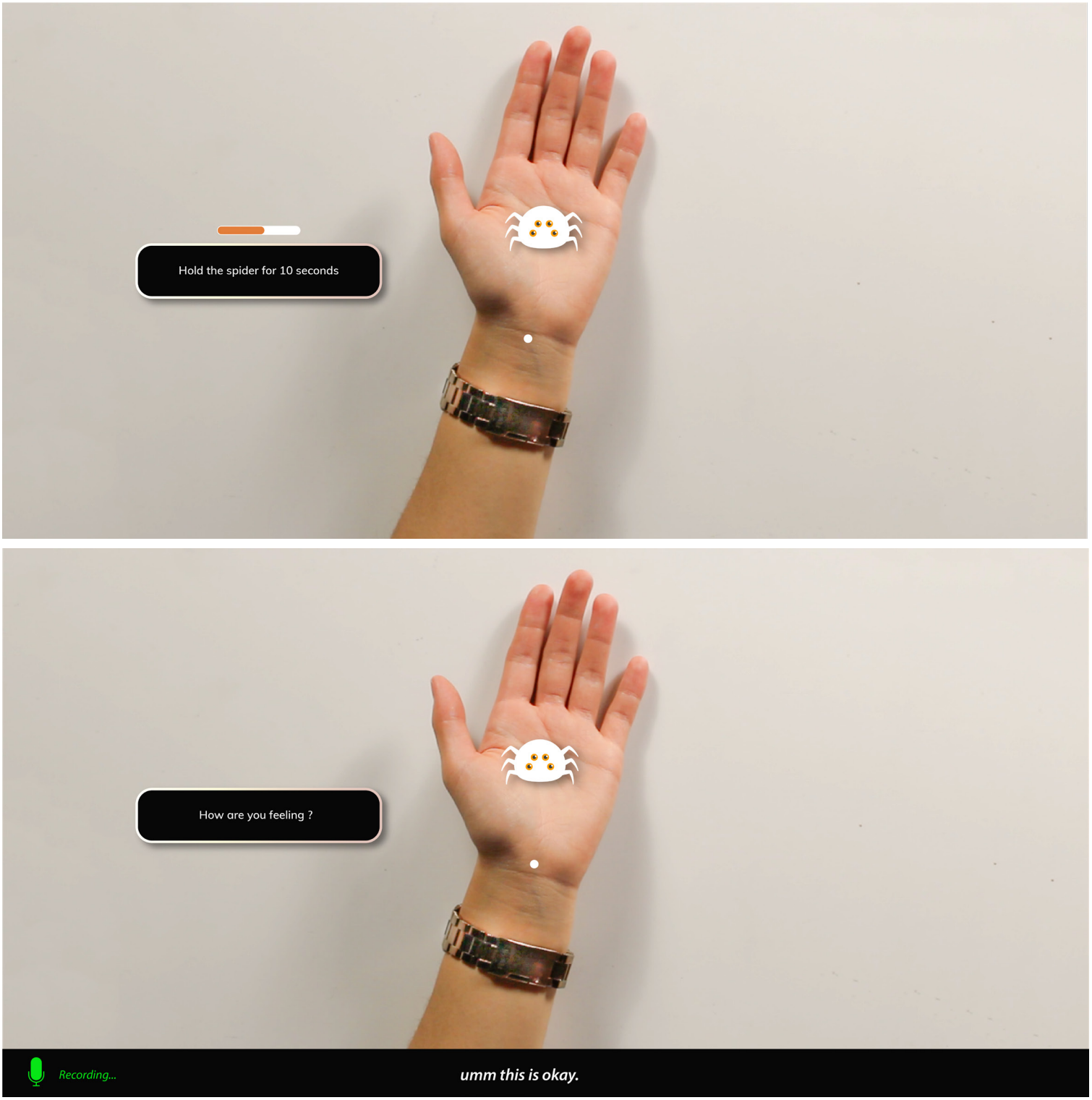


Figure 36: Part VI, Once the level is completed the patient interacts with the spider. This action helps to desensitize the patient for advance levels. The platform automatically records the voice if the patient says anything during any period of time while playing the game. This helps to record exactly how the patient responds.

Figure 36: Part VII, Following that the patient is required to input their physical conditions which are unable to be tracked through biosensors. This helps the patient to communicate their condition better with the therapist.

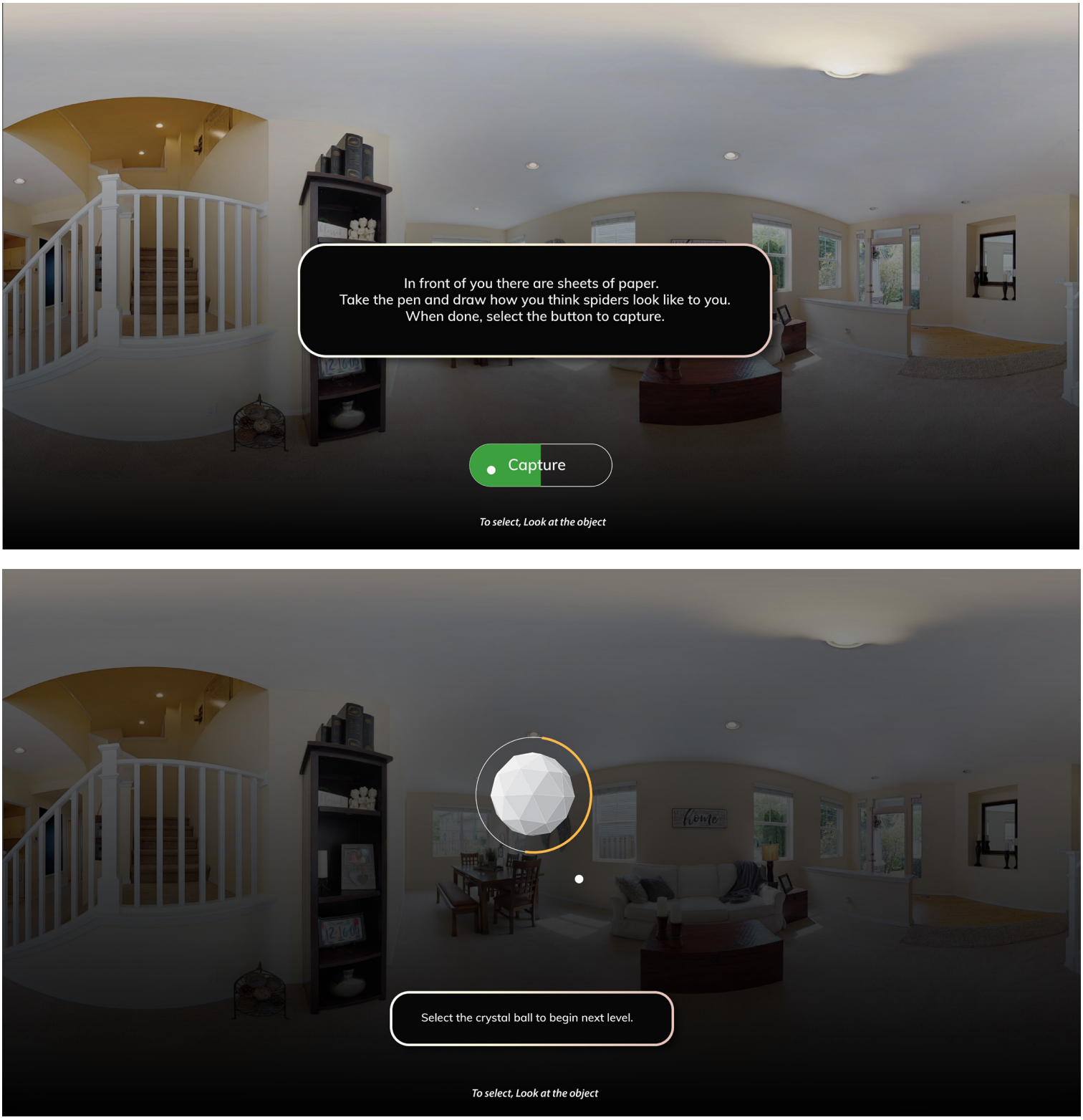


Figure 36: Part VIII, The top visual shows the ability for patients to click picture of their drawings of their perspectives of spiders. Once all the patient data is collected the bottom visual appears as a prompt to advance to the next level.

Figure 36: Part IX, The above visuals show the prototype of the last level in which the patient interacts with the realistic render of the spiders. The AR headset tracks the hand motions which provides natural interactions.

Figure 36: Part X, The level ends by capturing the spider using everyday objects for creating tactile memory with the game following the storyline of completing the seal to achieve the dimensional key. The objective of the game is to develop skills that can be applied to the real world context.

4.4. Summary

The design opportunities uncovered from the interviews and existing application analysis resulted in the creation of a prototype for an Augmented Reality platform for arachnophobia Exposure Therapy. The designed outcome addresses the design recommendations found in Chapter 2 Literature Review. The therapist interface and patient experience were created using a user experience framework and serious gaming principles. The novelty of this approach is based on better integrating the real environment and the patient into the system, and in recognising natural patient actions as a system input. In the end, the designed outcome offers a sound foundation and rationale for researchers interested in using immersive technologies for improving personal and clinical change.

5. Conclusion

In this final chapter, I provide a summary of my research findings, limitations, and challenges faced throughout the project, and finally, I conclude with a discussion about the future work required for this research.

5.1. Research Findings

The main findings of my research can be summarized in as follows:

a. Use of Immersive Media for Exposure Therapy

The use of immersive media (Augmented Reality/Virtual Reality) has already shown positive results in the treatment of the phobia of small animals (see Chapter 2: Literature Review) when combined with traditional Exposure Therapy. First, AR/VR helps the therapist to have more control over the virtual situations and elements in the computer program, such as, in the case of arachnophobia, the therapist can control the number of spiders, their size, appearance, movement, and behaviour. Second, these technologies can make patients feel more secure as the situations that they fear in the real world cannot physically happen in AR/VR. For example, the therapist can expose a patient to a virtual spider and remind the patient that it cannot bite them. As the patient progresses through the virtual narrative, the therapist can plan more challenging exposure tasks. Third, AR/VR technologies can recreate the phobic situation easily which increases the efficiency of the Exposure Therapy session. This efficiency is significant because it is not always easy to obtain real spiders as needed for Exposure Therapy. Immersive technologies, on the other hand, enables constant and easy access to realistic renderings of insects (or other phobia triggers). Fourth, in Exposure Therapy, the role of the patient is to try and focus their attention on the fear stimulus, rather than adopting safety behaviours—actions people engage in to neutralize their fears. The role of the therapist is to ensure

that there is no avoidance (e.g. the patient does not look away). These safety behaviours are harder for the therapist to track in traditional Exposure Therapy. Immersive media headsets use eye-tracking to help the therapist to determine what the patient pays attention to and what they do not.

b. Moving Towards Augmented Reality for Exposure Therapy

AR offers additional advantages over VR. AR headsets have clear lenses that allow the patient to look around making them feel less anxious whereas VR headsets are completely opaque, blocking out the surroundings when one wears them. While VR substitutes the existing physical environment with a virtual one, AR uses virtual elements to build upon the existing environment (Azuma, 1997; Azuma et al., 2001). In AR headsets the patient is able to see their therapist all the time and hence it does not act as a barrier for communication between the therapist and the patient. Since, VR headsets disconnect the patient from their surroundings, as a result, the simulation can cause motion sickness and discomfort (cybersickness) which can negatively affect a patient who already has high anxiety. In AR environments the patient is able to see their own body interact with the virtual elements (versus seeing a virtual representation of their bodies in VR). By embedding the virtual fear element in the real environment and allowing a direct "own-body" perception of that environment, it allows the patient to feel more present and increases the ecological validity of the scenario (Dünser et al., 2011).

Furthermore, the production time of AR and the costs associated with programming virtual environments is cheaper than VR, as it is only necessary to design and simulate the phobic elements rather than an entirely virtual environment. In sum, AR is an effective alternative to VR therapies.

c. Challenges with Exposure Therapy Mental Health Applications

Interviewees believe that scientifically developed mental health applications

will play an important role in the future. Such applications have the potential to deliver real-time interventions, bring the patient perspective into clinical appointments, and ensure that patient experiences and symptoms are recorded and represented. Currently, most mental health applications are not regulated by government health authorities, nor are they required to follow any specific mental healthcare guidelines. The interviewees believed that if these applications are not regulated, it can worsen the patient's symptoms and prove to be dangerous to the patient. Mental health applications that are clinically tested and developed in collaboration with healthcare professionals are very limited and expensive. As a result, individual practitioners are unable to use these applications in their daily practice. The Exposure Therapy applications that do exist are open to the public for downloads and are self-directed, without integrated support from a mental healthcare professional. Interviewees believe that current self-directed applications for Exposure Therapy can worsen the anxiety of the patients as, firstly, these applications are not clinically tested. Secondly, patients are unable to grade their anxiety levels properly, which can create confusion in understanding when to move to the next levels of exposure and can make the patient feel overstimulated. Furthermore, the patient's adherence to therapy protocols through these mental health applications is low because the application is often visually unappealing, not user-friendly and too complex, with many unnecessary added functions. According to the interviewed therapists, an ideal mental health application would allow them to tailor the tasks to the needs of each patient.

d. Challenges in Collaborations Between Designers and Therapists

Collaboration between designers, developers, patients, and healthcare professionals is essential to improve the delivery and effectiveness of mental healthcare services. The interviewed designers report that they face challenges when collaborating with therapists and developers. They feel that when they are working in collaborative teams, issues of power, professional hierarchy and

prestige among healthcare professionals negatively impact designers' ability to make design-related decisions. As a result, the flow of information and feedback becomes unidirectional. According to Thomas Jeffery, a user experience designer in healthcare, "It is because especially with doctors, whether it's intentional or not, doctors tend to believe they are at the highest level and are the smartest—which can create difficulties in a group." For successful collaboration, an equal balance of power among all the professionals should be maintained.

Another collaboration-related challenge faced by designers is that healthcare researchers and practitioners are often unfamiliar with design in general, and in particular, with design research. Design research often involves contextual inquiry, an emphasis on qualitative data, and user studies with small samples. In comparison, clinical research often takes the shape of randomized controlled trials with large samples and quantitative data. Similarly, it can be difficult for designers to get accustomed to healthcare procedures, standards, and culture. When the interviewed therapists were asked about their collaboration with UX designers, the role of UX designers was perceived as professionals who only work on aesthetics. Additionally, 3D artists and game designers were perceived as belonging within the subset of user experience designers. Understanding everyone's professional background, having a common language to communicate, and the use of consistent terminology can help to achieve a project's goal in multidisciplinary collaboration. Improved collaboration, interaction, and coordination leads to better health outcomes for patients.

e. Serious Games and Game Narratives for Exposure Therapy for Phobias

Exposure Therapy, whether traditional or AR/VR-based, requires that the patient shows strong willpower and determination when facing their fears. Thus, motivating patients can be difficult. Gamification and the use of serious gaming principles can enhance patients' experiences and can help to motivate patients to engage themselves with Exposure Therapy. Immersive

virtual environments, as a technology-based platform, complement serious games, due to their relatively faster development and deployment cycles, and lower cost of production. Serious games highlight the importance of game narratives in capturing the attitudes and perceptions of patients. The process of traditional Exposure Therapy involves a patient imagining their traumatic situation, then talking about it, looking at cartoon images and videos, and then finally, interacting with the phobia-inducing stimulus. Currently, most AR/VR/ mobile applications for Exposure Therapy for phobias replicate this process. Even though this trains the patient, the absence of narratives can make the experience monotonous and boring. Using narratives helps the patient feel more involved and more immersed in the game. It gives the game more meaning and helps the patient understand what they need to do and why. Metaphor, according to the study by Lelardeux, Alvarez, Montaut, Galaup, & Lagarrigue (2013), refers to,

> The substitution of a game universe for a context of reference, in which it is possible to use fantasy and abstraction to motivate or immerse the player. (p. 26)

The use of metaphor in serious game design can motivate the patient and enhance their engagement with Exposure Therapy, but when designing the narratives, a balance between the fantasy and the seriousness of the game should be maintained. For instance, some Exposure Therapy mental health applications for arachnophobia use fantasy game narratives such as dancing with the spider. While this is engaging, it holds no real life-training skills because the patient would not be dancing with a spider in the real world. Additionally, some applications train the patient to kill the spider with a flyswatter, which may train the patient but does not address the emotional aspect that patients have. The balance between realism and fantasy narratives should be maintained when creating a game for Exposure Therapy. The proposed design outcome uses a fantasy-based narrative surrounding common traumatic scenarios

that arachnophobes avoid such as camping in the woods, going to the attic, or making countryside trips. The narratives train patients and help to develop skills that can be applied to their real-world contexts. For instance, the fantasy narratives use sealing magic as a metaphor for the process on how to capture the spider using a "glass and paper" and to release them, without harming the spider. This balance of realism and fantasy helps the patient to learn coping skills, engage with the story, and create a non-clinical and fun learning environment. The use of fantasy-based narratives in the designed outcome can also help in overcoming the emotion of disgust for spiders by using cute, friendly, cartoon-like spider graphics, which is not possible in narratives that only use realistic images of spiders. The game narrative requires the patient to create a bond with the spiders to move through the game levels. This eliminates existing associations of fear with the spiders by forming new, positive associations. The proposed design outcome focuses on creating empathy with the spiders as well as living in harmony with the spiders.

f. Recommendations for Designing an Augmented Reality Experience for Exposure Therapy

When designing an AR experience for Exposure Therapy, it is important to understand the context in which it will be used. Creating a seated virtual experience for the patient can help to accommodate the use of the technology in the limited space available in a therapist's office. Using simple interactions with feedback (such as a circular visual for eye tracking) can make it easier for a patient to use and improve the efficiency of the AR system. Displaying information at a consistent position with a 50 to 70 character count limit can reduce cognitive load. If floating text is used, it should be placed within a background, which makes it easier to read and helps it to stand out from the surroundings. For legibility using a font size that is readable at an arm's length (if a seated environment) should be a minimum of 10 pts. Audio and visual cues should be used together to guide the patient and to encourage them to

explore the 360-degree environment. The audio should be faded or stopped altogether if the user is not interacting with the object. Animating the virtual elements, adding surprise elements and giving the patient the ability to interact with the environment's objects can enhance the overall immersive experience. The duration of the game should depend on the time taken by the patient to complete the assigned task rather than keeping a timer which might make the patient anxious. The patient should be given extra time to read or interact with a prompt. The application should help patients recover easily from missteps by guiding them in the right direction rather than displaying an error. This would allow the patient to gain confidence and reduce the stress of making mistakes.

The creation and use of visual attributes such as images, information graphics, and diagrams to show patient stories, emotions, sensations, etc., can support better patient-therapist communication as well as improved delivery of mental health care. Adding non-technology activities (such as drawing) between sessions can help to give breaks to patients, relieve anxiety, and help them to express their inner emotions and convey their feelings to their therapist. Additionally, including everyday objects with the AR experience can give tactile feedback and create a more immersive experience. Both patients and therapists should be able to contact each other whenever required. The most important element to enhance a patient's experience is to create strong visuals and focus on aesthetics/visual styles. Since AR can affect how patients imagine different phobic scenarios, designing a visually pleasing composition with compelling storylines can help the patient to create new, positive associations with the feared stimulus and decrease anxiety levels over time. Each session should start with a storyline and introduction to each level of the game. Keeping initial levels easy with an emphasis on fantasy-based visuals can capture the patient's attention and help them to get comfortable with therapy. The experience should be designed such that the environmental elements have the flexibility to change when played multiple times, helping to sustain the patient's interest in the game.

5.2. Limitations

The research presented in this thesis was subject to certain limitations, mostly in relation to Augmented Reality being a relatively new area of research in healthcare. Therefore, the limited availability of existing scholarly research relevant to this topic and the practical difficulties of studying healthcare environments emerged as factors for consideration. The following limitations are discussed below:

a. Limitations of Augmented Reality Technology

Currently, most studies on the use of AR in Exposure Therapy take place within research labs. Even though the research completed previously on the use of AR technology and Exposure Therapy shows promise, the implementation of AR in clinical settings is relatively low compared to that of VR. One of the major challenges for the adoption of AR technology in healthcare is the cost of the headset (the Hololens costs 3000 USD). The high cost of AR headsets makes it difficult for most individual practitioners to use this technology compared to using VR, the cost of which is relatively low (the Oculus Rift costs 250 USD). Other challenges include the technical limitations of AR technology, for example, AR headsets are unable to track the user's surroundings when used in a dark room.

b. Limitations of Augmented Reality Content

The use of AR in healthcare is a relatively new concept. As a result, there is not much scholarly literature available in this area. Part of the reason for this problem is a lack of expertise; there are not enough therapists working with Augmented Reality as it falls outside their area of training and expertise. The interviewed designers also said that there is limited AR content because there is no easy way for them to prototype the AR environment and test it unless they first learn software developing skills—skills with a high learning curve that most designers do not have. Additionally, there are no established guidelines for designing AR environments for a healthcare system, which makes it difficult to understand the requirements and complicates the process of unifying solutions

to the greater whole. This makes the overall development of technology much slower than it could be. However, these gaps also open up opportunities for researchers to explore new solutions and implement new ideas in healthcare, given the many promising aspects of AR.

c. Limitations of Using Serious Game for Exposure Therapy

The merging of immersive technologies with gaming approaches has made a positive impact in the areas of medical education, patient interventions, and public involvement (Kamel Boulos, 2011). However, the design, development process and guidelines for serious games on exposure therapies for phobias have not been emphasized by researchers. In the majority of scholarly literature, researchers do not discuss the game narratives and the visual style of the games (Ricciardi & De Paolis, 2014). As a result, if a designer or a developer wants to design a serious game for Exposure Therapy for specific phobias, it is difficult without any established guidelines and frameworks. Nonetheless, game design principles for game-based learning and game design theories can provide a starting point for developing a serious game. Further research is required to better understand the mechanism(s) of how serious games and game narratives influence treatment outcomes in Exposure Therapy contexts.

d. User Testing

Testing designed prototypes with intended users is an important part of any design process. This helps to determine if the design decisions that have been made are appropriate and address problems that are identified during the user testing phase. In this study, the user testing of the proposed design outcomes was not conducted due to the ethical restrictions surrounding the involvement of arachnophobic patients. Performing user tests with patients may have increased their risk of experiencing panic attacks—which would have required a therapist's involvement to monitor and manage such a situation. On the other hand, user testing with non-arachnophobic participants would not have depicted accurate

results as they are outside the context of Exposure Therapy and can create a bias for the study. Finally, because the use of Augmented Reality in Exposure Therapy is still a relatively new idea, most therapists approached to discuss the prospect of user testing were hesitant to participate as they were unfamiliar with Augmented Reality technology.

e. Recruiting of Therapists

Healthcare researchers and practitioners are often unfamiliar with design in general, and with design research in particular. Originally, I was hoping to interview more participants; however, this changed for a number of reasons. First, it was difficult to find therapists with expertise in the field of AR/VR therapy, as there is limited adoption of these technologies in clinical settings. Second, many respondents who had expertise in VR-based therapy could not participate, as the non-disclosure agreements they had with their employing organizations prevented them from having in-depth discussions with me on their work on AR/VR Exposure Therapy.

VR therapy software is currently viewed as holding immense commercial potential, which means that companies involved in their development are unwilling to disclose the details of the software for public access. This also created a barrier for me in understanding the functionality of existing therapist's interfaces. Many therapists who refused to participate expressed that they did not understand the role of user experience designers for enhancing the patient's therapeutic experiences and believed that it is their role to facilitate this, not the designers. These challenges in collaborating with therapists emerged either due to organizational or individual factors, including differences in professional power, professional cultures, knowledge biases, and limited understanding of the value of design. Through informal conversations with several design researchers, I noticed that many of the above challenges are not unique to my project, but are actually commonly experienced.

f. Design Challenges

An AR headset is required to test the design of Augmented Reality experiences—which is difficult as AR headsets are expensive. Additionally, to design a prototype for AR content, technical capabilities and engineering skills are required, which presents a steep learning curve for designers. Additionally, there is no standard method of designing and prototyping AR experiences for headsets. Projects which aim to create AR-based games for Exposure Therapy require a team of user experience designers, game developers, 3D artists, software developers, and therapists. Another limitation I faced was that, due to the confidentiality of the clinical settings, I was not able to observe the interactions between the therapist and the patient in an actual Exposure Therapy session. Therefore, there might be unknown environmental factors that I have not been able to take into consideration while making my design decisions. Moreover, each therapist has their own way of conducting Exposure Therapy sessions. The therapists I interviewed presented contradictory views regarding what should be included and what should not in a game narrative for Exposure Therapy. For instance, some said that relaxation techniques should be included and others said relaxation techniques can act as a distraction. These contradicting views made it challenging to choose which approach would be more effective in the game narrative I designed.

