

Virtual Reality Exposure Therapy in the Treatment of Anxiety and Related Disorders

Ojomu Paul Omolola

City University of Seattle

Department of Arts and Sciences

CPC 695: Research Project

Dr. Mike Sornberger

August 25, 2022

Virtual Reality Exposure Therapy in the Treatment of Anxiety and Related Disorders

Anxiety disorders, including generalized anxiety disorder, social anxiety disorder, specific phobias, agoraphobia, and separation anxiety disorder, constitute the most prevalent types of mental disorders, resulting in high healthcare costs (Baghaei et al., 2021; Bandelow & Michaelis, 2015). In addition, anxiety disorders often have comorbidity with other disorders such as depression and somatic disorders, resulting in greater healthcare challenges and costs (Penninx et al., 2021). Anxiety disorders are also the most common form of mental illness in children (Penninx et al., 2021).

Psychotherapy, with or without medication, is often used to treat anxiety and related disorders (Bandelow et al., 2017). Several therapeutic techniques and interventions can be used in the treatment of anxiety disorder. However, cognitive behavioural therapy (CBT) is the most used technique for treating anxiety disorders (Bandelow et al., 2017). One key component of CBT used in treating anxiety disorders involves exposure to the dreaded object or situation (Penninx et al., 2021). The exposure can be done by asking the client to imagine the feared situation or through in vivo or real-life exposure to the feared stimuli (Penninx et al., 2021).

Exposure-based techniques are some of the most commonly used methods of treating anxiety disorders (Kaczurkin & Foa, 2015). In addition to imaginal (i.e., occurring in the client's imagination) and in vivo (i.e., experiencing in real life) exposure techniques, virtual realities have also been used to treat anxiety and related disorders with significant positive results (Maples-Keller et al., 2017; Zhang et al., 2020). Virtual reality (VR) technology uses VR headsets connected to computer devices to create a real sensory experience. With VR, users experience a three-dimensional virtual environment similar to a real-world experience (Maples-Keller et al., 2017). VR can be used to assess an individual's interaction in a social situation; it

can also be used to evaluate cognitive performance in certain conditions. Furthermore, it can be used to assess and reduce symptoms such as auditory hallucinations, addictions, and phobia (Bell et al., 2020).

As more clinicians become more interested in incorporating VR in their practice, there is a need to understand what VR technology entails, the challenges of implementing this therapeutic