5.3. Future Recommendations

Further research is required to better understand the effectiveness of using serious gaming principles for Augmented Reality for Exposure Therapy. Based on my literature review, most studies suggest the use of serious games to improve the patient's motivation for seeking mental healthcare. However, none of the studies focused on the design process of game narratives. Therefore, further research should be conducted using different types of game narratives (such as fantasy-based narratives) to identify the effect of narratives on Exposure Therapy treatments and on patient motivation.

Most AR Exposure Therapy studies identified in my literature review showed that the efficacy of VR and AR in Exposure Therapy was higher compared to in vivo but utilized a small sample size. Performing rigorous user tests and clinical trials with a larger sample of patients can help to better understand the full potential of these technologies and improve clinical uptake. When analyzing the existing applications for arachnophobia, there was no significant prevalence of an assessment tool to evaluate immersive media mental health applications. An assessment tool was created for this research from the literature review and expert interviews. The development of assessment criteria needs further research so that mental health applications for immersive media can be better evaluated. Moreover, many studies on the usability of mental health applications show evidence indicating that patients have high attrition rates.

Research demonstrating the use of user experience design principles to improve the low engagement of the patients with mental health applications should be conducted along with highlighting the importance of visual design in interfaces for digital therapeutic environments. This research provides recommendations on how to design an AR application for Exposure Therapy for arachnophobia. Testing of these recommendations can help to gain insights into the needs of phobic patients. The role of user experience designers needs to be defined clearly across different disciplines to facilitate multi-disciplinary collaborations. Collaboration with therapists, patients, game designers, and developers can help to better understand the needs and goals for similar projects in the future.

This research focused on Exposure Therapy for arachnophobia but it can be applied towards the development of immersive media solutions to aid the treatment of other phobias, such as fear of flying or for therapy for social anxiety. In conclusion, AR is a promising technology to supplement traditional treatments for specific phobias and is likely to be useful for other psychological disorders as well.

5.4. Summary

This study presents a comprehensive overview of the AR field in arachnophobia therapy and provides a suitable starting point for researchers in this new field of Augmented Reality therapeutics. The research presents a prototype of Boo, an AR platform for arachnophobia therapy. The prototype uses fantasy narratives and proposes design practices that can improve patient's participation and therapist's experience for AR Exposure Therapy.

This thesis has explored the potential of Augmented Reality as a tool to supplement traditional Exposure Therapy models for the treatment of specific phobias. It is important to highlight that the use of serious game principles can enhance the patient's experience and motivate the patient to seek therapy. While traditional exposure is proven to be useful for specific phobias, this research argues that AR/VR or other similar technologies might have additional value for some types of specific phobias. Even if these technologies are only adding value to a small subset of users with phobias, the need for these solutions is arguably large. In medicine, both diagnosis and treatments have been improved over time through the integration of new technologies. In the same way, these changes are occurring in clinical settings and there is no doubt that mental healthcare services will continue to benefit from such technological advances. AR shows great potential in healthcare but more evidence-based research is required before healthcare providers and the general public accepts it as a familiar user interface.
The internet has succeeded in connecting us with information, now it is time for technology to succeed in further connecting people to people.

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Appendices

7. Appendices

7.1. Ethics Application

Notification of Approval

Date:	January 30, 2019
Study ID:	Pro00084867
Principal Investigator:	Anna Chakravorty
Study Supervisor:	Aidan Rowe
Study Title:	Augmented reality based hybrid narratives as a therapy for arachnophobia
Approval Expiry Date:	January 29, 2020

Approved Consent Form:	Approval Date	Approved Document
	1/30/2019	InformationLetterandConsentForm-Expert Participants
	1/30/2019	InformationLetterandConsentForm_non arachnophobia.docx

Thank you for submitting the above study to the Research Ethics Board 1. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Stanley Varnhagen, PhD
Chair, Research Ethics Board 1

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Date: Wednesday, December 11, 2019 8:48:25 PM Print Close

1.1 Study Identification

*All questions marked by a red asterisk * are required fields. However, because the mandatory fields have been kept to a minimum, answering only the required fields may not be sufficient for the REB to review your application.*

Please answer all relevant questions that will reasonably help to describe your study or proposed research.

1.0 * **Short Study Title** *(restricted to 250 characters)*:
.....Augmented reality based hybrid narratives as a therapy for arachnophobia

2.0 * **Complete Study Title** *(can be exactly the same as short title)*:

Augmented reality based hybrid narratives as a therapy for arachnophobia

3.0 * **Select the appropriate Research Ethics Board (***Detailed descriptions are available at http://www.reo.ualberta.ca/Human-Research-Ethics/Research-Ethics-Boards.aspx***):**
Research Ethics Board 1

4.0 * **Is the proposed research:**
Unfunded

5.01 * **Name of local Principal Investigator:**
Anna Chakravorty

6.0 * **Type of research/study:**
Graduate Student

7.0 **Investigator's Supervisor (required for applications from undergraduate students, graduate students, post-doctoral fellows and medical residents to REBs 1 & 2. HREB does not accept applications from student PIs):**

Aidan Rowe

8.01 **Study Coordinators or Research Assistants:** People listed here can edit this application and will receive all email notifications for the study:

Name	Employer
There are no items to display	

9.01 **Co-Investigators:** People listed here can edit this application and will receive email notifications *(Co-investigators who do not wish to receive email, should be added to the study email list team below instead of here).*
If your searched name does not come up when you type it in the box, the user does not have the Principal Investigator role in REMO. Click the following link for instructions on how to Request an Additional Role.

Name	Employer
There are no items to display	

10.01 Study Team: *(co-investigators, supervising team, and other study team members) - People listed here cannot view or edit this application and do not receive email notifications.*

Last Name	First Name	Organization	Role/Area of Responsibility	Phone	Email

There are no items to display

1.5 Conflict of Interest

1.0 * **Are any of the investigators or their immediate family receiving any personal remuneration (including investigator payments and recruitment incentives but excluding trainee remuneration or graduate student stipends) from the funding of this study that is not accounted for in the study budget?**
○ Yes ● **No**

2.0 * **Do any of investigators or their immediate family have any proprietary interests in the product under study or the outcome of the research including patents, trademarks, copyrights, and licensing agreements?**
○ Yes ● **No**

3.0 * **Is there any compensation for this study that is affected by the study outcome?**
○ Yes ● **No**

4.0 * **Do any of the investigators or their immediate family have equity interest in the sponsoring company? (This does not include Mutual Funds)**
○ Yes ● **No**

5.0 * **Do any of the investigators or their immediate family receive payments of other sorts, from this sponsor (i.e. grants, compensation in the form of equipment or supplies, retainers for ongoing consultation and honoraria)?**
○ Yes ● **No**

6.0 * **Are any of the investigators or their immediate family, members of the sponsor's Board of Directors, Scientific Advisory Panel or comparable body?**
○ Yes ● **No**

7.0 * **Do you have any other relationship, financial or non-financial, that, if not disclosed, could be construed as a conflict of interest?**
○ Yes ● **No**

Please explain if the answer to any of the above questions is Yes:

Important

If you answered YES to any of the questions above, you may be asked for more information.

1.6 Research Locations and Other Approvals

1.0 * **List the locations of the proposed research, including recruitment activities. Provide name of institution, facility or organization, town, or province as applicable**

On Campus (University of Alberta); Internet (VoIP) to record remote interviews (Skype or Source-Connect Now); various post-secondary institutions and offices for expert interviews.

2.0 * **Indicate if the study will use or access facilities, programmes, resources, staff, students, specimens, patients or their records, at any of the sites affiliated with the following** *(select all that apply):*

Not applicable

List all health care research sites/locations:

3.0 **Multi-Institution Review**

* **3.1 Has this study already received approval from another REB?**

○ **Yes** ● **No**

4.0 **If this application is closely linked to research previously approved by one of the University of Alberta REBs or has already received ethics approval from an external ethics review board***(s)*, **provide the study number, REB name or other identifying information. Attach any external REB application and approval letter in the Documentation Section – Other Documents.**

2.1 Study Objectives and Design

1.0 **Provide planned start and end date of human participant research.**

Start Date:
2/1/2019

End Date:
10/1/2019

2.0 * **Provide a lay summary of your proposed research which would be understandable to general public**

I am studying how augmented reality can be used as an adjunctive measure to arachnophobia therapy

3.0 * **Provide a full description of your research proposal outlining the**

following:

- **Purpose**
- **Hypothesis**
- **Justification**
- **Objectives**
- **Research Method/Procedures**
- **Plan for Data Analysis**

Purpose/Hypothesis/Justification

How can one be exposed to, and interact with, a spider without actually having one physically present? Augmented reality (AR) could provide an answer. Augmented reality presents itself as a very distinctive feature by mixing the real world with overlays of digital information so that users perceive an enhanced composite view of their surroundings. Unlike the vast majority of mental disorders that can easily be diagnosed through a series of tests, there isn't a specific set of guidelines or tests that an individual can go through to know if they have arachnophobia. It is commonly known that the majority of people who deal with a small number of issues associated with their phobia rarely seek medical treatment. With recent developments of AR technologies, patients may be able to overcome their fears with little to no risk. While current AR applications designed for phobia treatment are limited, the potential of such applications are clear and be greatly beneficial. My thesis focuses on how this new technology of mixed reality can help in treatments of spider phobias.

Objectives

The main objective is to understand:

- The potential of augmented reality in phobia therapy
- limitations with the current practices for therapy for arachnophobia.
- How to design Augmented reality-based narratives to enhance the overall experience of the therapy and improve the efficacy of medical care

Research Methods

The research process for this research is through:

- Examining detailed case studies and existing research in the field of AR for phobias and phobia treatments;
- Identification and compiling of current research for user ex9perience in AR;
- Interviews with psychologists in the field of cyberpsychology, phobias;

- Interviews with professionals in the field of immersive media, human computing and interaction designers
- Developing and designing AR based video narratives
- User testing with non-phobic participants to evaluate the AR user experiences. For eg: Which narrative was most engaging?

Plan for Data Analysis

- Qualitative and quantitative surveys to validate interactions from the above-mentioned user testing.
- Data collected from the above-noted research exercises will be analysed for meaningful results and placed in disseminated forms.

4.0 **Describe procedures, treatment, or activities that are above or in addition to standard practices in this study area** *(eg. extra medical or health-related procedures, curriculum enhancements, extra follow-up, etc)*:
N/A

5.0 **If the proposed research is above minimal risk and is not funded via a competitive peer review grant or industry-sponsored clinical trial, the REB will require evidence of scientific review. Provide information about the review process and its results if appropriate.**
N/A

6.0 **For clinical trials, describe any sub-studies associated with this Protocol.**
N/A

2.2 Research Methods and Procedures

Some research methods prompt specific ethical issues. The methods listed below have additional questions associated with them in this application. If your research does not involve any of the methods listed below, ensure that your proposed research is adequately described in Section 2.1: Study Objectives and Design or attach documents in the Documentation Section if necessary.

1.0 * **This study will involve the following***(select all that apply)*
Interviews and/or Focus Groups
Surveys and Questionnaires (including internet surveys)

NOTE 1: Select this ONLY if your application SOLELY involves a review of paper charts/electronic health records/administrative health data to answer the research question. If you are enrolling people into a study and need to collect data from their health records in addition to other interventions, then you SHOULD NOT select this box.

NOTE 2: Select this option if this research ONLY involves analysis of blood/tissue/specimens originally collected for another purpose but now being used to answer your research question. If you are enrolling people into the study to prospectively collect specimens to analyze you SHOULD NOT select this box.

2.5 Interview and/or Focus Groups

1.0 **Will you conduct interviews, focus groups, or both? Provide detail.**
Both focus group and interviews would be conducted. The three categories are:

1. Interviews with experts to collect information regarding the treatments and methods they use to evaluate arachnophobia and give medical care.

2. Conduct interviews with experts in the field of user experience, augmented reality and human interaction design to understand how to enhance the experience for creating narratives for the therapy and to validate the interactions regarding the technology.

3. Focus group study with non-phobic participants to user test the augmented reality-based prototype created.

2.0 **How will participation take place (e.g. in-person, via phone, email, Skype)?**
In-person, email, Skype/ online video calling and phone.

3.0 **How will the data be collected (e.g. audio recording, video recording, field notes)?**
Video recording to understand user interaction patterns with technology, Audio recording, transcribed and field notes.

2.9 Surveys and Questionnaires (including Online)

1.0 How will the survey/questionnaire data be collected (i.e. collected in person, or if collected online, what survey program/software will be used etc.)?
Offline data will be collected in-person.

Online data will be collected through SurveyMonkey and Google forms.

2.0 Where will the data be stored once it's collected (i.e. will it be stored on the survey software provider servers, will it be downloaded to the PI's computer, other)?
The data will be downloaded and stored on an encrypted external hard drive which is accessible only to the principal investigator.

3.0 Who will have access to the data?
Principal investigator

3.1 Risk Assessment

1.0 * Provide your assessment of the risks that may be associated with this research:
Minimal Risk - research in which the probability and magnitude of possible harms implied by participation is no greater than those encountered by participants in those aspects of their everyday life that relate to the research (TCPS2)

2.0 * Select all that might apply:

Description of Possible Physical Risks and Discomforts

No	Participants might feel physical fatigue, e.g. sleep deprivation
No	Participants might feel physical stress, e.g. cardiovascular stress tests
No	Participants might sustain injury, infection, and intervention side-effects or complications
No	The physical risks will be greater than those encountered by the participants in everyday life

Possible Psychological, Emotional, Social and Other Risks and Discomforts

Possibly	Participants might feel psychologically or emotionally stressed, demeaned, embarrassed, worried, anxious, scared or distressed, e.g. description of painful or traumatic events
No	Participants might feel psychological or mental fatigue, e.g intense concentration required
No	Participants might experience cultural or social risk, e.g. loss of privacy or status or damage to reputation
No	Participants might be exposed to economic or legal risk, for instance non-anonymized workplace surveys
No	The risks will be greater than those encountered by the participants in everyday life

3.0 * **Provide details of all the risks and discomforts associated with the research for which you indicated YES or POSSIBLY above.**
During user-testing the prototype the non-phobic participants might feel a bit anxious seeing spider images.

4.0 * **Describe how you will manage and minimize risks and discomforts, as well as mitigate harm:**
The user testing non-arachnophobic participant's study will be conducted in the SUB building and if any consented non-phobic participant feels anxious, Ill stop the study and personally take them to the health centre at the SUB building where drop-ins are available.

5.0 **Is there a possibility that your research procedures will lead to unexpected findings, adverse reactions, or similar results that may require follow-up** *(i.e. individuals disclose that they are upset or distressed during an interview/questionnaire, unanticipated findings on MRI, etc.)*?
○ Yes ● **No**

6.0 **If you are using any tests in this study diagnostically, indicate the member(s) of the study team who will administer the measures/instruments:**

Test Name	Test Administrator	Organization	Administrator's Qualification

There are no items to display

7.0 **If any research related procedures/tests could be interpreted diagnostically, will these be reported back to the participants and if so, how and by whom?**

3.2 Benefits Analysis

1.0 * **Describe any potential benefits of the proposed research to the participants. If there are no benefits, state this explicitly:**
The proposed research offers no direct benefit to participants. The experts and industry professionals involved in the semi-structured interviews will be participating in a conversation in their areas of interest, of which the main benefit will be to me as the researcher.

2.0 * **Describe the scientific and/or scholarly benefits of the proposed research:**
It is envisioned that the results of this development would help to expand the application of augmented reality and can serve as a possible model for therapy for arachnophobia in an accessible and economical manner.

3.0 **If this research involves risk to participants explain how the benefits outweigh the risks.**
It is envisaged that there is minimal risk to the participants involved.

4.1 Participant Information

1.0 * **Will you be recruiting human participants** *(i.e. enrolling people into*

the study, sending people online surveys to complete)?

● **Yes** ○ No

1.1 Will participants be recruited or their data be collected from Alberta Health Services or Covenant Health or data custodian as defined in the Alberta Health Information Act?

○ Yes ● **No**

4.2 Additional Participant Information

1.0 **Describe the participants that will be included in this study. Outline ALL participants** *(i.e. if you are enrolling healthy controls as well):*

All participants will be from the age 20-70, of any race and gender who are associated with the following area of expertise:

- psychologists in the field of cyber-psychology, phobia treatment
- immersive media, human computing and interaction designers

For User-testing, any Non-Arachnophobic participants who are currently a staff or student enrolled with UofA of any age, of any race and gender, any professional background will be selected.

2.0 * **Describe and justify the inclusion criteria for participants** *(e.g. age range, health status, gender, etc.):*

All participants will be from the age 20-70, of any race and gender who are associated with the following area of expertise:

- psychologists in the field of cyber-psychology, phobia therapy;
- immersive media, human computing and interaction designers
-

Non-arachnophobic participants with any professional background

The following participants are selected as they can very well articulate their perspectives and experience and help to develop my narratives for the prototype that would be applied as a therapy for arachnophobia without feeling anxious.

For User-testing, any Non-Arachnophobic participants who are currently a staff or student enrolled with UofA of any age, of any race and gender, any professional background will be selected because in order to provide them with health consultation via the SUB health centre if any of the participants feel anxious during the study.

3.0 Describe and justify the exclusion criteria for participants:

Phobic participants are excluded from the study and that would require a trained professional to carry out the testings.

4.0 Participants

4.1 How many participants do you hope to recruit *(including controls, if applicable?)*
15
4.2 Of these, how many are controls, if applicable?

4.3 If this is a multi-site study, how many participants do you anticipate will be enrolled in the entire study?

5.0 Justification for sample size:
There are 3 groups of 4-5 members. The three groups would include the following research method:
1. Interviews with psychologists who are working in the field of cyber-psychology, phobia therapy
2. Interviews with the professionals who are experts in the field of interaction design and immersive media
3.Non-arachnophobic participants for user testing which would involve questions and surveys.

Since the research is about creating narratives for AR based arachnophobia therapy and understanding the possibility of this application this selection would help me to validate my hypothesis both professionally as well as understand the common human interactions.

4.4 Recruitment of Participants (non-Health)

1.0 Recruitment

1.1 How will you identify potential participants? Outline all of the means you will use to identify who may be eligible to be in the study

(i.e. response to advertising such as flyers, posters, ads in newspapers, websites, email, list serves, community organization referrals, etc.)
Participants will be contacted on their professional e-mail addresses that would briefly describe my research along with an agreement if they are interested in participating in this research. The emails would be acquired through their display in public domains of websites, journals, forums or social media.

For Non-Arachnophobic participants, the selection will be through the response to the posters which will be displayed across the University of Alberta's notice boards.

1.2 Once you have identified a list of potentially eligible participants, indicate how the potential participants' names will be passed on to the researchers AND how will the potential participants be approached about the research.
Once the participants who have contacted back and agreed to be the part of the study, the researcher would send them the consent forms and further details for the research and accordingly plan out the schedule with the participant.

2.0 Pre-Existing Relationships

2.1 Will potential participants be recruited through pre-existing relationships with researchers *(e.g. Will an instructor recruit students from his classes, or a physician recruit patients from her practice? Other examples may be employees, acquaintances, own children or family members, etc.)*?
○ Yes ● **No**

3.0 Will your study involve any of the following? *(select all that apply)*
Payment or incentives, e.g. honorarium or gifts for participating in this study

4.5 Informed Consent Determination

1.0 Describe who will provide informed consent for this study*(i.e. the participant, parent of child participant, substitute decision maker, no one will give consent – requesting a waiver)*
The participant himself/herself will give the signed consent to the researcher.

1.1 Waiver of Consent Requested
If you are asking for a waiver of participant consent, please justify the waiver or alteration and explain how the study meets all of the criteria for the waiver. Refer to Article 3.7 of TCPS2 **and provide justification for requesting a Waiver of Consent for ALL criteria (a-e)**
N/A

1.2 Waiver of Consent in Individual Medical Emergency
If you are asking for a waiver or alteration of participant consent in individual medical emergencies, please justify the waiver or alteration and explain how the study meets ALL of the criteria outlined in Article 3.8 of TCPS2 (a-f)**.**
N/A

2.0 **How will consent be obtained/documented? Select all that apply**
Signed consent form

If you are not using a signed consent form, explain how the study information will be provided to the participant and how consent will be obtained/documented. Provide details for EACH of the options selected above:

3.0 **Will every participant have the capacity to give fully informed consent on his/her own behalf?**
● **Yes** ○ No

4.0 **What assistance will be provided to participants or those consenting on their behalf, who may require additional assistance?** *(e.g. non-English speakers, visually impaired, etc.)*

5.0 * **If at any time a PARTICIPANT wishes to withdraw from the study or from certain parts of the study, describe when and how this can be done.**
Participants may withdraw from the study within 8 weeks after your interview date by notifying myself (the Primary Investigator) by email, phone or in-person.

6.0 **Describe the circumstances and limitations of DATA withdrawal from the study, including the last point at which participant DATA can be withdrawn** *(i.e. 2 weeks after transcription of interview notes)*
Participants may withdraw from the study within 8 weeks after your interview date by notifying myself (the Primary Investigator) by email, phone or in-person. There will be no consequences.

7.0 **Will this study involve any group(s) where non-participants are present? For example, classroom research might involve groups which include participants and non-participants.**
○ Yes ● **No**

4.6 Expense Reimbursements and Incentives

1.0 **Expense Reimbursements:**

1.1 Describe in detail the expenses for which participants will be reimbursed, the value of the reimbursements per item as well as the total maximum reimbursement and the reimbursement process *(e.g. participants will receive a cash reimbursement for parking at the rate of $12.00 per visit for up to three visits for a total value of $36.00)*

1.2 IF you will be collecting personal information to reimburse or pay participants, describe the information to be collected and how privacy will be maintained.

2.0 **Incentives:**

2.1 Will participants receive any incentives for participating in this research *(i.e. gift card, cash payment, prize draw)***? If yes, provide details of the value, including the likelihood (odds) of winning for prize draws and lotteries.**
https://www.ualberta.ca/research/support/ethics-office/human-research-ethics/use-of-incentives-in-research

Gift Cards will be given to all the participants as gratitude for their time. Gift cards will be given to the participants once they agree and complete the given research task.

2.2 What is the maximum value of the incentives offered to an individual throughout the research?
10$ Gift Cards

2.3 IF incentives are offered to participants, they should not be so large or attractive as to constitute coercion. Justify the value of the incentives you are offering relative to your study population.

5.1 Data Collection

1.0 * **Will the researcher or study team be able to identify any of the participants at** any stage **of the study?**
● **Yes** ○ No

2.0 **Primary/raw data collected will be** *(check all that apply)***:**
Anonymous - the information **NEVER** had identifiers associated with it (eg anonymous surveys) and risk of identification of individuals is low or very low
Directly identifying information - the information identifies a specific individual through direct identifiers (e.g. name, social insurance number, personal health number, etc.)
Indirectly identifying information - the information can reasonably be expected to identify an individual through a combination of indirect identifers (eg date of birth, place of residence, photo or unique personal characteristics, etc)

3.0 **If this study involves secondary use of data, list all original sources:**

4.0 **In research where total anonymity and confidentiality is sought but cannot be guaranteed** *(eg. where participants talk in a group)* **how will confidentiality be achieved?**
Pseudonyms will be used upon request with a non-disclosure agreement to maintain the confidentiality.

5.2 Data Identifiers

1.0 * **Personal Identifiers:** will you be collecting - at any time during the study, including recruitment - any of the following *(check all that apply)*:
Surname and First Name
Initials
Telephone Number
Email Address
Professional Certificate/License Number

2.0 **Will you be collecting - at any time of the study, including recruitment of participants - any of the following** *(check all that apply)*:
There are no items to display

3.0 * **If you are collecting any of the above, provide a comprehensive rationale to explain why it is necessary to collect this information:**
For expert interviews, names, phone numbers and/or email address will be required for initial contact purpose with the participant's professional background to sort them into their area of expertise. Once done, only names and professional background would be used to share the perspectives of the participant if they agreed to sign the consent.

For Non-arachnophobia participants, only professional background would be used to share the perspectives of the participants as that would help me to understand their background impact their perceptions regarding this immersive technology. For example, perspectives of a game designer as compared to an accounting professional will be highly varied towards augmented reality.

4.0 **If identifying information will be removed at some point, when and how will this be done?**
Pseudonyms will be used to replace original information upon request by the participant.

5.0 * **Specify what identifiable information will be RETAINED once data collection is complete, and explain why retention is necessary. Include the retention of master lists that link participant identifiers with de-identified data:**
Participants' full names (Surname and First Name) and their professional position, institution and/or place of employment will be retained with their interview to lend their interview responses authority and to convincingly show their position as an expert in their field of work. Email addresses and phone numbers will also be retained to follow-up with participants post-interview.

6.0 **If applicable, describe your plans to link the data in this study with data associated with other studies (e.g within a data repository) or with data belonging to another organization:**
n/a

5.3 Data Confidentiality and Privacy

1.0 * **How will confidentiality of the data be maintained? Describe how the identity of participants will be protected both during and after research.**
Contact information for participants will be kept encrypted on an external hard drive. Identifying information will be replaced with pseudonyms on request. Any identifying element will be blurred. Face, license plate, brands etc. would be a part of identifying appearances.

2.0 **How will the principal investigator ensure that all study personnel are aware of their responsibilities concerning participants' privacy and the confidentiality of their information?**
I don't have study personnel. Only the participants and the PI will have access to the data.

3.0

External Data Access

*** 3.1 Will identifiable data be transferred or made available to persons or agencies outside the research team?**

● **Yes** ○ No

3.2 If YES, describe in detail what identifiable information will be released, to whom, why they need access, and under what conditions? What safeguards will be used to protect the identity of subjects and the privacy of their data.
Experts interviewed for this study will have their full names, their professional position, institution and/or place of employment with portions of their interviews published publically within the research documents. Identifying information will be replaced with pseudonyms on request.

For non-arachnophobic participants, only professional background data will be collected.

3.3 Provide details if identifiable data will be leaving the institution, province, or country *(eg. member of research team is located in another institution or country, etc.)*
Experts interviewed for this study will have their full names, their professional position, institution and/or place of employment associated with their interview responses, which will be published as part of this research project. Identifying information will be replaced with pseudonyms on request.

5.4 Data Storage, Retention, and Disposal

1.0 *** Describe how research data will be stored, e.g. digital files, hard copies, audio recordings, other. Specify the physical location and how it will be secured to protect confidentiality and privacy.** *(For example, study documents must be kept in a locked filing cabinet and computer files are encrypted, etc. Write N/A if not applicable to your research)*
Study Documents will be kept in a locked filing cabinet in my office at the university and digital files will be encrypted on the external hard drive.

2.0 *** University policy requires that you keep your data for a minimum of 5 years following completion of the study but there is no limit on data retention. Specify any plans for future use of the data. If the data will become part of a data repository or if this study involves the creation of a research database or registry for future research use, please provide details.** *(Write N/A if not applicable to your research)*
Participant interview data will possibly also be used for (but not limited to) future research projects, articles, books, academic and public presentations including podcasts, reports, articles, and similar.

3.0

If you plan to destroy your data, describe when and how this will be done? Indicate your plans for the destruction of the identifiers at the earliest opportunity consistent with the conduct of the research and/or clinical needs:
Online data will be deleted from the servers and any print data will be shredded after 3 years of research completion.

Documentation

Add documents in this section according to the headers. Use Item 11.0 "Other Documents" for any material not specifically mentioned below.

Sample templates are available in the REMO Home Page in the **Forms and Templates**, or by clicking HERE.

1.0 Recruitment Materials:

Document Name	Version	Date	Description
RecruitmentPoster_nonarachnophobic	0.01	1/18/2019 11:29 AM	

2.0 Letter of Initial Contact:

Document Name	Version	Date	Description
InitialContactLetter-Anna-thesis2018 ROWE	0.04	12/17/2018 8:19 AM	

3.0 Informed Consent / Information Document(s):

3.1 What is the reading level of the Informed Consent Form(s):

3.2 Informed Consent Form(s)/Information Document(s):

Document Name	Version	Date	Description
InformationLetterandConsentForm-Expert Participants	0.05	1/18/2019 12:00 PM	
InformationLetterandConsentForm_non arachnophobia.docx	0.03	1/25/2019 12:28 PM	

4.0 Assent Forms:

Document Name	Version	Date	Description
There are no items to display			

5.0 Questionnaires, Cover Letters, Surveys, Tests, Interview Scripts, etc.:

Document Name	Version	Date	Description
AnnaThesis_InterviewScript	0.05	1/18/2019 12:11 PM	

6.0 Protocol/Research Proposal:

Document Name	Version	Date	Description
There are no items to display			

7.0 Investigator Brochures/Product Monographs:

Document Name	Version	Date	Description
There are no items to display			

8.0 Health Canada No Objection Letter *(NOL)*:

Document Name	Version	Date	Description

Document Name	Version	Date	Description
There are no items to display			

9.0 Confidentiality Agreement:

Document Name	Version	Date	Description
There are no items to display			

10.0 Conflict of Interest:

Document Name	Version	Date	Description
There are no items to display			

11.0 Other Documents:
For example, Study Budget, Course Outline, or other documents not mentioned above

Document Name	Version	Date	Description
There are no items to display			

Final Page

You have completed your ethics application! Click "Continue" to go to your study workspace.

This action will NOT SUBMIT the application for review.

Only the Study Investigator can submit an application to the REB by selecting the "SUBMIT STUDY" button in My Activities for this Study ID:Pro00084867.

7.2. Interview Data

The following documents contain the Initial Contact Letter form, Information Letter and Consent Form, Interview Script, signed consent forms from the six interview participants, and the transcribed portions from each interviews.

7.2.1. Recruitment Profiles

Biographical information was collected through conversations in the interviews. Below are short biographies of the participants who chose to be acknowledged.

Dr. Crys Brown is a registered psychologist based in Edmonton, Alberta. She currently has her own clinic called Brown Psychological Services. Brown holds a Bachelor's degree in Psychology from the U of A and a Master's degree from McGill University in Counseling Psychology. She has over four years of professional experience in the area of Exposure & Response Prevention, Dialectical Behavioral Therapy, and EMDR.

Dr. Stéphane Bouchard is a pioneer in the field of treatment of anxiety disorders. Dr. Bouchard is currently a professor at the Université du Québec en Outaouais (UQO) in the Department of Psychoeducation and Psychology. He is also the co-director of the Cyberpsychology Lab of UQO which includes a unique immersive vault for mental health research in the world. He is the Canada Research Chair in Clinical Cyberpsychology. Since the 2000s he has focused on the use of virtual reality and telepsychotherapy. He is now at the intersection of several disciplines (3D arts, computer science, cognition, mental health, psychopathology, psychotherapy, human and psychosocial factors), which allows him to create, validate and test the effectiveness of technological tools to better help people with psychosocial adjustment issues. With Brenda Wiederhold, in 2014 he published the book Advances in Virtual Reality and Anxiety Disorders.

Dr. Joel Roos is a registered psychologist based out of Calgary, Alberta. He has experience in the public health system where he practiced tertiary clinics for chronic diseases and pain management. He is currently the Clinical Director of the multidisciplinary practice

(www.growthelife.com) Cultivate in Calgary. He specializes in chronic pain and disease management, anxiety treatment, clinical hypnosis, VR therapy, supervision/training of health professionals and many more.

Alexia Bucklet is currently working as Design Operations Director and UX Designer at Minsar. Minsar is a software platform that helps to create and distribute immersive 3D experiences for the emerging world of mixed reality. She completed her both bachelors and masters degree from Université Paris X Nanterre, France in Cognitive P sychology. During her masters, she mainly worked on Human-Machine Interfaces ergonomics and serious games. She previously worked as a UX designer at Ubisoft, Softbank Robotics: Humanoid Robots NAO and Adobe.

Krista Jäntti is currently the Lead UX designer at VARJO. VARJO builds high fidelity headsets with human eye resolutions and a VR software platform. She graduated from the University of Helsinki, Finland in 2001 with a major in Microbiology and Computer science. She worked as a software developer for seven years and switched to user experience design in 2014. She has been working in the space of virtual reality since 2018.

Thomas Jeffery graduated from the design program here at the University of Alberta with a degree in Visual Communication Design in 2017. Previously, he worked at a design studio called KEEN and currently is working as an Educational Materials Designer and a UX designer at Academic Technologies in the Faculty of Medicine and Dentistry at the UofA. A recent design project involved creating a neonatal resuscitation training serious game called RETAIN with the Department of Pediatrics.

Tyler Wilson started his career as a forensic archaeologist and is based out of San Francisco (USA). He switched his career to UX Designer in 2011 and has been working at Helios Technologies which is a part of Freeman, the world's largest brand experience company. Wilson is an active research member of the design and tech community giving talks on immersive media and experience design. He is currently working with Vineti, a Personalized Therapy Management (PTM) platform which enables technologies to align and manage the production processes of the cancer patient journey.

7.2.2. Information Letter and Consent Form

INFORMATION LETTER and CONSENT FORM
for Expert Participants

Study Title: Augmented reality based hybrid narratives as a therapy for arachnophobia

Principle Investigator:
Anna Chakravorty
MDes student, Design Studies
3-98 Fine Arts Building
University of Alberta
Edmonton, AB, T6G 2C9
Phone: (780) 729-5252
E-mail: chakravo@ualberta.ca

Supervisor:
Aidan Rowe
Associate Professor, Design Studies
3-77A Fine Arts Building
University of Alberta
Edmonton, AB, T6G 2C9
Phone: 780-492-8591
E-mail: aidan.rowe@ualberta.ca

Background

You are being invited to participate in a semi-structured interview for this research project because of your position as an expert or industry professional in the areas of **cyber-psychology, specific-phobias, Virtual or augmented reality, serious gaming on mental health and interaction design for immersive media.**

Your contact information was provided to me through my academic or professional circle of colleagues, or via articles, books that you have written in the areas of cyber-psychology, specific-phobias, Virtual or augmented reality, serious gaming on mental health and interaction design for immersive media or through public domains.

The results of this study will be used in this research project and in future academic and public presentations including podcasts, reports, journals, articles, and similar.

Purpose

The purpose of my Master of Design thesis project is to study how augmented reality can be used as an adjunctive measure to arachnophobia therapy through interactive narratives and how the user experience can gradually assist individuals in managing problematic fears—optimally fostering an evolution towards new methods and practices for other psychological therapies.

Study Procedures

- For this study I will be conducting 6 to 8 semi-structured interviews with experts and industry professionals in the areas of cyber-psychology, specific-phobias, Virtual or augmented reality, serious gaming on mental health and interaction design for immersive media.
- As an expert interview we will follow a semi-structured format, where you would be expected to engage with me in a dialogue focused on the themes of my study, specifically in the overlap between your area of expertise and my research project. Our interview will follow a guide and lead-in questions, but otherwise the goal is to have an conversation that follows an open-ended format.
- **Each interviewee will be expected to engage in one interview of approximately 60 to 90 minutes.**
- Your interview will optimally be conducted in-person in a quiet room where interruptions will be minimal (a private office or studio). When an in-person interview is not feasible then the interview will take place over the phone via internet (VoIP) such as Skype, Source-Connect Now, etc.
- Audio from each interview will be recorded and relevant portions of the audio will be transcribed.
- Type(s) of data to be collected:
  - 6 to 8 expert one-one interviews (60 to 90 minutes in length) that follow a format of back- and-forth dialogue, reflection and critique.

Augmented Reality based hybrid narratives as a therapy for arachnophobia | Ethics ID Pro00084867

- Your name, position and institution will be publicly identified/associated with your interview responses. Pseudonyms will be used on request.
- Interviews will be recorded using a digital voice recorder and then relevant portions of the interview will be transcribed. I will index and mark meaningful sections from each interview and then further analyze the data to reveal interrelationships and themes.
- All audio data from your interview will be retained and possibly reused for future studies.

- Procedures for reviewing and responding to your interview data:
  - I will upload the raw data (audio recording) from your interview into a secure, encrypted Google Drive folder within 2 weeks after your interview date and email you a private link. You will have the ability to edit, change or withdraw data that you have contributed via an ongoing back-and-forth dialogue with me, for the 6 weeks following your receipt of the raw data (i.e. from the day that I email you the link to your interview audio).
  - Any follow-up conversations will also be audio recorded.
  - Relevant portions of the interviews and follow-up conversations will be transcribed. I will index and mark meaningful sections from each interview and then further analyze the data to reveal interrelationships and themes.
- Portions of audio data recorded during your interview may be used as written quotes in the study document.
- **The research portion of this project will run from April 2019 to no later than November 2019.**

Benefits

- Your participation in the proposed research offers you no direct benefit.
- It is envisioned that the results of this development would help to expand the application of augmented reality and can serve as a possible model for therapy for arachnophobia in an accessible and economical manner.
- It is also envisioned that the results of this development can serve as a possible model of other psychological practices areas it is hoped that my dissemination will have value outside the field of design.

Risk

- Your participation in this study may cause you to face some minor social or cultural risk, given that your name and professional position will be attached to your interview, and interview audio and responses may be made public.

Voluntary Participation

- You are under no obligation to participate in this study. Participation is completely voluntary. You are also not obliged to answer any specific questions during the course of the study, and you can opt out without penalty at any point during the interview.
- You can also ask to have any collected data withdrawn from the data base and not included in the study by notifying me by email chakravo@ualberta.ca within 8 weeks after your interview date. In the event of opting out, the digital data from your interview will be permanently deleted from the digital voice recorder and any other digital storage location, and paper records will be shredded and recycled. Records will be kept stating what data has been erased/destroyed, when, and how.
- As participants, a gift card of $10 will be provided as a gratitude for your time.

Confidentiality & Anonymity

- Data from your interview will be used within my study, and also possibly within research articles,

Augmented Reality based hybrid narratives as a therapy for arachnophobia | Ethics ID Pro00084867

7.2.3. Signed Consent Forms

INFORMATION LETTER and CONSENT FORM
for Expert Participants

Study Title: Augmented reality based hybrid narratives as a therapy for arachnophobia

Principle Investigator:
Anna Chakravorty
MDes student, Design Studies
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3-77A Fine Arts Building
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Phone: 780-492-8591
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Your contact information was provided to me through my academic or professional circle of colleagues, or via articles, books that you have written in the areas of cyber-psychology, specific-phobias, Virtual or augmented reality, serious gaming on mental health and interaction design for immersive media or through public domains.

The results of this study will be used in this research project and in future academic and public presentations including podcasts, reports, journals, articles, and similar.

Purpose
The purpose of my Master of Design thesis project is to study how augmented reality can be used as an adjunctive measure to arachnophobia therapy through interactive narratives and how the user experience can gradually assist individuals in managing problematic fears—optimally fostering an evolution towards new methods and practices for other psychological therapies.

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- Your name, position and institution will be publicly identified/associated with your interview responses. Pseudonyms will be used on request.
- Interviews will be recorded using a digital voice recorder and then relevant portions of the interview will be transcribed. I will index and mark meaningful sections from each interview and then further analyze the data to reveal interrelationships and themes.
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- Portions of audio data recorded during your interview may be used as written quotes in the study document.
- **The research portion of this project will run from April 2019 to no later than November 2019.**

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- Your participation in the proposed research offers you no direct benefit.
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- Your participation in this study may cause you to face some minor social or cultural risk, given that your name and professional position will be attached to your interview, and interview audio and responses may be made public.

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- You are under no obligation to participate in this study. Participation is completely voluntary. You are also not obliged to answer any specific questions during the course of the study, and you can opt out without penalty at any point during the interview.
- You can also ask to have any collected data withdrawn from the data base and not included in the study by notifying me by email chakravo@ualberta.ca within 8 weeks after your interview date. In the event of opting out, the digital data from your interview will be permanently deleted from the digital voice recorder and any other digital storage location, and paper records will be shredded and recycled. Records will be kept stating what data has been erased/destroyed, when, and how.
- As participants, a gift card of $10 will be provided as a gratitude for your time.

Confidentiality & Anonymity

- Data from your interview will be used within my study, and also possibly within research articles,

Augmented Reality based hybrid narratives as a therapy for arachnophobia | Ethics ID Pro00084867

presentations, teaching, podcasts and web postings. Your data will not be anonymous. Your full name, institution and position will be identified with your interview data and you will be identified in the dissemination of the research.

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Further Information

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- The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615. This office is independent of the researchers.

Consent Statement

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STÉPHANE BOUCHARD , JULY 3rd 2019

Participant's Name (printed) and Signature — Date

Name (printed) and Signature of Person Obtaining Consent — Date

Interview Date — Final Day to Withdraw Data (8 weeks after interview date)

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KRISTA JÄNTTI — Participant's Name (printed) and Signature

14th May 2019 — Date

Name (printed) and Signature of Person Obtaining Consent — Date

13th May 2019 — Interview Date

Final Day to Withdraw Data (8 weeks after interview date)

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Crys Brown - Crys Brown — June 4, 2019

Participant's Name (printed) and Signature — Date

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Name (printed) and Signature of Person Obtaining Consent — Date

Friday May 31, 2019 — July 26, 2019

Interview Date — Final Day to Withdraw Data (8 weeks after interview date)

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Alexia BUCLET _____ _____

Participant's Name (printed) and Signature Date

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Joel Roos 	June 18, 2019
Participant's Name (printed) and Signature	Date
Name (printed) and Signature of Person Obtaining Consent	Date
Interview Date	Final Day to Withdraw Data (8 weeks after interview date)

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Thomas Jeffery _____ May 21, 2019

Participant's Name (printed) and Signature — Date

_____ _____

Name (printed) and Signature of Person Obtaining Consent — Date

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Interview Date — Final Day to Withdraw Data (8 weeks after interview date)

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Tyler Wilson *Tyler Wilson* 05/17/2019

Participant's Name (printed) and Signature — Date

_____ _____

Name (printed) and Signature of Person Obtaining Consent — Date

_____ _____

Interview Date — Final Day to Withdraw Data (8 weeks after interview date)

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7.2.4. Interview Transcripts

Thomas Jeffery

Anna [00:00:00] Can you tell me about your professional background?

Thomas [00:00:01] So I came from the VCD program here at the University of Alberta. Its been two years since I have graduated. I got a job at a very traditional graphic design kind of firm. After that I went from there to Patrick's group at Academic Technologies. at the university here at Faculty of Medicine & Dentistry. So I actually had found jthat in my degree I'd done a practicum with them for a semester and I was working on just projects within their group. So at the time it was a visualization for this physics concepts basically in terms of a we sort of ended up being a learned learning measuring system in terms of how can we create curriculum around these things. But it started as how can we animate physics concepts. So I think that's a very classic case of like you know it starts is really small direct scope 'I need you to make this little tiny thing' actually oh let's think about the big picture what would actually most important in terms of what can design do to some of the bigger issue and then from there I ended up now working there full time. So all right. Yeah it does.

Anna [00:04:18] How long have you been working in the area of serious gaming and what is your design process for creating serious games?

Thomas [00:04:21] When I was in VCD we actually had a presentation about serious games and it was these interactive online sort of video games or educational games just for simple concept. The idea of a serious game sort of natural made sense and hence I just explored. OK. So Patrick has been making card games for a really long time. So he's really into basically just that cards and card games can solve a lot of problems. So just to model things as you know simple cards it really is a nice way to break sort of chunks of information out and to say OK this is you know this is this is an activity this is a verb. This is a thing right. So just a break out on a molecular level different pieces. So when we were looking at retain I think that is we had sort of talking this forward when you're looking at retain we really had this problem of understanding what was going on. Like is this really complicated resuscitation thing that was like really way over my head and you would not know science or medical background right.

[00:06:56] So we started out as routine. We created these physical pieces just to start to talk with. So we just said OK here's a tool that we're just gonna show it physically rather than verbally and then I can remember exactly where that idea came from but when we started exploring in that area just like we make a board game out of it. Is that easier than to talk with them to talk about and then to use that to start to model scenario. So if we have players coming in and basically you know moving around on the board or whatever that would look like from start to finish that was sort of where that idea of a game came out of thinking originally just as a way to understand. But then it started to become its actual its own output.

Anna [00:07:45] So how is the interaction design for Retain computer game different from the board game?

Thomas [00:08:03] I think that what one the main thing that we were thinking about in a board game is that a board

game is very much about communication in a real time setting. So like traditionally a board game where it is is that people sitting around a table together and you communicate and there's everything from body language to eye contact to you know the flow of conversation and these kind of things that are apparent in the board game you know face to face when we're communicating. It's not there in for example a chat base interface.

Thomas [00:08:33] And a chat based interface was actually I think even a step towards board game in the way that there is communication rather than for example if it's just a video game and you're isolated in this resuscitation thing with just computers or whatever. So the idea of communication really I think is the main difference for me that you can actually talk about things you can pause you can have a conversation and there's no limits of I guess technology hindering that communication which is a big thing. I'm really excited actually about the future of things like collaborative VR multiplayer.I think I think right now the biggest thing that's that's that's just a bad about VR is that it seems so isolated. It's like it's so immersive. But so it's so common to be just so isolated and you're in your own world completely cut off but if you can share those experiences ever you can enter into worlds together. I think that's super exciting okay.

Anna [00:09:50] How do you think serious game influence a person's cognitive senses and behaviour?

Thomas [00:09:57] As you heard from Maria. She of course knows more of the theory and the research behind why that is all happening.

Thomas [00:10:13] OK so I'm not as familiar with the technical parts of it but actually found really interesting in and actually preparing for that presentation. Maria is she brought forward the research that she had in terms of like this is what we were doing and retain and this is you know the principles of gaming. And I found it funny how a lot of what we had to work through the design in terms of what we thought would be better or worse or more intuitive or basically just a better design for the board game and then also the chat based interface. But in the position we look at the board game was that was a lot of it just connected directly to what G was saying we had a good thing to do. Yeah. So like it wasn't at all like we had sat down and look through these principles and said OK we need to have you know this thing and again we need to have this principle. But actually it happened more just through the design but it seemed to a lot. Your line with what the good principles of beginning work which was which is really validating for me as a designer knowing that oh like we had I had just done a good design or tried to do a design that seemed to be actually incorporating a lot of these good principles of gaming which I didn't actually know at the time. So it's interesting that you can get to the right answer in different ways I guess.

Anna [00:11:54] Can you explain me your design process?

Thomas [00:11:55] I think we really took the approach which was easy because it was the situation was that we didn't know anything right. So what is easy for us to understand this is what we put into the game. So you know if you need physical items to do gesture with or to better understand concepts. That's what we put in and that because that was easy for us as the lay person which you know as the non content expert to understand this. That's I think would be good for people learning in terms of a game set right. So I mean me and Patrick were really the ideal people we were designing for in a sense because we had these sort of very peripheral knowledge of what G tried to explain to us about our association and why we did these things we we weren't at all experts. So in our process was to make sure if this is

the right or wrong way to do it. But we ended up just trying and basically designing for ourselves as the novice learner. The idea of of using objects as as verbs or as breaking out these kind of things on different molecular levels. So if you have these broad abstract categories then how can that be broken into smaller. That's how we looked at it. So if we have you know an action that consists of six things then how can we look at each of those things and what's important.

Anna [00:13:31] Do you use any guidelines or designed framework for your design process?

Thomas [00:14:03] I think we looked at a bunch of different things so it's like for example we were like We terms of the specific interface in the digital version. We models some of the chat based after the Google materials design guidelines for example. And when we when we did for example the board game we we looked at a bunch of different games. We actually went to a coffee shop working at a board games and just started playing games and seeing what was interesting seeing what was worked well saying what we thought would work well for our scenarios. So I think we sort of just tried to look everywhere I guess. And I know in terms of like the principles of design and things like that I think that a lot of it was in our minds just a good design was you know things like you know just all principles and things like that is a little bit.

Anna [00:14:59] How do you evaluate your designs?

Thomas [00:16:17] It depends. So for RETAIN, you need the sort of foundation of science knowledge just on the interest list and into. I guess the first user group to test our first prototype was a game. So that was that was real interesting to get a bunch of different perspectives from you know very sort of more competent even people in it Neutology. the resuscitation team needs to be something that's very diverse so you have people who are very very experts at things like the actual resuscitation event. So people like Georg who is at a neontologist just then he also have respiratory therapist, nurses and other people who might have you know varying degrees of knowledge and skills in terms of this practice of resuscitation but all those people on a team work together. So it's interesting to have then someone like a medical student who might have a very low knowledge but might be more representative of you know a therapist or a nurse or a fellow or someone else and then also having an expert like you are meant to lead that team. It was interesting. Okay. And from there I guess we just started working with the people with Royal Alex hospital.

Anna [00:18:37] How is the feedback regarding this game?

Thomas [00:18:38] Well it was it varies. So sometimes it was not very good design feedback like oh this is great. Keep it up for it. It's like doesn't really help. But occasionally we actually add some really interesting ideas and feedback come out of those sessions. So the idea of having the physical items originally we just had cards because it was sort of actually originally sort of the card game. So the idea of having those physical items actually as pieces to move round the table and to stick on the baby and do the things that came out of one of the nurses I believe on his care team. So that was actually landed some really good insight into what they needed to play and because we're obviously not we don't know how to do with the resuscitation and they do. So they sort of say Oh to do organization to the model that in this game I need I need this card or I need this piece. Right. So it was really interesting in that way.

Anna [00:19:30] When designing for a healthcare system what are your key concentration you take into account?

Thomas [00:19:57] I think for for us one of the most important things is to know that you're not the expert. So you can't

like you have to make sure that you collaborate with people who are. I mean you can't really be a solo designer in any way for the most part. Like in health care design because you know I'm not a doctor I'm not a physician I'm not any medical expert. So it's I think in that way designing for something like health care is even more of a collaboration rather than more of a service that design sometimes. And many times it ended up being more of a real time design. Let's sit down together and start to like this. And I think the other thing is there's a lot of ethics that revolves around specifically or at least more importantly in our minds in a healthcare setting. So you know teaching someone the right way to do something or the safe way to do something becomes a lot more important. It's actually talking about saving someone's life at least in my mind. Then if it's just the right way to defend from a zombie attack in P&Z game. I cause me more in my mind way more important in terms of to do it justice and to get the right outcome.

Anna [00:21:26] And what about the visual systems?

Thomas [00:21:59] Yeah I think on a really really generic sense I think that design like in my design doesn't have a stop. Design should be in the context of whatever it is and then the style should be the most appropriate thing that does that job. So in healthcare I think that that just informed a lot of decisions okay what should this style be like or how should it look was dependent on what the context was. So you know it's for example in a we got toured through the resuscitation room so basically the medical rooms where this event happens is this baby is just dated so a very medical like very you know a lot of big machinery all sort of surrounding this little tiny cradle. And I think actually that experience of being in the hospital of being in the infestation room and seeing how they're actually going to be set up when they actually do the real life resuscitation informed some of the visual design of what the game looks like. So just the general color palette for example it was like a blue teal kind of thing. Now that was more just a decision to look at what's a like what do people think of when they think of health care. It's sort of like a scrub color you know like that goes sort of a blue kind of thing. I mean obviously there's you know in terms of color theory there's no right or wrong really. But a lot of that was just based on what would make more sense for people. So if they if they think about health care if they think about these kind of things that's the color that they could usually associate that with. So that was a lot of that thing. And then in terms of just like the design style and the visualization of it like that the typography and the design of the icons and all these kind of sort of more simple design things we really just try to keep it as simple as we could. So it's in the same way that we talk about this this need for getting it right. I think it was just the least confusion and the least you know as as minimally styled as it needed as it needed to be so the communication was very clear. That was what we tried to do.

Anna [00:24:10] What challenges do you face as a designer when you're working with professionals in the field of medicine?

Thomas [00:24:17] I think that idea of breaking the surface relationship and not as much of OK. Like a classic thing in someone saying oh I need you to make me a poster. It'll look like this. No just make it right. And that's sort of in my mind taking away any of the value of design and actually just saying can you create something for me that I've already designed right. So that's the worst case scenario. Let's just say so I think if we can if we can put it into more of a collaboration that I think is is where designers can actually provide real value so then it's it's getting information and and what's needed to design out of those content experts like Georg and and Maria and everyone also working with and in the end I think designers seem in this place to act almost as more as project managers and that they sort of

have to coordinate everyone's thoughts and effort and put it into and translate it into whatever the design will be. So it's it's interesting in that way.

Thomas [00:25:29] So part of that idea I was getting into collaboration because I think that's where you need to get to any difficult to get that way because you know especially with doctors in North America more than anywhere else it's doctors are at the highest level right. So in terms of hierarchy and prestige just like you're the smartest person ever seen and that's all I think a lot of doctors are about whether it's intentional or not. And the sooner you can break down those barriers of Hey we're on this you're more or less on the same level we're working together to do something the faster you can get to something that's really interesting and meaningful. So I think Georg was actually really wonderful to work with in the way that he very quickly realized that it's more of that collaboration and more of and less about him telling us to do something that he has thought through or whatever and more about him coming with a problem and we'll work through it together.

Anna [00:26:22] How do you distinguish yourself from other designers?

Thomas [00:26:32] I'm really interested in experience but I don't know for sure if that's you X because you X is sort of this box that I sort of identify with and am interested in but it's I don't think I mean I don't think I'm just a UX designer. I don't think I am the expert. I'm sure but as you know as you sort of alluded to the very start. It's like design is really trying to define itself in all these different ways and everyone has a different idea of what it is or what it means. So the strongest association for me is something like a UX designer I think because it's it's about every kind of touchpoint your experience which is basically the definition of the US design it all lends itself to the final thing right. Anything else that makes the communication better realm and all of the little pieces along the way really matter. So whether it's how you how you word the email that someone might get as an invitation or in terms of the language in terms of the design in terms of how simple it is to find information. These are all these things matter. So for me I think that something like a user experience designer because that seems to be an all encompassing thing.

Anna [00:28:04] How important is the role of the designer in the field of medicine?

Thomas [00:28:10] I think it's I think it's really important. I think it's especially North America just starting to be understood. I heard a podcast which talked about where the design is moving.So ittalked about the three different generations of design. The first generation design department. The second generations is designer has a seat at the table so that you can you add that higher table making decisions in a part of the larger group. So it's it's not that you're secondary but it's actually part of the main decision making process. The third generation which they're saying is sort of coming now is that design is actually throughout the entire company. So it's it's throughout the communication it's throughout the engineering it's through every single thing ingrained in all of those different departments so it's not at all separate it's actually enthralled within everything. I think that that's super interesting to me in that I think that design is about all of those little tiny pieces. Right it's about giving everything I mean everything to an extent a certain extent everything needs to be designed it is thought of like a system right. Yeah exactly. So it's basically like you design.

Thomas [00:00:04] So I think design and medicine I think is really an interesting piece because of the weird system that medicine exists in. There is so much old that hangs around like there's because of the decision making because of the different processes that you know in terms of privacy security all these things they they end up big stuck on.

For example like Windows in government and in healthcare is still a big thing because they made a decision and now it's hard to change because well that's all of our security than that thing. So we can't just move to the program. In that way I think there's so many like medical basically any any UI and medical that's terrible and absolutely terrible. You've seen many but it's just like everything they're using for all the back end things and input data to patient charts all these things just the worst design ever. I don't really know why other than it's just they don't. They can't really change because they're stuck in this thing that those decisions are made for a reason than they find it hard to get out of those things because it's all about patient confidentiality and privacy and security and all these things that it's hard to change. But it's funny how things like medical forums so like patient forums or prescription bottles or these kind of classic design projects are actually really really important because it's about just like I said for the board games about things actually really matter. Like it's about like potentially life or death or other things. I think that in medicine at least here at the University I'm actually really seeing this sort of a weird split between people who have discovered design and be like oh I see the value that design can add and I didn't realize that was the thing before to people who just haven't discovered design yet who say oh this is just the way it is this is how we do things, this is what our forums look like right.

Thomas [00:01:56] Yeah. So I think in a weird way design is sort of this this attempt to change in medicine which is really a slow moving process especially in medicine especially in government and things like that.

Anna [00:02:19] Who in that industry do you follow or read?

Thomas [00:02:26] I know a lot of podcasts so there's there's ones there's a Google design podcast there's Google materials podcasts there's Invision actually has a really good podcast. So there's one called Design Matters which I love.

Anna [00:05:16] Do you have any apps or games you think have a good user experience design?

Thomas [00:05:29] When you were testing your games which one did you feel. Good. I don't know I think there's I think there's always part of everything I look at but it's like you can critique a little bit and like I'm not sure why they made this decision. But what I've also come to learn is that it seems like every decision that might be a bad decision is always because of something. So it's like they had to compromise on some aspects and that's why it is not that they chose to make it bad design or anything like that as generic as it is. I think a lot of the Google stuff is really interesting. It's very clean and its entire system is there in terms of things that you get used to. So in terms of like apps I think the ecosystem of Google does something really nicely that other larger systems don't really do. For example like Adobe nothing matches operate it's like shortcuts don't work like everything is completely different. Although they have connected apps it's like everything is a separate thing where Google I think does it really well in a way that everything in their thing is is using the same kind of interactions and thinking of design so you get familiar with those ideas as well as trying to constantly improve clean UI aesthetic.

Anna [00:00:03] How do you come about your narratives for the game?

Thomas [00:00:22] I think there's a few really guiding things in me that I am interested in. One of which is I think just the word experience. So everything from you know if I'm walking in the room how am I feeling. I'm thinking what am I interacting with what interacting with me. How are we talking what do these kind of complex things that make up

everything that I'm experience. So in terms of design that could be you know what am I doing what I'm interacting with what you know what's what's happening. I find that super interesting. The other is something around thoughtfulness so about I think that really just connects to why I think design is interesting as any use for you said it yourself is just the question of why. I think everything sort of has to have a reason in my mind at least like any anything that's random doesn't make any sense and sort of gives me anxiety. Although there is a place for random things like board games chance but that even in itself has a reason. So the idea of asking why is really important.

Thomas [00:01:26] And I think the last thing for me is I think there's moments in life that are these really poignant interesting memorable moments that everyone has. And it's the kind of thing where you watch a movie and you just get chills or you or you hear a certain point in the song and you get chills. I'm getting chills is common in this kind of emotion. And those are the really memorable things that I think that also if used really effectively can potentially add to things like how can you how can you learn something better. How can you remember this thing or how can this have a lasting impact on your life as well as I actually sort of think that that kind of deep emotional feeling whether it's sadness or happiness or elevation or just or relation or anything like that kind of deep thing is sort of the point of life like what else is the point other than to just be emotional in that way. So I'm really interested in those moments and that Toy app is one of those things where I think it's just this really really complicated emotion that deserves some sort of thought. I actually have a list of moments that I have started recording these moments in in a in a wiki that I have. It is basically just like potential things to explore for VR. Of like these kind of moments that you can play out there.

Alexia Bucklet

Anna: Can you tell me about your current and previous background?
Alexia: Currently I'm working at MINDSAR who developed a software to create immersive experiences without any development skills. We want to democratize the immersive technologies because um, there are two main things preventing people to adopt immersive realities. Firstly, the lack of contents which we are want to solve and the user experience of those devices. So I'm really concerned about those two problems at my current job since I am a UX designer and design operation director at this company and previously I was working in robotics, video games and the marketing software.

Anna: So what are your perspectives on the current and future possibilities regarding augmented reality and virtual reality and how do you see their adoption and application of the immersive media?
Alexia: 03:30 I think they will be more and more adoption, thanks to the decreasing graph in price and, and the user experience will be way better because currently to setup VR device is really cumbersome to fit in your room and if you move one sensor, then you have to do it all of again. It's really annoying and this is the one of the reason why people don't use it very well right now. But I think when we will have the devices compatible with the population expectation and not only the early adopters as are right now. We have a infinite of possibilities of our application. You can use it for everything. I think we would be surprised by how this will be used in the future.

Anna: How do you think augmented reality is reinventing user experience and user interface?

Alexia: Augmented reality is more apparent with Hololense and Magic Leap because augmented reality for mobile phones is really influenced by the current 2D mobile standards. You can put things on the screen and as usual to the devices, you can display some elements in the depth but it's not that much different, I think because you still have the screen and and hence the interactions are quite the same. But for HMD's it's really different because you don't have a screen anymore to interact with as the screen is on your eyes. So you are learning ways to interact with the new experiences and interfaces. Then there is 3D matter. It's really different. You don't have the same integration, you don't have the same way to present information. You are in 360 and so the information can be behind you. It's really different and it's quite hard to think of all possible scenarios that can happen and some different scenarios like 'What to do if they are looking somewhere else during your information showcase ? What if someone comes in the room and they start talking to them, what do you do? The rule changes because when someone take the chairs and move, you have a lot of different things to think about.

Anna: How can you improve experiences currently in immersive media?

Alexia: Our eyes are quite magical.But I think eye tracking will be able to reinvent the way we interact with things depending on if we look at them or not. Since our eyes are always stimulated itt really helps us to understand where the user pays attention and to what.

Anna: If you have tried other VR and AR apps, which do you think are really have good user experience design?

Alexia: Um, I think tilt brush because you have a lot of possible interactions. The rolling brush in controllers, it's a really clever idea and it's great.

Anna: How do you think immersive media effect a person's cognitive senses and behaviour?

Alexia:In VR, you simulate the physical world and hence almost all your senses are stimulated. So you behave like you do in reality. For example, "My friend and I were playing a VR game and I asked for the controller and my friend threw the controller towards me and I actually ducked down and save myself from the virtual controller!" Also, there are examples of virtual VR social scenarios where females felt uncomfortable when someone was too close and felt like someone invading their personal space!"

Anna: How different it designing for AR say magic leap compared to VR say HTC Vive?

Alexia:Difference lies on device possibilities. For example, Hololense you have no controller, Magic leap you have two button controller, Htc vive has six button controller etc. so there are different possible interactions. Other thing is in VR, you have to take care of the reality or the physical world. It really depends on the base capacity. AR headsets have lesser performances regarding rendering. So you have to work with really optimizing the 3D models but I think in future there won't be any difference. I don't see why you want to use different models in AR and VR.

Anna: Can you suggest me any guidelines for designing AR interfaces?

Alexia: Magic leap, hololense have built universal design guidelines personally I use a bit of everything. I like to say that all machines are quite the same to work with but its the understanding of human behaviour that helps me to design.

Anna: I read in your article that you've studied masters in cognitive psychology. How does it impact your design process?

Alexia: 26:12 I learned the psychology of space as well as your personal space - 'How you behave, depending on where others are?' How is your emotion, how would you perceive it? How you express it? and how you learn in a group to see resolve problems?' And it's really useful as to know how all this works and helps me when I am designing something for someone that I don't know. You also need to get the knowledge on how humans behave in specific context to run researches without any bias and I think psychology is really useful for this.

Anna: Do you see any distinguished roles in the role of a designer and role of psychologist when you are designing user experience?

Alexia: Both the studies that I followed, it is quite the same. The two experiences are mirror. But there are lots of ways to become a UX designer which do not meet the accreditation standards as compared to psychology. And hence I think many don't have the skills, for example, to run the user test unbiased or understanding the human behaviour which are quite difficulty since I got 5 years training in it. But on the other side for designer one would be more able to a design an aesthetically cooler interface. I'm not skilled at all at the aesthetic part. I'm really into the interaction, information architecture. So if you want a UX designer that focuses on experiences and interactions then the psychology or computing experience is beneficial. UX design roles are defined by the company's need. Some want them for wire-framing and make costumer journeys and other for making an app. Here in psychology they react as 'technologies. What are those?' And lot of designers ask me how I became a UX designer if I studied psychology!

Anna: How do you imagine the use of immersive media in medical care?

Alexia: I think this will be really cool because I, uh, I saw, for example, an reputation for kids, uh, when they are your best. No, So with the character that you follow and everything, and it's University of in a way, uh, to make doctors, uh, to make it easier for doctors to, Kevin can hold the year around the killer. You don't like to go do this [inaudible] it goes with things. So I think it can be a fool to, we like a drain. The also doctors because, uh, if it's really immersive so you can simulate, we conditions, uh, of a consequence erosion or, or something else and it can help you or to, to train, uh, without icing really have full for, uh, for patients and for doctors also. And I, it's not my field of expertise, but I think there are other things to be done in this field.

Anna: Have you ever designed any immersive content for healthcare? If yes, what is it?

Alexia: Immersive content no but I worked on robots. I worked on placing the robots in hospitals to give some company for elderly people or hospitalised people. We ran some research around the expectation of the robots because old people have concerns about security but they worked with me and their opinions changed and were different when they saw and were like, this is so cute!

Anna: During the development process for immersive media, how do designers aid the development process and what stage do they enter?

Alexia: I think as we work on the same project, we have to be friends. A designer's role should be from the start and not "oh now we want some assets or now we want something pretty, find some designers!'

Anna: What challenges do you face when working with a developer?

Alexia: In past working places, some of the developers would think they are better designers than you because they know the tool. In this company, when you have a developer that understand you and you understand them everything works fine because we learn and adjust on how to speak each other's language and jargons. So it's not a challenge. It just working with someone that doesn't think in the same way as yourself, but it's great because it really enriches the data and I think a good idea can come from anyone.

Anna: Is there any need for designers to create immersive experiences ?

Alexia: I think currently the adoption of these technologies is due to the lack of content. So the more you will have the, people to create experiences the more the need for designers will exist. I think designers of really about to play in this field because if you have only developers working on it their main objective is looking at technical aspects but it's not always adaptive to the audience. So you need designers to make this technology to adapted. So it's a real teamwork.

Dr. Crys Brown

Anna [00:00:06] Do you give me the consent to record this call?

Crys [00:00:11] Yes of course.

[00:00:38] Thank you so much. Can you tell me about your professional background and for how long have you been working with exposure therapy?

[00:00:46] OK. So I am a registered psychologist and I've been registered for two years now but for exposure therapy for almost 4 year now and a bit before that because we work before we're registered here in Alberta. So exposure therapy is one of my main areas of work.

[00:01:11] Can you please briefly explain me your process of exposure therapy for specific phobias and what tools do you use?

[00:01:27] You know when I am treating any kind of phobia or OCD or PTSD so basically disorders where avoidance and really high anxiety have become a really big component. The first thing I want to do is a really thorough assessment to figure out what sorts of triggers exist in the environment for the person. So for example with blood, an injection phobia often people have triggers that have to do with medical equipment sometimes language. So words like blood or vein sometimes can trigger and say taking someone's pulse would be very difficult. And so you just kind of talk through what sorts of triggers the person is encountering. And after that I teach people how to use a rating scale from zero to 100. So they might say saying the word blood puts me in an anxiety level of 30 out of 100 that getting my blood taken or getting an injection that's 100 out of 100. And we put them in order so that people are starting to approach triggers when we start this therapy that are a little bit less intense for them and we call that an exposure hierarchy. And so basically it's a graded list from easiest to hardest triggers that need to be approached. And then we basically to start at about a level of 30 or 40 so triggers that are going to elicit a little bit of anxiety but not overwhelming. And we have the person approach that trigger and then record their level of anxiety each time they approach it. So the first time they might say oh you know I looked at the word blood written on a page and my anxiety got to 30 and I did that for a few minutes and then went back to next day and it was a little bit easier. There was a 20. And you do that until they have habituated to that trigger. So it's not arousing anxiety anymore. And then it's tools. Often the exposures that we're doing involve real objects. So that's one tool. So I might bring a syringe into session I might bring a it can into session for a blood an injection so we can have the person handle and look at those items. So that's one kind of tool like a prop. I also do use a lot of still images. And so what what I do and what a lot of people do is we set up slide shows on PowerPoint so often I start with animated images. So illustrations for example of someone getting their blood taken. Those are usually a little less anxiety provoking for the person. And then I might go to real life photos of people looking very calm getting their blood taken and then I might have photos of people getting my blood taken and the person looks like they're not enjoying it very much. And then I might do close up photos and then often we go on to videos after that. There can also be audio components.

[00:04:38] How do you select your visuals or props?

[00:04:47] So usually I do my own selection with especially simple phobias. So the ones that I treat most often are a

emetophobia. So here vomit and vomiting and then also blood an infection of the two. I treat most often but with OCD. Essentially you can think about OCD as a disorder just involving dozens of little phobias and no similar exposure process. But because people might have really unique triggers sometimes you do have to settle with a little bit so you there's. I would say like 70 percent consistency between people. You always have to do some little adjustments for some people one thing might not be as anxiety provoking so I do the selection all myself.

[00:05:39] Can you define me the role and interaction that the client/patient with the therapist perform during the therapeutic activity?

[00:05:49] So the role of the clients in this is usually explained very carefully is to try and keep their attention as much as possible on the stimuli. And so it's important to not be distracted or to be doing what we call safety behaviors or if it's OCD that compulsions. So these are behaviors that people might do to try and neutralize their fear of something. And so you just want to remind them to not be doing anything to distract themselves or try and reduce their anxiety while they're working no breathing exercises. No no nothing. You want to let the anxiety completely rise on its own so that the person can observe that they don't have to do anything to make the anxiety come down that it will come down on its own. And then the role of the therapist I think of it as like a coaching role. So I encourage clients I say hey you're working really hard. I don't reassure them at all. So I don't say like oh it's not scary Oh it's not a real need. Oh do you not get a picture you never say that exact sort of thing. And yeah it's mostly just to encourage and then also to draw their attention back to the exposure. And then sometimes you have to do a little bit to make sure that the person is actually emotionally engaged in the exposure. And so that might involve actually making some statements that help to elicit a little bit more anxiety from the person or to just draw their attention back to the stimuli.

[00:07:25] How do you enhance the user engagement and experience during your sessions?

[00:07:34] I think that the use of exposure props is part of how we enhance the engagement. Technically a lot of these things you could just think about them and they would elicit some anxiety right. Like my ability to do that I think, during an exposure. I might ask people what they notice, so I might say like when you're looking at this needle what kind of thoughts come to mind. Can you imagine what someone might use this for. What do you observe about it. How sharp do you think it is. Do you have any memories that come to mind. And so I really trying to solicit related stimuli and I also think that helps us generalize ability. Right.

[00:08:18] Okay. All right. What are the coping strategies you suggest that to your patients?

[00:08:27] Essentially saying that maintains phobic responses is avoidance and safety behaviors. So I encourage what I like to call approach behavior instead. And I like to encourage. I do a lot of psychoeducation about the nervous system basically so I let people know I say things like what goes up must come down you don't actually have to do anything to make your anxiety come down you don't have to avoid it. It will come down on its own. So there's a lot of coaching about that and I'm just asking people to stay in the situation in terms of external kind of coping strategies like you might use to purposely soothe someone's anxiety. There is actually a lot of that. If there's blood an injection phobia however some of those people have what we call a bagel bagel response which means that they can lose blood pressure and faint. And so there's a muscle tension technique that you have to teach to people that faint in reaction to those stimuli as well. Otherwise there isn't a lot of coping skills other than practicing the exposure right. Behold one of the big tenants of exposure therapy is that

no other coping skills needed.

[00:10:01] Well I think that something like arachnophobia could actually be self guided and so simple phobias would be like absolutely the easiest of all the things that I treat right. And so they tend to be pretty accessible sorts of triggers. There's nothing usually super immoral or dangerous or unreasonable about them. They're easy to find easy to access right. And so arachnophobia actually I think could be done on your own. Certainly though I think the parts that would need to be very carefully structured would be the rationale provision right. And so when someone's nervous system is really telling them they're in a lot of danger, the support of a therapist can mean the difference between success and failure with exposure. And I think the biggest risk to the person is if there is no one there to help them coach them help him make the exposure effective. There is a chance that people will become a little bit overstimulated and then abandon the exposure which is essentially just practicing having a phobia by getting anxious and then avoiding is what a phobia is. And so I would just that would be my one really significant reservation about self guided therapies.

[00:11:27] So what assessments do you use to diagnose specific phobias?

[00:11:35] I don't use any special assessments to diagnose phobia. You can use the DSM criteria for a little bit. Kind of loose. And for certain OCD there are assessments for sure. But I just don't know of any that have kind of the reliability and validity that's significantly above what I can determine as a clinician. Right. These are not super tricky to diagnose.

[00:12:11] How do you evaluate whether the patient has been cured of the phobia?

[00:12:18] So I think that first and foremost being able to restore functioning to them. Right. These are often they're way more than just being slightly afraid. So someone with blood an injection phobia when I see them they usually cast attend a doctor at all or a damaged stride that's really significant and so restoration of functioning number one. And then you know a simple way to determine that is partly if they're able to tolerate the most difficult exposures the exposure hierarchy. Right. And so I would say that someone is you know maybe partially treated if they're able to tolerate looking at a needle talking about blood walking past the blood donor clinic seeing someone else bleeding but not able to get an injection. They're not cured per say. Right.

[00:13:12] Do you face any challenges or any limitations with the exposure therapy?

[00:13:24] So I find exposure therapy to be very very effective kind of I guess kind of similar results to what research indicates that I should get. And so it's little. The treatments are very robust. The difficulties can come with the fact that it's a very difficult treatment for the client. Right. And so by definition you're asking the person to get anxious and that's just an aversive for most human beings. You don't want to feel that way. And so that can be a little bit tricky to motivate people to do that sometimes. Additionally if people have had bad experiences with exposure therapy that can especially be tricky. So people would know you have no training deliver it. People don't appropriately grade the exposures. They don't understand when one exposure is done. And you should go to the next. There accidentally may be falling into some safety behaviors with a client. And then people are not very motivated or hopeful about exposure therapy when they come to someone else even though they're there have you can troubleshoot those problems often pretty quickly.

[00:14:42] Do you use CBT with exposure therapy? If yes, how do you get people to approach ET?

[00:14:56] Yeah. I think that the biggest part of that is psychoeducation. So teaching them about how anxiety works and

encouragement right there because it's experiential learning. There's kind of not a different way to persuade people other than success and that's partly why that exposure hierarchy needs to be set up really well. And basically the first items you want that person to be 100 percent successful. That's what I'm aiming for. You might even if you have someone that's very scared you might take an item that's even a little too easy. They might say oh this is 20 out of 100 anxiety. And so you know that that person can tolerate 20 out of 100 anxiety and they gain confidence as they go actually exposure therapy is a form of GDP. I do a lot of exposure therapy but I don't use a lot of additional cognitive interventions.

[00:16:09] Do you use any reward system?

[00:16:13] I use praise and encouragement and so like when someone's tolerating a stimuli really well I give them a lot of encouragement. A lot of praise. I'm like hey way to stick with it. This is really hard right. You're doing great. Keep going. I'll mention to them that I think their progress is really great. They're working really hard and that kind of constant throughout treatment and so that is a form of interpersonal reward. And I also make sure that I point out that the person is doing the most work. So I make sure that they can feel proud about what they're doing. They feel empowered by what they're doing and that's a huge reward right. And that's a really important part. So I wouldn't just let someone successfully do an exposure and say OK you know again this is the next one and I make a really big deal out of every single success like. Hearty handshake big smile right. Yes.

[00:17:19] What are your perspectives regarding VR therapy for exposure or Mental Health apps?

[00:17:41] The VR research is actually like relatively promising the most recent stuff that I've left that seems to show like and effect size it's similar to traditional exposure therapy. I think I looked at some 2017 research recently and it was about the same effect. So for me though, VR would have to add something that I can't already do. So if there's a similar effect size. With what I'm already doing why would I then purchase additional equipment. Right. You know what I mean. You have to know where I do see a really huge potential is with phobias that are really hard to access like fear of flying. Yes. That's super super common. Very very hard to treat with traditional exposure therapy unless someone has a lot of money because you're just not going to have a lot of access to airplane rides to someone to repeat the exposure. So I find VR interesting. I would be open to using it in my practice but it would have to kind of be providing a clear value added. So I would need some research that shows that it's more effective than what I can do or it would have to give me access to stimuli that I otherwise can't access right. So that's the one thing and Mental Health Apps I find that while there are a ton of them they have tend to have not very good adherence from clients like clients do not use them consistently enough. I have clients you know mood tracking for example can be really really important to some kinds of treatment and clients just do not do it. So I thought at first I got really excited and looked into tons of different mental health apps but I find people get really interested for a couple of weeks and then they're using it 50 percent of the time and then they're not really using it at all. So I haven't really found any that stay over a month people use really really consistently. Like there's always maybe one client that has one app that they use but there's no app that I've ever found where you can give it to clients and even like two out of 10 are going to use it for more than a few weeks right. I'd say the adherence is very bad.

[00:20:09] Can you think of any reason why they stop using the apps?

[00:20:20] I wish I knew honestly I feel like my intuition has always been they'd be really helpful and so I keep waiting to be proved right. And I just can't figure out you know some of the apps aren't very visually appealing. By candidates

one called the key to Mood Tracker. That's popular with psychologists to recommend what it's really like not super user friendly. The interface is not very appealing. Sometimes there are too many options like the after too complex or they're not tailored enough to a client's needs. So you know my dream mental health app would allow the psychologists to setup what the client needed to do in the app. Right. That would be brilliant. So if the psychologist could say you need to track your medication and your sleep compliance and you need to do these three exercises where you look at you know Spider pictures for the first week and communicate your results to me in the app. Right. That would be brilliant. But so far I don't know of anything set up like that. Right. So it's just not. Clients don't want to look at 20 different things that they don't need for the one thing they do need right. Yes.

[00:22:12] Let's move on. I just wanted to us like how was the collaboration platform between psychologists and designers.

[00:22:20] But yeah I think that from what I've seen and this is not a great sample it's just too I know in Edmonton. Some people get student designers to set up their websites. Most psychologists build their own. I don't think my Web site is amazing but I think that actually it's a little bit better than some. Like I look at a lot of them there tend to be low collaboration with designers. To my mind. Yeah.

[00:22:48] All right. Do you want to share anything with me or do you have any questions for me?

[00:24:25] I think your research is really promising area of research and I'd certainly love it if there are some tools out there that could help folks. Especially simple phobia. Right. Like OCD PTSD. We treat these with exposure it's quite complex. So yes but simple phobias like this is something that people should have to live with. It's not terribly complicated. Oh that's good.

[00:25:11] Thank you so much for your time.

Dr. Joel Roos

Anna [00:00:03] Hi Joel. Can you hear me?

Joel [00:00:05] Hi there. I can hear you Anna and I understand you started our audio recording.

Anna [00:00:11] Yes I did. All right. So can you tell me more about your professional background?

Joel [00:00:18] Absolutely.So my name is tool belt. J O E L last name. R O O S. I'm a registered psychologist with the College of Alberta psychologist and I have been fully registered for about five years now. And yeah my background prior to psychology which he was in both mental health and yeah religion theology and philosophy. My interest in psychology a spurn out of my career choices. And yeah I'm also a member of the Canadian Psychological Association as well as a member of the American Society of Clinical Hypnosis. And so I have been working out Calgary here for about a decade. I have a master's degree in counseling psychology and that you're in graduate school time. I began work with a local counseling agency here. I worked with them on staff for about four years. Then I spent about another four years in the public health system with a specialty tertiary clinic for chronic disease and pain management. And yeah for about the last five years or so when that overlaps a little bit with my time at AHS I started up a practice called cultivate which is a private education and psychology practice. And yeah I've been using VR therapy since my days with public health.

Anna [00:02:13] For how long have you been involved in the area of VR therapy?

Joel [00:02:15] I think I actually first had an interest in that way back in the 1990s when it was largely being managed down in California for PTSD and mostly obviously it wasn't you know consumer level or anything like that you'd read the reports about machines the size of a room and things like yes that. Yeah. No. For him the more accessible more recent history and you know I've always been a bit of a technological enthusiast and for about the last five years or so the VR stuff has been more publicly available like adaptable with technology that's already out there like computers and cell phones and whatnot. So yeah around the time that I finished my license saving clinical hypnosis and neurological applications there I was working with the chronic pain crowd the in the health care clinic and that we were using tools like neuro feedback and biofeedback and I was using clinical hypnosis and things like me and VR mindfulness then that yeah see our therapy works on a lot of the same brain mechanisms as these other types of interventions.

Anna [00:03:35] All right. Thank you. I want to know what your perspective on the current and future possibilities regarding VR in medical care and how do medical professionals view VR therapy?

Joel [00:03:55] These are some good questions. So let's talk about current application personal argues the framework and reference of what I'm doing in my practice currently with it and so I've got a VR right get mobile one one for the office that I use with clients pretty regularly and some examples of where I've used it frequently is for exposure type treatments and so oftentimes when I'm treating that like anxiety stuff with folks or past traumas or stress related things often the exposure or method of treatment however you're doing it like formal CBT exposure or you know using those rhythms in a narrative therapy or whatever it is becomes quite useful because you're essentially at the biological

level sensitizing the nervous system that's getting treated worse in responses that are healthy. So how ya become as useful as I can rather than use traditional exposure tools activate a little bit more of the brain that. One time in a more engaged way to kind of amplify the effect than usually the time line of exposure. So where I would traditionally think about using no maybe 5 somethings or 10 minutes of something to work with. So by the Yeah in an exposure methodology I can accelerate that with my VR. Another way that I've been using VR 10 of its current application form and what it's good for is that I've used it as a what I like to call a hook. One of the areas I work in this family therapy so I work with adolescents and children and parents of mom and dad. There is a generational shift that has happened in kind of a familiarity and that acclimate the actualization and that yeah the comfort level I suppose with technology the tap and kind of between the what we call the Gen X generation than the more any older man now moving into the GNC and especially with the clients who are falling into that mid to late Millennial to the early Gen Z to even. Now they have a familiarity with technology is a language they already speak great and so there's actually an appeals for them sometimes to engage in a therapeutic modality that uses technology rather than a quote unquote analog one. And so we'll definitely have a hook there and what I do with my younger folks is again I look at a current therapeutic modalities and I see what can be both useful from the literature of what we know already but also with evidence informed types of practices because some of this is just being research now you know working through good ideas about what could be useful too. So from working with an adolescent where I use a traditional CBT learning tool to develop some critical thinking with some maybe what I'll do is I'll put a puzzle game in my VR environment and actually work on developing their critical thinking that way right. Another way I've used it in kind of this family setting is a tree of a trunk with a couple who had been on vacation and then they weren't a Caribbean country somewhere and they were held up as tourists that done what you can. They had experienced a pretty significant trauma that kind of exposing both the use of the modality as well as with some of the learning that possibilities with the VR equip and one of our treatment roads took us down actually going back to the place in the Caribbean nation where they were mugged and being able to kind of walk around that environment safely in the VR environment as we have you know realistic satellite imagery that can kind of put you right there. So yeah looks and sounds like you back there again and yet a very useful thing for this particular couple who were you know having an issue going on a vacation later on because they suffered the trauma and the last time they went together. Yeah. So the current adaptation but that a couple of teachers in my practice that use this as curriculum substitution. So they do everything from mass to education enhancement even geography social studies. HANSEN some of the tools and applications of the headsets right. Yeah. As for future prospects stuff where I see it growing a lot is in the area of kind of the attention and focus shifting interventions. A great example is that earlier this year thanks to a small donation from a funder the health care system started using VR in the rehabilitation we at the rocky few hospital here in town. And that's what they're doing there is they're essentially slapping a headset on somebody so they can experience the peaceful scene of their choosing like a beach or a walk through nature or something like that. And they have the patients engage in this while they're receiving dressing changes from the staff. So if they have like an open wound or recovering from it all three and they actually report you know quality pain reduction and an ability to not suffer from you know the necessity of addressing issues. And so here I see VR only as the technology becomes you know 10 years ago none of us have smartphones right. Yes. But as it becomes more widely accepted and widely adapted in the culture you're actually gonna have the ability to communicate with people you know who aren't necessarily in the room in front of you and be able to say something like Hey here's something.

With your VR headset that you have laying around the house so that you know pain management part of your problem rehab can come into your psychologist's office and get the worksheets and learning how to do it at home. Then following up on your headset and start to work on on yourself.

Anna [00:10:33] Can you explain me about your VR therapy process and what challenges you face with this technology?

Joel [00:10:47] We are simplistic I would suppose for a private practice. We leave it up to the therapeutic reaction between the clinician associate and the client/patient to kind of decide that the course of therapy usually based on what's working for treatment. And so VR, most of our therapists kind of see it as one of the tools that they may have in their tool belt to address the concerns that they're already going to be working on with their clients. And so the assessment of when the therapy is useful or which clients going to receive it is usually an individual variable within the treatment of the particular things that are going on in our practice. And so we tend to see you know it's most common uses like I mentioned you know things like people working on anxieties or what not they have maybe a prevalent sort technology or they're younger or they're looking for an experiential therapy along the lines of you know a hypnosis and or biofeedback or something like that. So VR can fit into there. And yes a little happened is that we actually have that VR kind of set up in our therapy rooms integrated that to the rest of our kind of capital assets. And it's as simple as kind of being psycho educated in the moment. Our clients say hey look here's the gear here's what you can expect. And they usually do a short orientation trial with the client if it's their first experience in kind of an altered reality setting so they're not you know to shock to make good on that for the first time so maybe that the associate will say "Hey we're gonna try out the equipment see what it looks like to stand or in the room"... Before they begin a protocol and then all of our folks are kind of trained with different protocols and tools you going to work somebody anxiety accounting programs we have in our program suite Which one is going to fit best for your client. So on and so forth and work on exposure to something.

Joel [00:12:54] Well here's a one for geographical location, here are one for keynote person places and things. So on and so forth. All right. Yeah. The client will go through the protocol go through the actual VR therapy experience with clients and they would document in their case notes the way they would document any other kind of therapy that they do. So the same details they would put in about whether it's CBT or whether it's any kind of other experiencial therapy they'd report in your case notes and you kind of you know a little bit of the scene within that doing and the rest are interventions. This is to say look for clinical supervision and so on and so forth.

Anna [00:13:39] Okay. Yeah yeah yeah I know. Sorry go ahead. All right. And they face any challenges?

Joel [00:13:47] I mean you know probably the biggest challenge would be stigma around new technology. There is a general public consciousness about this idea could be challenging or something could go wrong with it. And usually with the introduction of like a new stimulus like that people with a form of technology and tried before we could see things like heightened anxiety use or even a little bit of a what I call a placebo effect or an anti placebo effect where people would maybe have an expectation that it's not going to work for them the first time and so this is why we have a bit of an orientation process to do technology for people as well. Yeah okay. Costs can be prohibitive. Like we are private practice from a business plan. So we invest in technology and one to go in this direction and you know if I don't think if you phoned up to a local you know publicly funded or community funded counseling agency you're necessarily

going to be early adopters of perhaps locally cost based technology. Right. But even that cost thing this is how it's become successful in the last five years as you see out of completely out to reach and now it's becoming more and more regularized.

Anna [00:15:33] How do the clients respond? What is that feedback like?

Joel [00:15:39] It as variable and sometimes you know you your client independent of having VR therapy or not and they give you different levels of feedback right but generally I can say that atleast in the kind of session work that I've done with that one on one with clients I tend to see a welcome rate of apt reaction to VR therapy then to some other experiential therapies generally compared to talk therapy. Experiential therapies can present where people will go through the first round a bit and kind of say something to the effect of "Oh I did like that I didn't feel good for me I didn't enjoy the process of doing this " rather than talk and what we know is genuine when people have those kinds of reactions and experiences it's more limited to the process of the experience they went through than the effect of the experience and the impact of it. And so as therapists or clinicians This is when we think about changing modalities a little bit. And so like for instance you know one in ten people that do clinical hypnosis might say you didn't like that let's not do that again. I would say overall as compared to those categories of experience patients they use the VR therapy tend to have less reaction and so it's like one in a hundred rather than one in ten.

Joel [00:17:07] So that said that's kind of nice to see in clinical practice. Yes you're think that you know I'm not going to have to deal with it so much sometimes of shifting gears with your clients and that's other than the report of this mostly works for me that clients give. I'd say the other thing I get fairly regularly is that a little bit of that novel experience new experience was quite a bit. You know you take somebody skiing for the first time and they're amazed that you like get up and slide down the mountain side. But one hundredth time they've gone you know some of that novel is worn off the VR experience for the brain it really does give a novel kind of new experience and that's very frequent. But I get the record of that and usually again and has that kind of acclimatised wisdom to it where you know 10 or 15 or 20 or 30 experiences in somebody might say oh this isn't some novel were amazing to me more.

Anna [00:18:15] When you show these experiences a headset, who designs that?

Joel [00:18:28] So for our VR therapy at Cultivate, we actually do. So we do use some commercially available like software programs and experiences but generally when we're using those we then kind of either pulls from them or select from them or use them in kind of our particular protocols and ways in that yeah we between myself and a couple of other clinicians and I'm technology expert who's actually a teacher a licensed future and we kind of sit down together and we have ways to design new ones and design ones that are particular to clients and ones for generalized protocols that everyone can use. So on and so forth.

Anna [00:19:13] How do you evaluate the user experiences?

Joel [00:19:16] Yes we do feedback collection for guests about all of the therapeutic interventions we do for VR therapy or not. And so we tend not just on the field report - one by one basis but we do systemic review with those as well kind of over the course of everything from treatment evaluation to a business planning and things like that. We get some qualitative stuff. Throw in some like scales get some quantitative stuff from.

Anna [00:19:48] Have you collaborated with designers?.

Joel [00:19:54] Yeah. We. We had them through his practicum students even because of the opportunity to do this level of design and things like that. So no this is that in the VR world specifically even this area of design is interacting kind of a sub industry on a drone and there is already things like certifications and professionals who are like you know able to wave their certification about everything from game theory and design, psychology and game design. So no these are and I think one of my earliest psychology courses is actually the psychology of imagery and perception. So this is something that's always very at the top of our radar.

Anna [00:20:56] What are your perspectives on using serious games for therapy?

Joel [00:21:03] So this has been actually widely written in the literature as I'm sure you understand. I tend to follow along the side of the arguments around integration of technology from the user experience and wider society. And that definitely that integration that I look to utilize with the VR around the types of ideas of using as a "hook" for a demographic of people who are already somewhat acclimatised to the technology. There is a guy actually at our office who is a gamification of learning expert and his job with the school board is to run around and show other teachers how to do this when they don't know.

Anna [00:21:55] Do you have practice the area of specifics phobia? If yes, what are the current treatments for arachnophobia?

Joel [00:22:06] Oh yeah absolutely. So I do specific phobia over time so that's a specific phobia in the mental health world is essentially a subcategory of anxiety disorder. So treatment guidelines aren't written in stone for psychology or for medicine or for most helping professionals over working with mental or physical health. Usually what we look at are things like best practices, most modern research things like that or even different governments will say we offer this kind of funding for treatment needs to be this type not that type. And so sometimes you get normalized in a particular culture. But yeah good scientists good clinician is usually trying to look through the lens of what information do we have about this and what is the best practice. With regards to arachnophobia it would fall under specific phobia type and really the only treatment difference from specific phobia type just specific phobia type is the type of exposure that we generally want to use and look at it. Exposure therapy is as the number one treatment for just about all phobia types and subtype and they followed very closely by CBT complemented by MDR mindfulness based stress reduction. And this is actually one of the reasons we've found so much overlap in using VR therapy use. These are things that are very used to do VR.

Anna [00:24:20] what tools you use for exposure therapy?

Joel [00:24:32] Okay. So I give you a good theoretical example say someone came to my office said I'm aranchnophobic and scale their fear from 1 to 10 is a 10 coming to life and stuff and we would have a great conversation about what a course of exposure therapy would look like. And our conversation might sound like any " the first time we're working on this together we're talking about concepts we're talking about a match". I mean you know being at the same place looking at very practical tools like how to control my body in these situations my breathing my blood pressure heart rate stuff like that and kind of escalating the amount of exposure with the repeated pattern over time. So we would move from just imagining these things to maybe having conversations with a picture or two of spiders in the room and

we might grow that from you know standard pictures to watching some video with sound and then you know all along the way we're repeating that you know and then we might be watching the video we said we'd ad you know a contained spider aquarium with no live creature in it adjust the setting right. Yeah. And so on and so forth and we may even then carry it through you know where we'll have a hand or with a spider in the aquarium in the world. More we'll take a trip to the zoo together and go to the Amazon house and look at stuff behind the glass or you know and in this scenario this is where we ask them sort of VR experiences it gives us another sense of reality. That's also more control.

Anna [00:26:25] [00:26:25]What are the coping strategies you suggest? [0.9s]

Joel [00:26:28] [00:26:28]There's an interesting amount of what we would call a biological self soothing strategies we could use. So everything from the different types of breathing we can do with flow to again tools of biofeedback. Off the court and its tools. Distortion channeling Gene side editing. Yeah there's like literally hundreds I get lost so it's more about the tools that fit the corner and I'm working with the head. we go with cognitive tools and if it's the body hyperventilating we go with biological tools and so forth. [42.0s]

Anna [00:27:12] Last question is how much does a therapy or treatment for arachnophobia cost?

Joel [00:27:19] So our practice follows just from the fee schedule for the Psychologists Association of Alberta and they publish their fee schedule annually it changes year to year. I think currently it's like two hundred dollars per psychological session. And so that's our cost. If someone comes in and we successfully do exposure therapy in one or two sessions. Usually again more about the response of the clients and patient to the protocol we're going through. For some people it takes two hours of sitting with a picture before they're comfortable video and something that takes two minutes swearing and so different from person to person.

Krista Jäntti

1. Can you tell me about your professional background?

I graduated from the University of Helsinki, Finland, in 2001. My major was microbiology and my minors were computer science and biochemistry. In the end of my studies I already knew that my passion lies in computer science so I left the university lab and got a job as a java coder. Later on I found out that I am more interested in interactions and user interfaces and user experiences so my employer paid me to go through an internal training called UX Academy. After spending 6-7 years at designing 2D interfaces for the web & mobile apps I wanted to try something else. Switching to 3D interfaces sounded very tempting and challenging. My first experiences in the virtual world were very powerful, I felt this is something I want to work with in the future.

2. For how long have you been working in the area of immersive media?

I started at Varjo in Jan 2018 so I haven't been working with VR that long. But I have been very passionate about it, I have gone through a lot of VR UX material and spent so many hours in VR trying different apps, reading user comments from Reddit, and academic articles, following a lot of XR developers in the social media. In the short period of time, I have learned how our eyes work, how our brains work, learning about different sensors, the principles of optics, ergonomics and many other human factors. The UX in immersive media is so different than in 2D world!

3. You are currently working at VARJO, what is your role and responsibilities?

I am Lead UX Designer meaning that I both do design by myself and comment on what others have designed. We work in a team so we comment and discuss a lot every day. There are so many things where you can have an impact on: the unboxing experience, the setup experience, the desktop app, manuals, And then there is the actual immersive part, what is the UX inside our headset. I can't tell much about that but I can say that I have recently done experiments how to use eye tracking in interactions.

IMMERSIVE MEDIA

1. What are your perspectives on the current and future possibilities regarding augmented reality and

virtual reality? How do you see the adoption and application of immersive media?

In augmented reality I separate handheld devices and head mounted displays. With handheld devices, such as mobile phones I believe in growth of commercial applications, such as tap-to-virtually-try-on ads: you see an ad of a shoe, makeup, sunglasses, furniture, jewelry and then you can virtually try those on and click to buy them. With head-mounted displays I believe the Hololens stays in the professional use and when we finally see AR eyeglasses with prescription lenses (which look like normal glasses!) then the consumer market is ready for them. They would be great for identifying different things and for navigation purposes.

For virtual reality I see so many possibilities when being together in the virtual spaces: you can design everything which is spatial in real time even when the persons are in different countries, you can train and educate and meet different people, no need to fly anymore. You can save money when there's less need for tangible prototypes and you

can visit places where you can't travel. The adoption takes time, there are so many still out there who haven't been in virtual reality or haven't understood the possibilities beyond games.

2. Can you describe the differences between virtual reality and augmented reality regarding

designing?

Virtual reality is 100% immersive so you have to take into account that the person who's in there can't see or hear the others around him/her. You have to make that person feel safe all the time, that there's an easy way to

get out of the experience, don't make that person to feel sick, let him/hem have a grounding feeling, use the virtual space wisely, don't let him/her hunt for the content, use binaural sounds wisely as cues, design the surroundings and virtual reality in the way that the person is not going to hit the wall. Avoid using a lot of white, it hurts the eye.

I guess some principles are the same with augmented reality: use the limited field of view wisely, think where you are going to put the content and in what form, use the cues like highlighting and sounds. I haven't designed for AR so far so I can't say much about it.

3. How is Augmented Reality reinventing User experience and user interface?

When we talk about mixed reality, meaning that when the real world is interacting with the virtual world things start to get interesting: the virtual objects occlude with real world objects, I want to see more of that. It is slowly coming, it makes the games so much more interesting. The interfaces turn from 2D into 3D more and more.

4. How is interaction design for immersive media different from other 2D digital media? Can you give

me few examples?

Even when you can manipulate 3D objects with 2D, like with CAD software by using keyboard and mouse, it is still so much more difficult to understand the proportions when you can be in the same space with the object.. When you have the possibility to go to that actual 3D space, it changes your point of view, literally..

Like you can have 2D blueprints of a house, and you can view that house in a dollhouse mode on the desktop or you can "walk" in the building with W,A, S,D keys via desktop but when you have the chance to put the HMD on, and experience the same space in virtual reality you feel that you are there and you can look around and understand things you couldn't otherwise see. In the immersive mode you have the possibility to manipulate that space in real time and even have someone else to be there. Those are the things you can't feel with 2d apps, you can't interact with 3D objects in the same way.

5. How do you think immersive media affects a person's cognitive senses and behaviour?

We are all different. Some people are easily very immersed, they forget the real world and can even lean on to virtual furniture and get hurt. Some are more reserved and don't have the courage to do anything. I don't recommend VR for very small children, they can be very scared when they don't understand what's that place they are suddenly taken into.

There are several studies that show that virtual reality can have a sustained change in our behaviour. It can reduce racism http://www.neuwritewest.org/blog/white-people-in-black-bodies-how-to-reduce-implicit-bias-for-a-long-time

or it can reduce gender bias https://confer.csail.mit.edu/chi2019/paper#!pn8065 Virtual reality can be used for good! 6. Can you share some examples of hybrid narratives/wearables that you think would be effective with immersive media? For examples: Haptics, Kinect, leap motion, audio etc. and how?

Every gadget whether it is a smell mask or a body tracker which helps us to feel more immersed in the virtual environment, making the experience feel more real is a good thing. Personally I prefer to have whole body in virtual environment. I hate when I don't see my legs, it makes me feel like a ghost.

7. Who in the industry do you follow and read? Where do you get inspiration from?

So many! Jessica Outlaw https://medium.com/@jessica.outlaw Luca Rizotto https://medium.com/@lucasrizzotto Navah Berg https://medium.com/@navahk Mel Slater http://www.melslater.me/ Tony from

https://skarredghost.com/ company 6ai https://medium.com/6d-ai Fable Studio https://fable-studio.com/ I get inspiration from wherever: book, sci-fi films, twitter posts, while being in VR

Mike Alger's http://aperturesciencellc.com/vr/VisualDesignMethodsforVR_MikeAlger.pdf is still very good article even though it is 5 years old!

DESIGN PROCESS

1. Can you briefly explain your design process for creating an immersive media environment?

I first try to find if there has been already some sort of research on that particular subject so that I don't have to reinvent the wheel and make mistakes so I google and study what I can find and I google some more if there's something new I need to understand. Then I search for benchmarking examples and analyse what's good and what's not in those if I can find any. Then I design with a pen and paper what sort of content needs to be done and where and I play with measurement tape and sliding bevel to find out sizes and depths. I "play" the scene though.

After that I make a 2D sketch with Adobe XD and go through my design concept with my colleagues and a developer. I am not a Unity developer so I need help from a developer. The developer is the one who makes it happen so I usually stand next to him and we go through what needs to be done. I usually get many good points here from the developer. We iterate a lot and get comments from the other designers too.

2. Have you ever built an AR experience? If yes, can you briefly explain to me more about the use case

and the interaction design process?

No, I haven't.

3. What guidelines would you use/suggest for developing augmented reality interfaces?

4. What are the different interaction models you use for your immersive media environment?

The difficulty is that there can be so many input methods! You can use headset reticle, eye tracking, controllers, keyboard, mouse, speech, hands and meanwhile keep the consistency. So far I have used the first four mentioned.

5. Describe the tools you suggest using for designing an immersive media environment?

Well, you need to own a personal headset. I have tried different prototyping tools other than game engines but I

haven't been happy with them so I really need to find the time to learn to do prototyping with game engines such as Unity and Unreal Engine. It takes a lot of time to tweak the environment with a developer like depth, font sizes, colors, backgrounds, buttons, highlighting effect. All these could be easily done by designer. So I suggest the designers learn the basic with game engines.

6. How do you prototype for immersive media?

See above

7. How do you user test your immersive environment?

We have UX researchers who make A/B testing with test groups and get very valuable feedback.

8. How do you collaborate with others? What's your hand-off process like?

9. During the design process, how does the feedback and evaluations system work? 10. In your medium article you said " I sort of tear down different VR apps and analyse why some things

work and feel right and then again why some don't work and learn from those experiences" How did you evaluate the apps?

It's a skill you get during the years you spent doing UX :) When something feels natural and seamless it's done right and there's a lot of work behind it, good UX is never a coincidence.

11. Which VR and AR apps you like according to good user experience design?

Tilt Brush made excellent work when they invented the rolling palette model. I also like wrist menus. I also like Job Simulator. Google Earth is very easy to use and people get it. The controller buttons always are a bit tricky to new people. I liked one AR Navigation app in one big exhibition hall in Finland, the navigation was very easy. Google Maps with AR looks very promising, haven't tried that one yet though.

HEALTHCARE - (If applicable)

1. How do you imagine the use of immersive media in medical care?

Medical training is very expensive, the more people train the better doctors they become but sometimes there just isn't enough uh-uh dead bodies which the doctors-to-be can train with and dissect. In AR there are already app like inside your brain and heart and with AR you can plan dental surgeries,

In VR you can have surgical training like Osgenic have done. Then there are physiotherapy apps where you train your muscles, therapy apps for people who have been through post traumatic stress disorder and there are different kinds of exposure therapy in virtual environment. Like http://www.vobling.com/projects/face-your-fear/ In a safe environment you take baby steps. I see that virtual reality can benefit from Cognitive-behavioral therapy (CBT)

ALso with kids who suffer from serious burns injuries don't need such high doses of painkillers when they are in virtual environment during wound debridement.

2. When designing an immersive media for a healthcare system, what are the key considerations you take

into account?

The setups are still quite troublesome, at least 6dof environments. There has to be someone who takes care that the devices are working, they are clean and helps the people to teach how to use them and make them feel safe. No one wants to look stupid of scared or want to break stuff accidentally. The human side is very important when introducing new technology, it has to feel human, otherwise it's not going to be used. "I once tried virtual reality and I hated it, not going to use it ever again". The hmds and controllers look off-putting to many people, they don't want to put the headset on and don't understand what to do with the controllers.

4. What kind of improvements do you like to witness after using this technology in healthcare?

Better planned surgeries, faster recovery times

5. How does immersive media stimulate the future of medical practice and the future of the medical

industry?

1. During a development process, how do designers aid the development process and what stage do

they enter?

The earlier we are having a dialogue the better

2. What type of professionals are needed to create an AR app?

Designers, game developers, business people, marketing people, machine vision specialists

3. What challenges do you face when working with a developer?

I don't know the limitations of the game engines, it's hard for me to understand which features take a lot of time and which are easy to make. Sometimes it's hard to communicate how important is the fine-tuning of the visuals.

4. How do you distinguish yourselves from other 2D- UX designers or interaction designers or product

designers?

I have quite a vast understanding of different technologies, I have coded and I understand how hardware works. My background as an academic researcher, even though in cell biology, helps me when I need to analyse new things and find relevant articles.

5. Is there any need for designers to create augmented reality experiences? Please elaborate.

The world is shifting towards more 3D all the time, so I guess there will be more demand on the designers who know something about that side too.

6. Final interview question: Is there anything else you'd like to share or quote ?

Just today my boss cited John F.Kennedy when we complained how hard this sometimes is.

"We choose to go to the Moon! We choose to go to the Moon...We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard" and he made us all smile!

Anna [00:00:02] Since you have answered all the interview questions. I have few questions for you and if you could elaborate them.

Krista [00:00:02] Sure go ahead.

Anna [00:00:03] Regarding to the response to the second question, I asked you for how long have you been working in the area of immersive media and you said you've just started like in 2018 which is pretty new but I wouldn't blame because this technology is pretty much right now developing so it is okay. I had one question about when you said "I used lot of VR UX model". So what were you looking at when you were looking at the are you VR-UX materials?

Krista [00:00:38] When I started. So I have to start from zero again. The first thing I found was these you probably know Mike of Jerry's the VR manifesto. The manifesto was written in 2015 and I think that's quite valid even today. Yeah. And I just reread it a few weeks ago and I still think that's one of the best things to start you are in this area.

Anna [00:01:15] Okay. And the other question was when you were trying different VR apps right, So what were the different VR apps you were looking at and when you said "how our brain works learning about different sensors the principle of optics, ergonomics and many other human factors" So when you were talking about these, What do you mean?

Krista [00:01:56] Well I found out about ergonomics, very good resource down by Microsoft hololense. And that's was perfect for my purposes. They were all different like What's the optimum curve where we feel comfortable? what's the optimal field of view when we look straight forwards and with our neck position what's the good show. So that was perfect or any economic purposes. And I saw a lot of references to that article as well.

Krista [00:02:41] So I think I found a good one and I've been using that in all my work. So that's a good question. I don't remember anymore. Sorry.

Anna [00:02:52] It's okay. I mean the thing is I was looking at what other VR apps. So you've given me "Job Simulator", "Tilt Brush" and Google earth VR. Any other apps you know which you think have a good user experience design or which you would prefer to use in future?

Krista [00:03:12] Yeah I went to a steam store and I looked for like you can check "Limit" but I follow for a different purposes and I wanted to try educational and software like everything else than gaming because gaming ux is a bit different experience and I was looking for examples of tools and when you're making the tools you always have to think more about the many. And in what order and what sort of labels and what sort of patterns. So that's why I look for is everything else about gaming apps.

Anna [00:04:02] Okay I agree with you.

Anna [00:04:04] So the last question is, when I was talking about wearables and hybrid narratives you mentioned quite a few in your medium article like "mood stimulator", health tags like "spyer tags". Anything else you would recommend which helps someone to be more immersive during a virtual environment?

Krista [00:05:18] Yes. I usually like to use vive trackers if the app has the possibility that it supports that I can put one tracker on my belt and two to my feet. And that way I can have a lower body in a virtual reality. I really like that that my body's whole and I hate when when I only have upper body. Yep like that and then there are all sorts of different

gadgets like “smell-mask”. but I haven’t tried that. And of course our headsets have the eye tracking. It tracks the eyes and I really look forward to that we are going to use that all for Avatar purposes. That when someone else is in the same space as an avatar then we can actually have a real conversation and eye contact. I’m really looking forward to that. So everything which helps us to be more immersed and especially in the social situations. And if for example there is a British company called “emteq” who makes sensor masks and emotional AI. So it takes your face micro expressions. It can read how your face is interacting. You can bring that technology to a virtual avatars. And when we have that eye tracking and then we can have a humanlike expressions. And that’s something that I’m really looking forward.

Anna [00:07:23] Yeah that sounds really exciting. That’s so cool. Last question. During your design process when you said “I played the scene through”. Like what do you mean by that. Can you elaborate on it?

Krista [00:07:57] Yes yes. I didn’t. Let me explain. So when I have my papers and I have the sliding level I like to put the papers in front of me or I tape them and then I try to get what’s my field of view. What’s the font size. I I usually even have the virtual reality headset and then I try to figure out how do I view that thing. I have to try to imagine in my mind and try to be in the virtual reality. I sometimes ask help from my colleague that we move the papers.

Anna [00:08:42] Oh my God. That’s really good idea.

Krista [00:08:44] Yes I think so fast and Cheap and you get the first concept of what you are doing before you move to anything else.

Anna [00:08:54] That’s a really good idea. I mean amazing. Yeah that’s something I will try it out.

Krista [00:09:00] It even helps that I talk to my colleague that I am going to be here now and then I use my phone as an acted controller or I’m going to click here bascially I try to play the role of the user. Telling the story is what I’m doing. And then my collegue who is a very experienced designer as well. He tries to identify holes and ask questions like “have you thought about that?” And then I go back and redesign. Yeah. That’s really cost efficient too.

Anna [00:09:35] So. I think I’m good for now, you have pretty much answered all the questions.I really like your quote. There was one more thing, I saw your twitter handle where you mentioned “augmented reality is like an argument reality!” What do you mean by that?

Krista [00:10:17] People seemed to have strong opinions. No way the virtual reality or augmented reality...it’s a technology that’s going to pass by and the gadgets are too difficult. We still haven’t seen the big set success. The killer app. So why do you work at that business and why!? We are starting to have arguments and usually the people those who haven’t tried or have tried like one app or something once tried, they have this very strong opinion that they didn’t like it saying “It was just for the gamers. Things like that..” So that’s why I said that sometimes I tend to have an argument reality.

Anna [00:11:12] Oh yeah I know even I’m having the same struggles. It’s so hard to make people imagine. Is this like until people actually tried to learn it. It’s very hard to you know make people understand the importance of this. It’s a very strong tool because I even read that you were doing a virtual reality meeting with Varjo right. So yeah know collaboration and ideas generation is very important. It’s a pretty strong tool. I agree but the device is not accessible to

everyone. That's the reason the adoption is less the day the device is more accessible to people. I think what adoption will be that one limitation even I see.

Anna [00:12:01] But okay let's see how my thesis go. Do you have any questions for me.

Krista [00:12:09] Have you checked the VR spider therapy? I think I've seen a Swedish company called "itsy"

Anna [00:14:44] Yeah. Yeah.

Krista [00:14:46] And so you're seeing that even the small babies's pupils they dilate. They see a spider like something how they move this spider even babies don't yet have that fear. Yeah it's something very deep in our instinct that that is something scary. It's weird. Me. Does not snake movement. Yeah. Snakes move let's see. I was a biologist so I'm always fascinated about animals and human behavior again.

Anna [00:15:42] Anyway thank you so much Krista! Let me know is you have any concerns or questions and thank you for answering so many questions. Thank you for being so patient with me. I let I'll keep you updated with my thesis.

Krista [00:16:09] All right sure. Good luck.

Anna [00:16:16] Bye bye. All right.

Dr. Stéphane Bouchard

Anna [00:00:00] Can you please tell me for how long have you been working in the area of augmented reality exposure therapy?

Dr Stephan B [00:00:04] My background is as a clinical psychologist. I became a psychologist in 1991 And I am also a university professor at the University of Quebec, where I am right now. I got the job in 1995 and I was at the time essentially interested in the treatment of anxiety disorders and more specifically the CBT Cognitive Behaviour Therapy to test if CBT works and if yes why? I got my first grant and started my first research project on VR in 1999 and I've been doing cyberpsychology or broader than just VR in about 97.. About 1997 I got a grant for video conference based psychotherapy, where you do psychotherapy using video conference system and two years later, I got a grant to do virtual reality.

Anna [00:01:41] Can you briefly explain me your process of A.R. exposure therapy for specific phobias. What tools do you use and what was the narrative of the experience? What was the process?

Dr Stephan B [00:01:54] The mechanism of exposure for phobias is the same with or without virtual reality. Essentially we know from abnormal psychology research that what causes and maintains phobias are two things: perception of threat, we perceive threat and avoidance: If you avoid what you're afraid of, you keep thinking that its threatening and that relates to the brain and the limbic system, the amygdala on one side or just clinically makes sense that if you don't confront what you're afraid of you'll still believe in this. So the behavior reinforces the thoughts and that is how the brain works. So we know that for, we've been aware of that for decades for anxiety disorders. One would do virtual reality, my line of work is that is showing that it is exactly the same thing. its just that we can actually fool the brain to make the brain think that stimuli is real. So the limbic system the amygdala process information very rapidly with shortcuts. So If you see a snake on the floor and you're afraid of snakes. Your brain is not actually seeing a snake that's too detailed. As soon as your brain sees something on the floor that is long and curly it could be a snake and then the brain reacts. And so you might be using a hose or you could be seeing a branch on the floor or something on it on the ground and misperceive that as a snake. So its automatic, twelve milliseconds very rapid and if the virtual stimuli are real enough. So it means if it seems sufficiently realistic just not visually but mostly with the fact that when you move around your brain follows the information that goes to your brain is consistent. We call it Multisensory integration. you see what you hear with your head movement with your proprioception it all matches to tell your brain that what you're going through is right, is real, which is a really good illusion. And so when this is sufficiently powerful the brain see the virtual snakes spiders whatever heights or whatever location that you're afraid of as potentially the real thing. The limbic system the amygdala the part the brain the doing the motion reacts and when you're frightened and what we do the exposure is the goal of exposure is to learn new associations with lack of threat. But not only learning in terms of content so it's not by talking to yourself but you get to learn that what is usually learning by experience. So you build new associations in the brain with the lack of threat with no danger. We do that through exposure. Exposure is essentially facing what you're afraid but the goal of exposure is to develop new associations with the lack of threat. And we do exposure in VR exactly as we do in-vivo. In your real life situation. The tools to do, well the tools to do that and the tools to measure, the tools to do that. You can use different tools here in our lab. We have from we have a range from affordable HMD the Oculus go and stuff like that to high end HMD's to a CAVE which

is immersive room where images projected from real from the back of the walls and you're wearing stereo goggles so you see things floating in front of you. The advantage of a CAVE is you can actually see yourself in the virtual environment. And if you were two people you'd see me and you in the environment as opposed to the goggles where its blocking the view. So we're using from the head mount to the cave in terms of emergence. We do standard CBT is one thing that I'm struggling against is that I think people should not call ,You might have seen VR E.T. read virtual reality exposure therapy. I think it's a problem because it's like that because the therapy is not because you're exposed to VR but because you're exposed to what you're afraid of. Plus this VRET expression gives the illusion that it's plain exposure. Well for specific phobias it's true that its mostly exposure but you still need motivation understanding and warmth therapeutic relationship with your therapist so you can trust that person is going to ask you to hold the spider which is totally crazy. So you need to create that bond and the therapist needs to be able to adjust to tailor the treatment to your specific needs. It's not the one treatment that works for all it's really tailoring the treatments. So for phobias it's mostly exposure, But there are other ingredients.. So we should not equate the therapy was just the exposure. The mechanism is true but, and then if we go broader than phobias and you talk about more complex anxiety disorders it is definitely more complicated therapy. Think about PTSD. For example. So the tool to measure that well we can measure it different ways, we measure the treatments success in different ways. Usually we use questionnaire spider questionnaire. We also measure behavior. So we have live tarantula in the lab and we can offer patients pre therapy if they're willing to get closer to tarantula. And we measure how close they can get and actually touch this tarantula. And if they refuse it's a zero score on scale if it touch the tarantula it's a ten score on a scale. And if you do that pre treatment 10 is seen as a sign that is not phobic. So usually phobics get a 0 or 1 score. And then we do the therapy and then after the therapy we ask them to touch or do the same thing again. So we have an objective measure or can they actually not only tell me they're going well but I can see that they can go close to a live tarantula in an open vivarium and they can hold a pen and you know push the tarantula with the pen was something they thought would never be able to do. So we have objective measures and when we do that we also have physiological measures, we measure their heart rate. So we can see that they tell me they're going better. I can see that behaviorally they are doing better. And on the monitor I can see that their heart rate is just normal when they are doing that. So these are these are the kind of tools we use to measure. And the therapy flows just as you would do with standard CBT. So we take the time to get in touch with each other know each other we build a bond understand what's going on in the case of specific phobia, it usually takes a session say three sessions so it doesn't take forever. It's much longer and more complex anxiety disorders go through more stuff. But then when they're ready we say OK its fine too you know the whole thing is about avoidance you need to stop avoiding to learn that it's safe.. You can talk to yourself knowing that it's safe. But talk therapy in itself is not sufficient because they know that its safe. But they are still frightened. So now it's time to actually do it. So put the goggles on, I would see on the computer monitor what they would see in their glasses and I would help them do exposure. And the key ingredient for a psychotherapist is that you want to tailor progress the exposure so the patients don't avoid. And that's a key element because if I want to learn new associations with like a threat, I cannot avoid for that. Which brings us brings the issue of relaxation where oftentimes people would teach relaxation or oftentimes therapists would be tempted to talk to their patients to reassure them when needed therapy if you need to do relaxation or talk it's because you're going too fast. Because the point is when I see a spider or a snake or I take the plane I don't relax all the time I just see it and I don't mind. You want them to do exactly the same in the real or in the virtual situation so you don't want to do relaxation or talk or self reassurance or positive thoughts or all of these things that are may lead to avoidance.

So you need to adjust your pace. So they actually just fully experience what they're afraid of.. Which needs a strong bond because we're doing something that they see as crazy.

Anna [00:11:50] If you use any visual material, how do you select and evaluate the materials?

Dr Stephan B [00:12:22] OK there is a global selection, a specific selection. Obviously if I have a patient afraid of a spider I'll take an environment for spiders so which seems an obvious question but it's not. But usually I would select the content based on what I need but will come to that later because there's a myth or something we need to quantify. But once I say I need a spider. OK. Then what you need is the right cues for the right patient. We should think about spiders. You don't need a huge spider that you would see in movies and horror movies or stuff like that.. you want to have something that would allow progressively patients to learn that it's safe. So you want small spiders you want bigger ones you want and you always want to have in the gradients what the patients are afraid of. And in terms of spiders, patients are afraid of the small ones because they run fast and they can hide in your clothes and your hairs. So you need some small ones that run fast. They're afraid the big ones the big fatty ones that look disgusting and that move with their legs in such a fashion that it's either gracious or disgusting. But that's the kind of thing that bugs them. Then some have the pointy legs some have the fur.. And then you have the lack of control so you don't know where they're going to be or go, where it is coming from. So these are the ingredients you want to have in the construction of the virtual environment and that's totally different for snakes or for fear of heights or fear of flying. So you want to know what these people are specifically afraid of and you need to put that in the environment.

Dr Stephan B [00:14:27] OK the design comes from knowing what are the specific things that they are afraid of. Then we have a team of graphic artists and they would either buy the assets on unity stores or any store that provide them or they would just draw and draw them in 3-D and actually then give them life. So you do the texturing you know the process and then you do the animation and do the programming and we design this in the lab because I have a research lab so I have programmers and graphic artist and I assess or evaluate that whether I can actually get the cues that I need which is much different from realism. I don't need a realistic spider. I need a spider that is disgusting when I need it and unpredictable when I need it. And just the size that I need. So although it's not perfectly realistic, as long as it can fool the brain it works for therapy.

Anna [00:15:37] Can you define me the roles and interactions that the client and the therapist perform during the therepeautic activity?

Dr Stephan B [00:15:58] Well it's simple and complicated. Simple is exactly the same as standard therapy. So roles are we need to agree on what we want to do. Clarify be honest work together stuff like that and then the therapists will explain to the patient what I mentioned before, avoidance and threat, and then help the patient without avoidance to what to face what they're afraid of and the patient's role is actually to accept to engage in this crazy idea of facing what you're afraid of. And that would raise emotions in them so they need to be able to tolerate these emotions until they go through the end of the experience. So exactly the same roles and functions that we do in standard therapy.

Anna [00:16:53] When the patient is going through VR threapy, what activity is the therapist performing?

Dr Stephan B [00:17:06] The therapist would ensure that we start at a pace that is fine for the patient. So some patients can pick one spider and that is sufficient. Some can take a lot more. So we need to agree on the starting point. And then the

therapists will help the patient to get close to that Spider or classic fear of heights or whatever. And therapist role is then to let the patient experience their emotions and nothing else. So it's not the time to talk about blah blah blah. Because if you talk you're distracting. Its not the time to do relaxation because if you relax you're distracting. So the therapist role is to help the patient go through these emotions fully without avoidance. So make sure if the patient is counseling in their head or closing their eyes and looking away the role of therapists is people have to look at it and ensure that there's no avoidance.

Anna [00:18:13] How do you enhance user engagement and experience during this session?

Dr Stephan B [00:18:22] Well depends on your budget and then it depends on what you do. Usually VR environments have visuals and sound..spiders .. Is not that much sound but fear of heights. For example there's a cliff but there's also probably a waterfall water falling or something like that rocks falling you can hit them. So you can enhance the experience in such a way you can have a fan, a physical cheap fan that you can have blowing air in front of the patient for fear of heights. So it gives the impression that it's windy and stuff like that. But we know that you don't need perfect replicas of the realities of fear of heights. Fear of flying. You don't need to have a hydraulic system to get an efficient treatment.

Anna [00:19:12] Do you recommend any assignments during no session times or in between sessions, when the therapists and clients aren't together?

Dr Stephan B [00:19:28] Yes the question is how? We know that what's going within one session is usually not sufficient unless you get really long sessions and usually we recommend patients do homeworks/exercise at home between sessions. So that's a yes. Then how do you do that. Well if they can bring the VR equipment with them at home that would be the best. But usually costly and there's technological issues sometimes whatever. So sometimes it's cumbersome. So if it's cumbersome then the patients could have other exposure exercises at home. In our research protocol we don't do that because it's a research we need to be able to show that it's VR retreat. But in other circumstances in clinical practice I would recommend for my patients to practice live what we did in virtual reality.

Anna [00:20:26] All right. And what all information would you like to track or monitor when the patients are in between sessions during an exposure therapy?

Dr Stephan B [00:20:51] Yeah we yeah we measure usually level of fear, level of avoidance, if they actually do the exposure and confidence in their ability to succeed. What we would call self efficacy is the belief that we can actually face it. And you want to monitor that to ensure that it improves. And you also want to monitor avoidance to ensure that they don't avoid.

Anna [00:21:19] How do you monitor them when they're not in the session?

Dr Stephan B [00:21:24] Self notes, taking notes usually will have a little document they need to fill in either daily or after each exposure or depending on how we set that up. But they take notes of what's going on.

Anna [00:21:50] How have you witnessed the adoption of AR therapy in Canada or is VR better?

Dr Stephan B [00:21:52] For me VR and AR are two different technologies.So we can talk about AR first and then VR. AR is essentially in my mind at the point that VR was probably 10 years ago. AR became very popular and then we had lots of adoptions that you could see for example with Pokemon Go and other things. But in clinical practice for phobias AR sometimes is still limited because say its a virtual spider, well the spider could actually be walking into thin air in AR,

so they're not always located on objects. So the technology is not there yet so it's very promising but we don't see any adoption in practice. Apart from a few phone apps there's a few nice phone apps that exist but if you put this phone on the air the spiders floating so there's still work to do. In terms of VR, the adoption is slow because for a long time there was this issue of cost that took a lot of time costs for hardware cost of software and then therapists perceptions. Cost for hardware is less and less of a problem with the Affordable popular HTC product and Samsung Gear VR. Costs of software, we need to have more software companies available so there would be competition and reduction in cost but it's getting there and therapist adoption.. Therapists still need to get acquainted to using technology in therapy. Usually when therapists want to become psychologist or psychiatrist, they don't want to be engineers.. They want to help people.. So they now need to see that if you use VR it's not that complicated.. You don't need to be an engineer to do that and you're actually helping people. So it's progressively getting there.

Anna [00:24:08] What is the patient's feedback on VR therapy?.

Dr Stephan B [00:24:13] Amazingly well.Patients love it. They're surprised to see that, they get so emotional or frightened, but it works, works well and they like the fact that you can use technology. They think it's gonna be easier.

Anna [00:24:33] What are your perspectives regarding mental health apps. Do you use or recommend any mental health apps to your patients. ?

Dr Stephan B [00:24:42] Sometimes I do.For now the problem with mental health apps is that there's no regulation, so there are wonderful apps and there are awful ones. And it's very hard to know which one is good and which one is not and which one is actually safe and not tracking you and sending your data to someone else. And so there's tons of implications. And because it's not regulated it's really a mess in the field. But yes it's part of the future.

Anna [00:25:17] Do you use or can recommend any of them? If you could name some mental heath app?

Dr Stephan B [00:25:22] Yes I like one called Mind Shift, because mind shift was done by the Anxiety Disorder Association of Canada so I trust them for the content and the safety. That's mostly what I use sometimes. Sometimes PTSD coach is useful as well but it's becoming more and more comfortable.

Anna [00:25:49] All right. Are there any key consideration you would like to recommend a designer for who is developing or creating a mental health app.?

Dr Stephan B [00:26:00] Yes. Among the key recommendations one is please stop reinventing the wheel , look at the science.. Because I see so many start up companies saying oh yes we could do that or we've discovered this and when actually there's been decades of research on this topic.. People like to say that they're the first doing this and doing that, But it's been done already and we know why and why it doesn't work. So I think developers need to focus on what's known, what's already there. Second, we should never focus on the technology for the technology. We should focus on the technology for what we cannot do without it. OK. So it makes a big difference big because it means that you don't develop an app or VR environment because you think you need so and that's what engineers are often inclined to do. Yes we can do that. Yes. But what are the real users saying in the field. What is it that a psychiatrist or psychologist or therapist can not do and need the app or the virtual reality for and then you get something useful.

Anna [00:27:22] So do you see the gap there as you said it's not regulated, there are no universal design guidelines for

developing a mental health app or an AR therapy app for it. So how wide do you see those gap. ?

Dr Stephan B [00:27:43] Huge. There's a huge gap between regulation what we want to know what we need to know what we already know on one side and the market and hope for profit on the company side where they're actually....uhhh. There is hope and people are creating lots of things but the same thing if you look at apps for stress management, there's tons of them.. some are free, some cost a lot and the vast majority doesn't work more than if you just take a small breath and relax. So there's a huge gap to reconcile between science what we need to do and what people want to do.

Anna [00:28:46] Are there any challenges you face when working with a designer?

Dr Stephan B [00:28:53] We're facing small challenges and the small usually because we're talking different languages and have different aims. Programmers want to do good codes and complicated codes.. Psychologists can't use computer things because they're not good at tech. Artists want to create because they're artists. They want to create something create something nice and complicated.. Psychotherapysts don't want something nice, we want something that has the right ingredients to help patients deal with their fears. So we have to have a common objectives of creating something simple that is not that innovative in terms of arts but it is definitely on the right to to help people and because of that we need to talk a lot and make sure that we're all understanding each other. So it's not a big challenge but this is where it's important to work with multidisciplinary areas and people who are open to exchange views and stuff like that.

Tyler Wilson

Anna [00:00:00] Can you tell me about your professional background?

Tyler [00:00:04] I was a forensic archaeologist, so I traveled around the world and dug up skeletons and then I was at a non-profit where we were designing a mobile field solution for archaeological data collection. Then I was at a design agency designing AR and VR mobile experiences for brands and currently I am actually in the healthcare space designing the workflow solutions for cancer patients.

Anna [00:02:35] What are your perspectives on the current and future possibilities regarding augmented reality and virtual reality?

Tyler [00:02:44] I personally think that augmented reality has a stronger consumer use than virtual reality. If only for several reasons. Our reality is by its nature a more shared theory because you are not taken out of context you can still see the world around you. So it's easier to collaborate. Also augmented reality I think is more approachable piece of technology because everyone has a phone. So the barrier entry is inherently lower compared to virtual reality where you have to buy a headset where the cost is inherently larger. I think there has been some stronger use cases for commercial use of augmented reality. Popular in construction or virtual training, health care position etc. I do believe that there is some interesting research being done using virtual reality for pain relief and pain management.

Anna [00:05:00] How is augmented reality reinventing news experience design?

Tyler [00:05:07] It is really forcing both designers and users to think in 360 degrees or at least you know it's kind of it's basically taking an experience that has traditionally been a 2D flat thing and adding depth and real world context through that experience. So as opposed to traditional 2D experiences where you know you're on a Web site or your own application on your phone you are pretty much 100 percent in that part because you know you are in that application and that is kind of a guarantee that you have a designer that if I want to log in to Yelp and use Yelp for something as an example that is 100 percent what I'm going to be doing you know within that application. Augmented reality I think is forcing the discussion of you know how do I use these applications and still have the real world be a larger part of that discussion or that interplay between my application and my user the real world is now interpose between your application and the user in a much more literal sense where you currently I'm to ask you all the time in San Francisco where people just walk around looking down all day and they run in a lamp post when they're on their phone walking around so that the real world is hidden. Currently, the 2D application, the real world is more of a hindrance than maybe something that you really have to interact with.

Anna [00:07:05] What are the challenges you face when you're designing for MAR compared to AR headsets?

Tyler [00:07:13] For headsets, couple of the constraints are just purely hardware related. Battery life is a huge constrain they are large and their capacity is very limited.

Tyler [00:07:51] According to interactions, teaching people how to interact with something that is in front of them is a huge thing. Even teaching them to do small interactions can be hurtful because oftentimes the stability of the

headsets isn't as precise. So there is kind of a jitteriness in there so you its difficult to build intuitive gaze and head based interactions. Complex interactions you know like the Hololense air tap is the stupidest thing. We had to spend so much time teaching people how to do that gesture than having them be in the application. So whenever you introduce that new type of interaction. There is a huge amount of overhead that goes into teaching people what it is. It's the same thing like when the iPhone. Nobody knew how to scroll like nobody knew how a pinch and zoom. And a lot of those interactions that Don Norman tried to simplify and now they're just kind of taken for granted. So yes there is a huge kind of learning curve in any type of new interaction that you make in terms of you know head mounted display. There are other this head mounted displays like Focal by North. They are smart glasses. They are more like Google Glass where they project the UI over one of your eyes and you can interact with them via a joystick with interactions similar to mobile phones which is probably a more well known UI convention than an air of tap type interaction. For instance the air tap can have constrains like 'how far away can you do it and how far away can you be from the augmented reality object for work. There are so many unknown other constraints rather. The other constraint that you have to deal with people who don't have functioning vision. So you can't use one size fits all corrective lens. So you should know people have to be able to wear their glasses underneath the headsets and that can sometimes depending on your visual correction the amount of curvature on your lens can affect the image that you might use. Another main constraints is just getting people to notice the UI at all. Because people are so used to walking in front of the screen. If the UI is all the way over back, how am I getting people to look around and notice that is huge problem especially changing the mindset of people and getting them curious takes a lot of effort.

Tyler [00:12:35] There are some kind of unique Mobile augmented reality challenges. I'd say the first one would be as opposed to head mounted AR is, headsets are a little bit more natural just because it's on your face. You are more free to look around. For mobile, the viewing canvas is the size of your phone. So you have to think about the most important interactions and UI have to be constrained to the size of your phone screen. So that you really need to think about placing the AR objects in such a way that the entirety of that UI and object is always visible on the screen of your phone. That's not to say that you can't have like really big awesome augmented reality objects and they to have the move. You also need to take into account the part hardware on the phone meaning gyroscopes. If they are older phone might not have as accurate gyroscopes or they might not have gyroscopes at all. So you you need to be much more sensitive to the physical hardware if that is actually on the device.

Anna [00:01:26] Where do you get your inspiration from?

Tyler [00:01:39] I follow a lot of Magic Leap people on Twitter. I read a lot of tech blogs like AR Technica and Engadget because they're usually some of the first ones to be able to demo hardware. Basically you know the people that get developer units for things and then it's their base their job is to basically literally take them apart and see how they work from a hardware level. Okay. I find that's always useful because that's how you figure out like oh you know the battery on this thing is large or you know they have like they need to heat sinks for something that really helps figure out you know are we moving closer towards hardware standardization or not. And of course I read Medium a lot. It Is really nice because you know it is kind of the free form of expression where anyone can just kind of jump on and write their thoughts. So it kind of has some of the best. And again the lowest barrier to entry for discourse.

Anna [00:03:35] How do you think AR and VR influence a person's cognitive senses and behavior?

Tyler [00:03:44] I think that there is a huge potential for immersive media to influence people's perceptions in a lot of ways. I think in its current form the VR and AR can make us appreciate the real world more because you know you can be in a virtual reality or augmented reality regardless of the current limitation on the fidelity and polygon count that you could have live experiences, it's almost like a separate sensory deprivation tank where you're in this very sixth realm. Once you leave that mixed reality space you should be able to appreciate this of the real world even more. You know whether you are in a museum and looking at the art and understanding the process through AR real time or seeing the Van Gough making his sunflower or whatever. I feel like there's always this kind of push in the industry whenever a new technology comes out that you know we need to push the technology to be as high fidelity as the real world. And I think you know in a certain case for virtual reality particular. I think. We should be not be afraid to embrace having slightly lower fidelity experiences because I believer in the real world is still useful. I mean the real world is always going to be there. Once we leave it's reality. So we should use reality to let us appreciate the real world and not as a replacement for the real world.

Anna [00:05:56] [00:05:56] [0.0s] Could you briefly explain me your design process for creating an immersive media?

Tyler [00:06:03] So the first thing I do basically draw out kind of an overhead view storyboard. Here's where the user is going to be and these are these rough placements of all of the objects and their light sources. I have a theater background so it kind of helps me think of like you know a theatre set in terms of this is my users walking and this is how the user is going to move in relationship to all of the things in the scene. After that I'll either do a paper first person sketch it from their point of view or I'll jump into Quilt or Tilt Brush just the kind of anything that would just let me do it all in the virtual reality of 3D space. And I mainly do that to make sure that the you know the rough sizes and position of all of the elements makes sense. Once I do that I will go into unity a grayscale wireframe of every scene using blocks or I'll use Google blocks but I find it doing it in unity to be slightly faster. Once I do that once I build the scenes I will usually use this free tool called Vizor.io. What I like about this is again my kind of design philosophy is people shouldn't have to put on a headset to view something if they're not comfortable with that or if it takes too much time. So the reason I use something like Visor.IO is that you can use it on a desktop computer or you can use it on your own phone. So it's basically creating a more familiar way for people to get that same experience right.

Anna [00:08:42] What guidelines do you use from developing an interface?

Tyler [00:08:50] For MAR, you can kind of borrow the UI from the traditional mobile society. So think about your button. Other researched aspects like, buttons need to be large enough that if you have giant fingers you risk hitting both of them. Contrasting colors is important so you don't think about context of where people are going to be a lot. Also I find a lot of print designing for printing graphic design conventions. So you need to make text large so you know the largest there are the smallest text in your application should be viewable from you know the minimum distance that people are going to be away from it. You also want to think about the length of text that people want to read. You know Milton you know you want to basically use the newspaper headline approach in the sense that only tell people what they need to know. Don't have anything super verbose in there. You want to think about people's physical limitations. I mean holding a phone up like this to read something you don't think about it but I think its exhausting. Like doing this for more than you know a minute at a time is very tiring. So you need to provide enough breaks in your UI so that people aren't forced to do this all the time. You want to give them opportunities to change you know the

way that they are holding their device and change where they are looking. So that basically you know their arms aren't tired. You also want to think about audio so you know bluetooth headphones or connected headphones you know is something that is useful but you want to think about you know has your experience been used with our audio. Because you know depending on you know for accessibility reasons maybe the person in here or maybe the contact that people are using your experience maybe they are not able to use headphones or hear things. So you want to provide enough visual cues that people can use your experience without audio too.

Anna [00:11:30] How do you evaluate your immersive environment?

Tyler [00:11:43] First I look at the scale depending on how the experience is framed. Is the environment built to my scale and life size or is it smaller than life in miniature you know is it larger than life and I know it's meant to be grandiose? Does the scale of the environment empower me or does is it supposed to all me or is supposed to be normal. Then the size of the kind of the distance or the total you know open the world trap ability travel ability of the environment. So you know. Can I. Just you know. How long of a journey do I have to take to get through the environment is it kind of a quick thing where I can just stand in one place and kind of spin around. Does it required me to actually physically move around. How easy is it for me as a user to kind of navigate the environment without a map. Do I need a map. You know how familiar is for me to kind of move around in. And then again color is a huge thing. So particularly for augmented reality you need to think about it in the environment you know how close it is the augmented environment to blend in with my contacts is it meant to be separate from my contacts. How well is that distinction made.

Tyler [00:13:58] User testing depends on the time-frame. If its quick projects you have to do it yourself. You know obviously user testing is the goal and getting multiple people to do it is the goal. Especially in San Francisco and in the tech industry in general we tend to think that people have a much greater familiarity with this hardware and experience than they do. You know it has been my experience that you know people who are not in tech people even people who just aren't from SF or the Bay Area have to on board them into this experience takes twice as long as it does for someone who is in the industry. So you really need to consider who your audiences and you know you need to tailor your on-boarding accordingly.

Anna [00:15:13] You talked about micro-interaction frameworks. What micro-interactions you consider when designing for AR and VR?

Tyler [00:15:20] So it depends for mobile AR, the lowest barrier to entry is just point at a thing and then something happens. If you do need people to touch a screen then just use no phone interactions. Tapping buttons is super easy to do. Pitching to zooming and rotating is also pretty easy. For the headsets is the thing you honestly always try to keep the space simple. I mean head tracking and grasping touching gestures they are super finicky and honestly they're just super difficult to use. The software is not the hardware are not there to make those interaction easy yet for people who are not familiar with them. So if you want to use a HMD, just use gaze based interactions. For virtual reality, the problem for that is obviously you can't see your hands. So even if you can't visualize controllers you still don't really know where your hands. So my recommendation for virtual reality is to use physical UI controls on the controllers wherever possible. Usually their fingers are on some of the triggers that use buttons. As soon as you get to joysticks for

rotating things or touchpad, those can usually be explained easily but again it's just another thing for people to have to figure out. So instead of having someone have to use the trigger to select something and then use the joystick to turn it around maybe just consider having them you know grab something with a joystick and then just let them move it around physically with their hand. Anna [00:17:39] How do you use empathy in your design process?

Tyler [00:17:44] Empathy is the most important skill for anybody but especially for a UX or product designer. I basically approach designing as I am a child or I am someone who has never experienced anything beyond you know a point and click traditional desktop or phone experience. How can I make this totally new experience have enough familiar touch points that I don't get scared or that I am intrigued and I want to do this more. I try to tell people is 'Innovation is terrifying'. Innovation is where you tends to where users go from repeat users to using something once and getting frustrated with it and never turn back. So the initial onboarding, keep your innovation to a minimum.

Anna [00:19:06] How do you imagine the use of immersive media in medical care?

Tyler [00:19:11] I think there are a lot of possible ways augmented reality and virtual reality can help people. I think virtual reality has huge potential for therapy. I mentioned the study in Mexico using low cost HMD to treat burn victims. Virtual reality to treat PTSD or phobias I think is a huge. I think real time notifications is a big thing. Augmented reality is huge for physicians and clinicians and doctors. You know if I'm a doctor, I no longer have to you know carry my patient's paper records say I can just look at my patient and see everything about them that I have in my records or I can look at my patient and you know if I have their blood pressure cuff on them and no finger monitor and maybe I'm tracking their glucose or something I can have that data automatically fed into my HMD and I can just see that data next to them or wherever you know as I'm looking at them so it kind of removes one layer of distractions and can see that data immediately which builds empathy between the medical staff and the user. I can take a 3D scan of about healthy spine. I have a 3D images constructed from a patient's spine or pelvis or something. I go to orthopedics for this. I can compare the healthy spine to the patient's helping me to get a much better context for where I am and what I'm doing and the exact problems that I'm currently trying to solve.

Anna [00:22:19] When you're designing for health care system specifically, what are the key consideration you take into account?

Tyler [00:22:44] Other industries use the big UX terms like user delight but for health care there is none of that. For health care your primary goal is to display data. If these healthcare professionals need to see this data all the time and they need to see it clearly and so you can't waste time like oh this is going to have a gradient or this micro animation could be amazing no one cares. You need to display data in the same place at the same time always so that no matter the context I would never lose the data that is related to my picture. The other thing that you need is an audit trail. All of this data and the interaction that if you make any treatment decisions or if you record any data all of that data needs to be explicitly written down somewhere so that a government or a hospital can see it. [00:23:57] [0.0s]

Anna [00:23:58] What kind of improvements do you like to witness after using this technology in Healthcare?

Tyler [00:24:02] I mean I think honestly there needs to be big companies that are pursuing AR VR MR. I would love to see companies like Google Facebook other them to have dedicated health care professionals. Currently all of the applications are one time user experiences or trade-show show specific things or brand focused or they are games.

And my worry is that if these big companies don't find it useful to funnel money into healthcare or to raise awareness that health care is an industry that needs these technologies that the whole conversation is going to be dominated by these other you know more frivolous or impermanent or just other industries. So you know that there needs to be a buy in from the big players that have the clout within the industry that health care is an important thing and health care is an industry that we need to all focus on.

Anna [00:25:34] I just want to know what barrier as a designer you face when you're working with medical clients?

Tyler [00:25:44] So broadly we are certainly working on the treatment of cancer and the associated manufacturing and supply chain of back. So if everything from collecting whole cells from patients. Doing something to those cells either freezing them or spitting them into their constituent parts. Sending those to a lab somewhere where science can be done to them and then stored and some of them and then sending the rest of it back to the original hospital to then put those cells back into a patient to treat them.

Anna [00:26:30] What is your role in that?

Tyler [00:26:35] I am a product designer so I basically need to understand the whole context from you know who are the people who are going to be doing the thing you know. What is the context. They're doing an eight hour day in hospital are they in a lab, what are they going to be doing. Are they. Actually working with a patient in a hospital. Are they Are they manufacturing staff or are they working in a clean room. So you know what is the material they're working on. What other kind of hardware are they using. What kind of data do we need to have in our system. And then you know where are in the process are we. Does the material need to be split. And then I design the UI for the following system.

Anna [00:27:36] During a development process. How do designers aid the development process and what stage do the enter?

Tyler [00:27:44] In the ideal world designers are a part of the process from the very beginning. You know as soon as a client comes in with a brief. The more context we have as designers the better we're gonna be able to do our jobs. So hearing straight from the horse's mouth is always preferable to having those needs filtered through simple people. So again depending on the project depending on the process you could inherit a project that has already been worked on so in which case you're going to have to hope that there is a lot of documentation or internal technical documentation being written for the work flow. Basically the more context you have, better the design. I feel designers should be able to articulate the best case scenario for their users in whatever context they are and then depending on time and resources, the developer scopes may have to be taken out, things might change yet but design should be involved in the process and should be the ones saying for our users this is the best thing.

Anna [00:29:33] What challenges do you face when working with the developer?

Tyler [00:29:40] I mean the first thing is just a common language. You know developers have their own very specific language when they're talking.

Tyler [00:00:00] You know even what language they're developing and they have very specific terms that they use for things and those can be either you know that those terms can be the same things that you have in your design system

but they could be talking about something completely different. So you know that there's a lot of either in the terms the term is the same but they mean different things or the terms are just complete non standard and you have to figure out a way to bridge that gap and say OK when you say X I also say X and they are the same. A lot of the other constraints are just figuring out how to effectively demo a flow or functionality for them because you know you need to find a way as a designer to say you know in my flow if I do A And then I see I could jump all the way to F or I could go to C and D and then you have to adequately basically you just have to figure out all of all of those use cases and you have to basically give them the confidence that they will know what the entire flow of whatever you're doing.

Anna [00:01:24] You said in your medium article you said 'anyone can be UX designer'. How high do you future of the role of UX designers?

Tyler [00:01:35] I almost feel that the title UX designer will eventually become meaningless. I feel like the title has kind of become such a blanket term for so many different things. So depended on the company a UX designer could be someone who wireframe, prototypes, designs or codes and does project management. For another company UX designer could be someone who just researches and wireframes. I feel like there is far too much variability in what we have kind of tried to shove under the UX designer umbrella that eventually we might need to go back to more specific terms for what pieces of the process people do. And I think that is happening already. Currently you have you know a UX writer that is a position that I see a UX researcher. Those are things that are specific terms. It is one of the few professions where kind of having a background that is outside of design can really add to your expertise because you that coming from like if you are trained in the classics like literature or art history or anything it just gives you a broader perspective to draw from when you are designing.

Anna [00:07:50] How do you distinguish yourself from other UX designers?

Tyler [00:08:00] Yes. I didn't. Know aside from my wit and good looks. I mean I think I tend to think a lot more about the context of a person and kind of their personal history as a human because that's kind of where I come from on the archaeology side. So my first thought is always Where is this person going to be doing a thing and how does this impact on the person just kind of you know as a human in terms of like you know. Thinking about the human body just like a system of lemurs and pulleys. And then I try to think about you know their psychology where they are. They're feeling it kind of you know. I try to kind of ascribe the overall context for what they're going to be doing. I think my personal design ethos is really functional minimalism where I can. I mean I'm a huge fan of applications like Adobe Photoshop or excel even because they have specific use case that didn't go well in terms of you know I mean they're not like super dreamline UI by any means. But they present all of the tools that people need and they present the way that people can always find good and useful. So I'm a huge believer of that we should not be hiding functionality behind clever tricks. Functionality is the first thing to think of in your hierarchy of needs.

Anna [00:10:12] Can you suggest me and some good VR road apps you think have good new user experience design?

Tyler [00:10:20] I really like Google measure for Android phones. I think their UI actually very simple can you. I really don't like lifestyle applications that try to do everything all at once. This is a simple application that does one thing. It measures things on your phone in augmented reality so it's a very purpose built single use for single use case rather than application. For virtual reality, there is a game called Waltz of Wizard. It's kind of weird like the Victorian

steampunk sort of thing. The game is fun because again you basically can kind of you play it with other people which is nice and you basically can teleport. Around these various platforms and just shoot kind of magic at people. So again it does it's very simple. You know you can teleport and then you aim and you shoot and then you have a shield that you can bring up. So we've done three things and kind of the most work was put into the world and making the magic that you can. So again it uses established movement convention ended and they really made a bold choice in their world aesthetic which I really appreciate.

Anna [00:12:01] Is there any need for designers to create AR experiences?

Tyler [00:12:32] I mean it's not to say that you know developers aren't empathetic or don't care about usability but I think you know in terms of like you know keeping your job title consistent. Yes. I think UX designers should be able to design thing in AR experiences. I think the real barrier or problem at this point is there just aren't a lot of easy ways to quickly prototype.

7.3. Design Materials

7.3.1. Evaluation Criteria for the Mental Health Applications

Mental Health Assesment	Usability Assesment	Immersive Game
Therapy Purpose	Able to use offline	Devices Used
Therapy Model	Minimum Size	Technology
Symptom Management	Ability to Export Report	Input Interaction
Designed with Medical Professionals	Good App Performance	Narrative Type
Content Verified	Ease of Use	The goal of the narrative
Supportive Resources	Easy to Navigate	Reward Mechanism
Safety Measures	System Speed	Character Style
Privacy and Security Measures	Automated Data Entry	Inclusion of Storyline
Advisory	Reminders	Visual & Audio Cues
Phobia Type	Well determine user flow	Retention of the Action
Support Comorbidity	Clear Legibility	Spatial Audio
Comparison of Behaviour	Information Hierarchy	Players
Goals and Planning	Consistent position of Info	Immersiveness Effect
Real-Time expert Involvement	Clear Prompts for input	Cybersickness
Randomized Controlled Trials	Helpful error message	User's Mobility
Knowledge Libraries	Minimum Learning Curve	Comfort
Avoiding Medical Jargons	Performing task straightforward	Inclusion of breaks
Consistent Terminology	Uniform Colour palette	Speed of the narratives
Number of Sessions	High Quality of Graphics	Render Quality
Duration of Session	Quick Access to Instructions	Interaction Lag
Encrypted Data	System Feedback	Stimulating Experience
Access to History	Device Compatability	Accuracy
Diagnosis Methods	App Availability	Ability to Repeat
Short Term or Long Term Use	Flexible System	Natural Engagement
Ability to communicate	Language	Navigation
	Disability Accessibility	Orientation
	Technical Support	Haptic Feedback
	Tutorials	Enjoyment Level

Appx 1: Evaluation Framework

7.3.2. Storyboarding of Intro Animation for the Game

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Appx 2: Part I, Storyboarding of Introduction Animation to the Serious Game for Arachnophobia Therapy.

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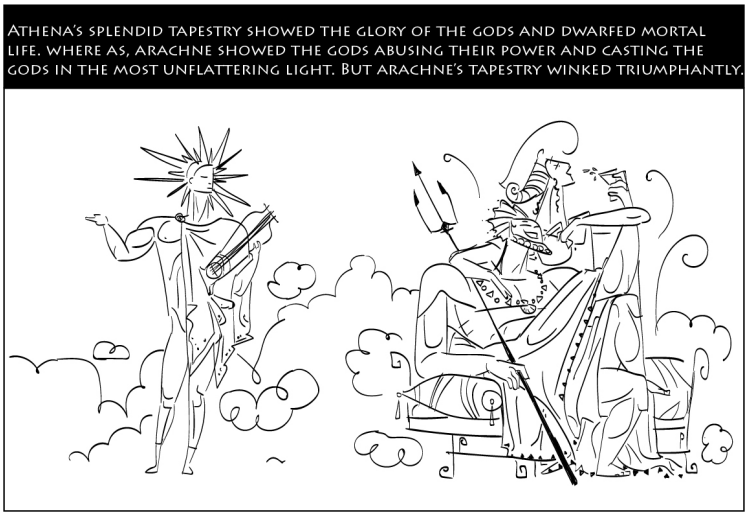

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Appx 2: Part II, Storyboarding of Introduction Animation to the Serious Game for Arachnophobia Therapy.

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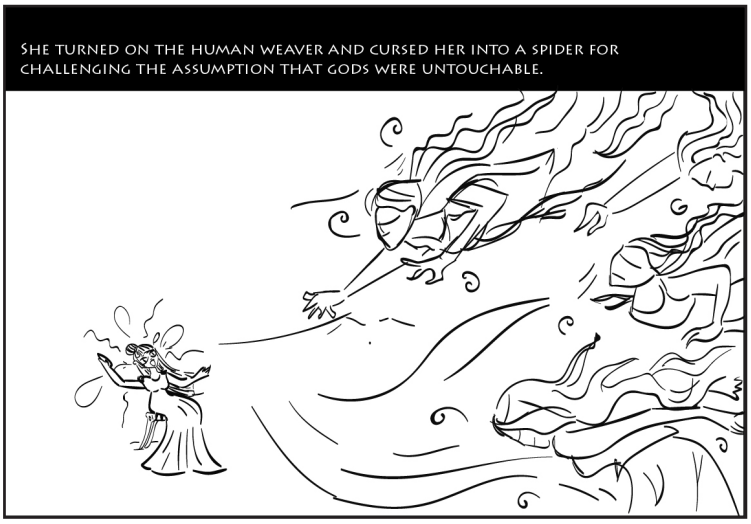

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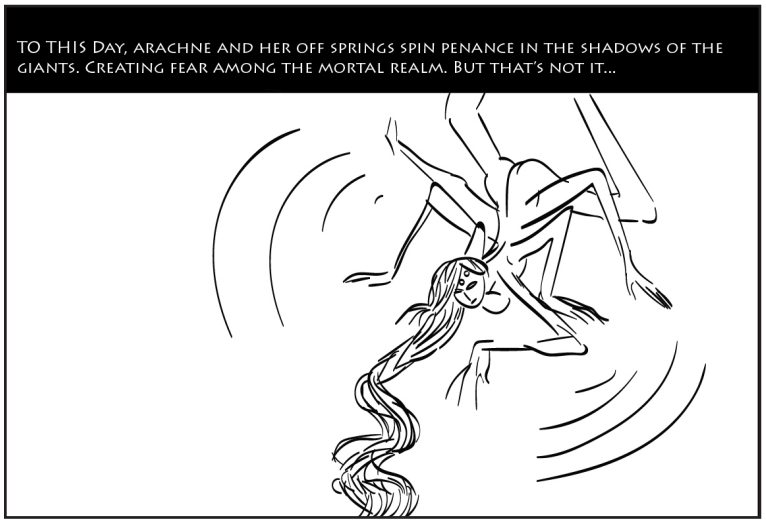

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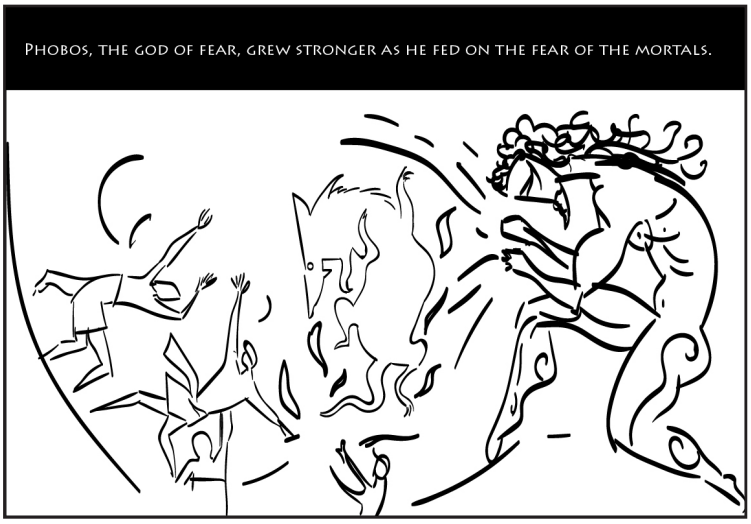

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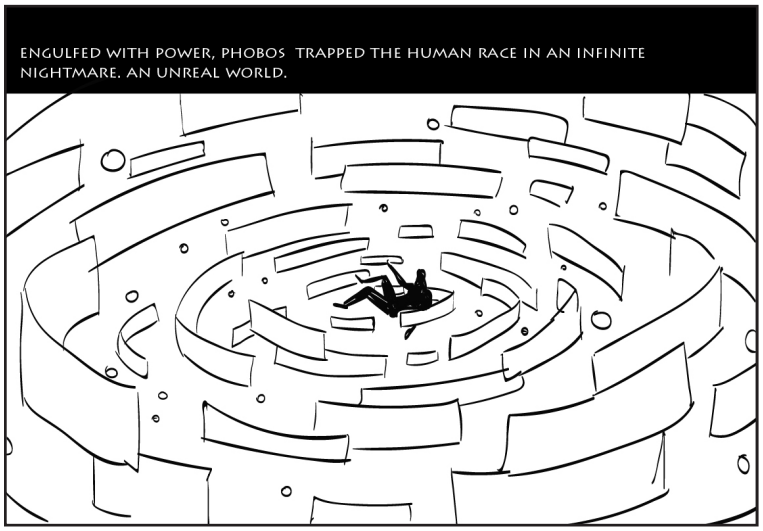

Appx 2: Part III, Storyboarding of Introduction Animation to the Serious Game for Arachnophobia Therapy.

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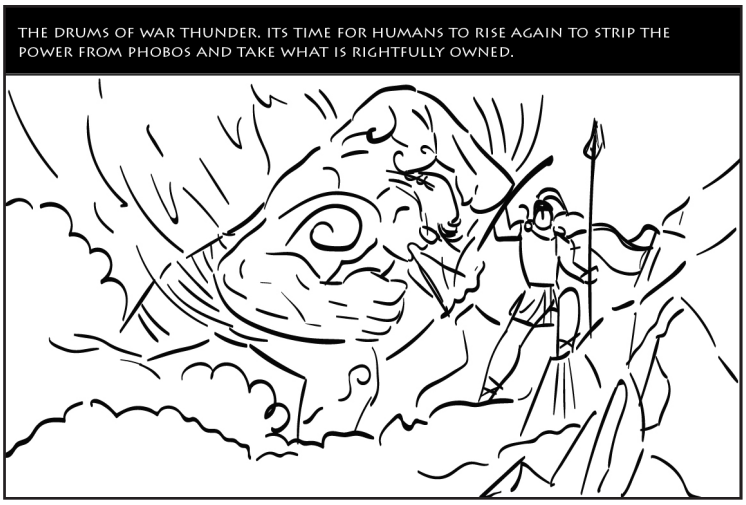

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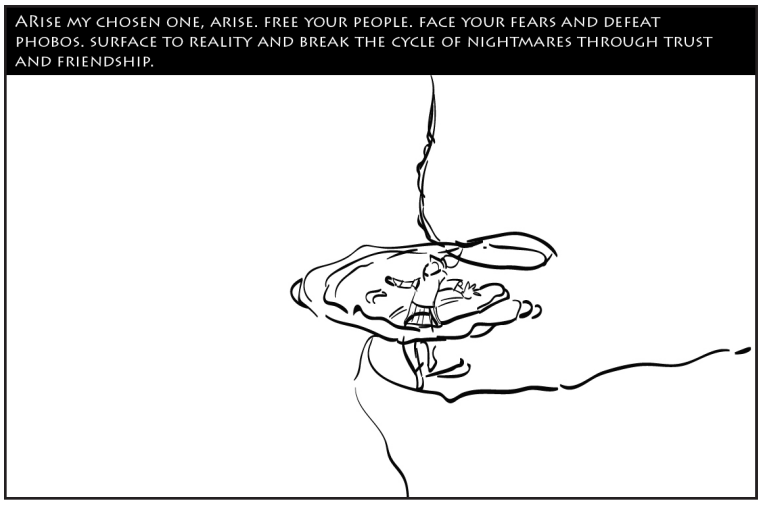

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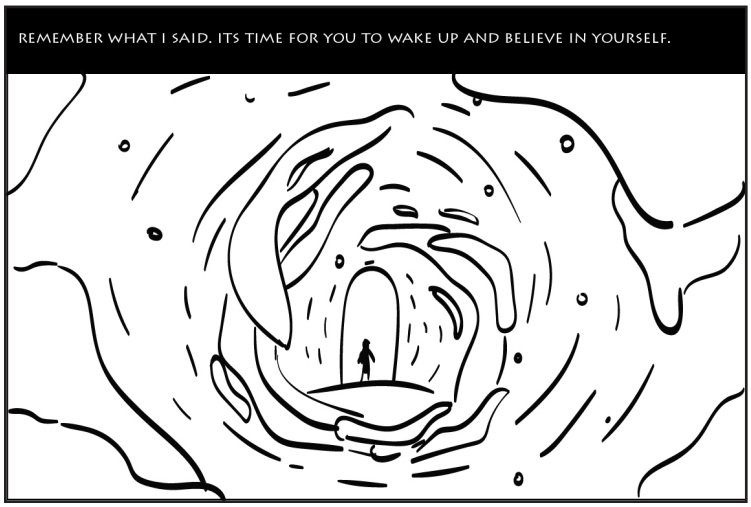
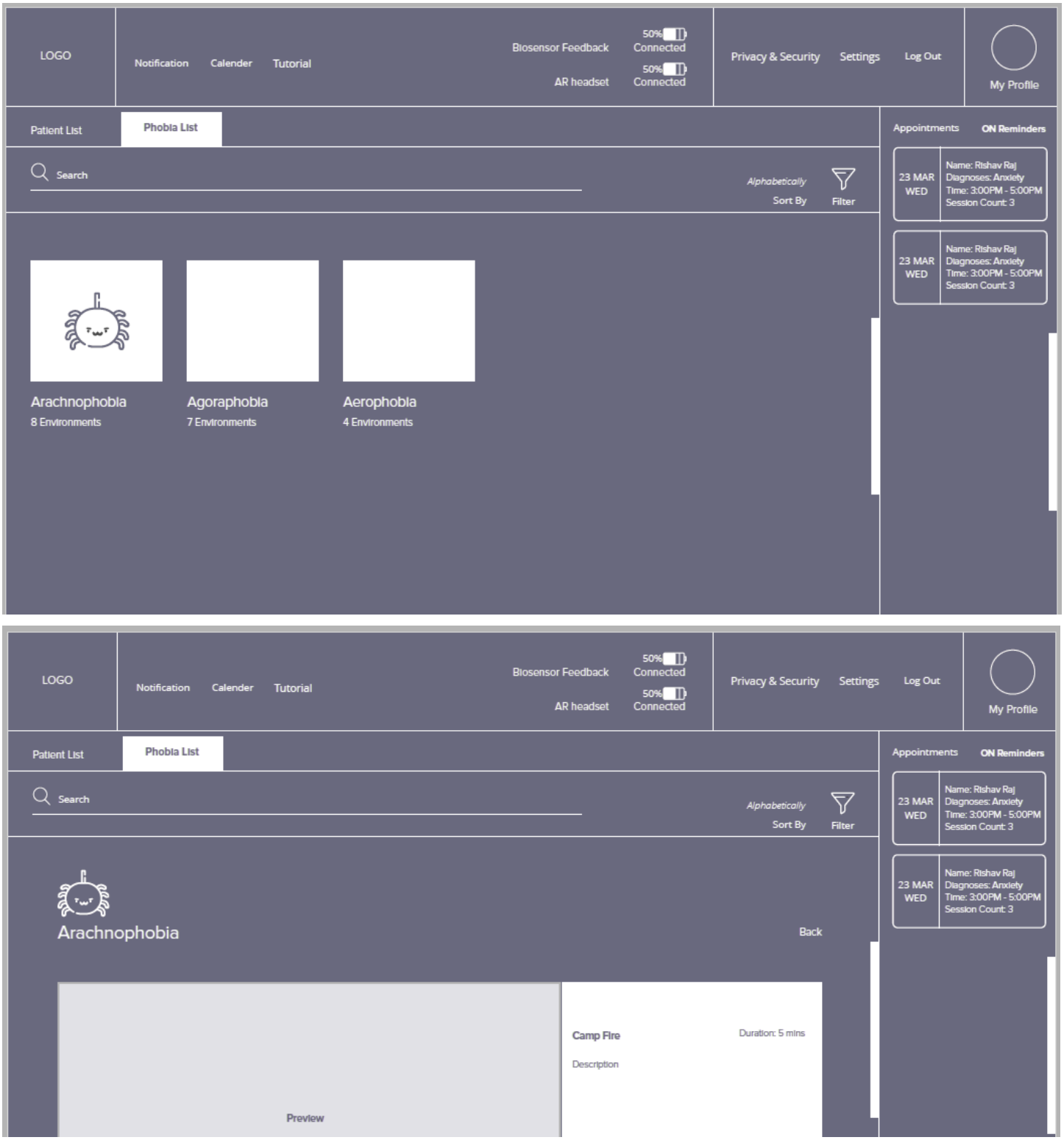


Appx 2: Part IV, Storyboarding of Introduction Animation to the Serious Game for Arachnophobia Therapy.

7.3.3. Wireframe of Therapist Interface

Appx 3: Part I, Wireframe of the Patient List (top) and Patient Profile (bottom)



Appx 3: Part II, Wireframe of the Patient List (top) and Patient Profile (bottom)

7.4. Exhibition Documentation

Appx 4: Thesis Exposition: Fine Arts Building, University of Alberta

Appx 4: Thesis Exposition: Fine Arts Building, University of Alberta

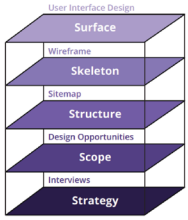
Augmented Therapeutics:
Designing an Augmented Reality Platform for Arachnophobia Treatment

My research focuses on the challenges surrounding a patient's engagement with mental health applications (MHApps) using arachnophobia as an example. The objective of this dissertation is to:

- Identify the range of techniques used for Exposure Therapy (ET) for arachnophobia;
- Investigate and propose design practices that can improve patients' and therapists' experiences for Augmented Reality Exposure Therapy (ARET); and,
- Better understand the effectiveness of and challenges in Augmented Reality Exposure Therapy.

Expert interviews were conducted from the fields of psychology and user experience design to identify the underlying design opportunities for AR therapy and discover the factors impacting the patient therapeutic experience. **Qualitative analysis of existing AR/VR applications** was used to develop a framework for evaluating the current design practices in AR/VR applications for arachnophobia.

The main outcome of this research takes the form of a prototype for an interactive AR platform called Boo, to support exposure therapy for arachnophobia. In particular, it employs **user experience design frameworks and fantasy-based serious gaming narratives** that can improve patient's participation and therapist's experience for AR Exposure Therapy. While AR technology is relatively new and is still being tested in clinical settings, it is important to consider optimal ways of integrating it within existing clinical models of care, with minimal risks, ethical safeguards and an emphasis on building relationships between patients and providers—and in so doing—empowering the mental health care delivery system.



Design Process: *The Elements of User Experience* framework developed by Jesse James Garrett

RESEARCH FINDINGS

- AR/VR helps therapists have control over the fear-inducing stimuli and patients feel more secure as the situations that they fear in the real world cannot physically happen in AR/VR.
- AR/VR can recreate the phobic situation easily which increases the efficiency of the ET session, additionally, the headsets use eye-tracking which helps the therapist to ensure that the patient focuses their attention on the fear stimulus and there is no avoidance.
- AR has additional advantages over VR as AR allows the patient is to see their therapist and hence it does not act as a barrier for communication. Furthermore, AR does not cause motion sickness (cybersickness) as patients are spatially oriented with their surrounding.

Appx 4: Panel 1

- Mental health applications that are clinically tested and developed in collaboration with healthcare professionals are expensive and often limited. As a result, individual practitioners are unable to use these applications in their daily practice.
- The patient's adherence to therapy protocols through these MHApps is low because the application is often visually unappealing, not user-friendly and too complex, and are not tailored to the needs of each patient.
- Serious games can enhance patients' experiences through interactive storytelling and can help to motivate patients to engage themselves with therapy.
- Game narratives are important in capturing the attitudes and perceptions of patients. They help to tackle the emotion of disgust by creating a bond with the spiders and enable patients to apply the learned skills in a real context.
- Fantasy narratives can help the patient in overcoming the emotion of disgust for spiders by helping patients create empathy with the spiders, learn coping skills, and create a non-clinical and fun learning environment.
- Design recommendations on how to build an AR environment for Exposure Therapy are presented.

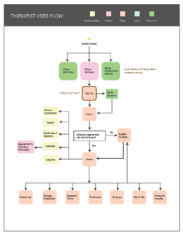
NAME AND IDENTITY DESIGN

Boo is a slang word that has been used since the 19th century to scare or startle someone. The logo reads the word Boo as well as shows the medium of the therapy ie. immersive media. The logo communicates the meaning—an AR platform for overcoming fears through playful narratives. Psychology notes that the colour purple can trigger creativity, and it is often associated with magic and power.

Logo design

THERAPIST INTERFACE

Mental Health Guidelines

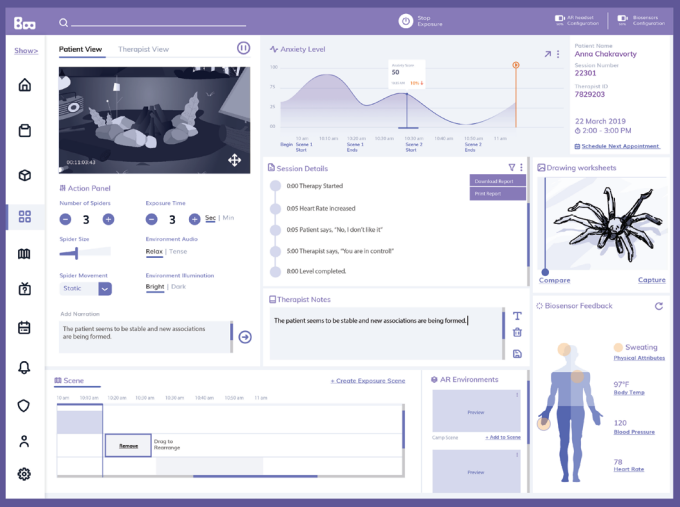


Sitemap

Wireframe of Therapy Dashboard

Mental health guidelines and design opportunities were addressed through the therapist's AR platform. Sitemaps and wireframes were created to lay out the user flow and the functionalities for the platform. Boo's therapist platform is created to help therapists to conduct AR Exposure Therapy for arachnophobia.

Appx 4: Panel 2



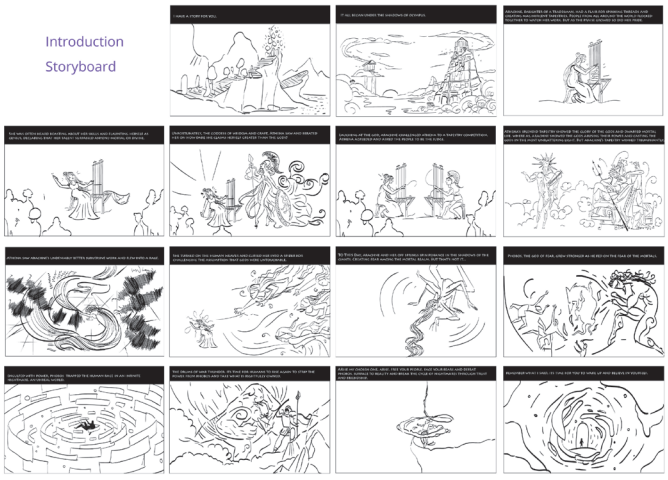
User Interface of Therapy Dashboard

The Therapy Dashboard allows the therapist to create the exposure levels and change variables depending on the patient's response. Biosensors are used to track anxiety levels and the software creates an automated recording of the session.

PATIENT EXPERIENCE

The word arachnophobia comes from two roots, arachnid, "spider," from the Greek Arachne, and phobia, "fear," from the Greek Phobos. Thus, the game narrative is inspired by Greek mythology. The storyboard shows the introduction of the game. Each game level will have short animations of stories.

Introduction
Storyboard



Appx 4: Panel 3

GAME PROTOTYPE

The initial level of the game starts with a camping scene in a whimsical forest which is inhabited by forest nymphs and magical creatures. The patient is required to build a campfire by collecting wood, stones, etc., which is guided by the Boo character (played by the therapist). During these actions a spider appears and the patient is required to capture it by looking at the spider (eye-tracking) until the timer finishes which is the exposure time. The patient can interact with the surroundings through eyetracking, gestures or voice. Once the level's tasks are completed, the patient is required to answer questions regarding their mood, anxiety level, draw their perception of spiders and map their physical symptoms. As the game advances, the patient is exposed to a more realistic render of the spider. Everyday objects are added to build tactile memory. The patient is trained on how to manage their anxiety, change their emotions towards spiders and learn how they can capture spiders without killing them.

First Level of the Boo Game

Patient Data Collection

Final Game Level

Appx 4: Panel 4

Appx 4: Boo, Level 1 ARET Prototype, video simulation

Video Link: https://vimeo.com/387620154

Video Access Password: annathesis2020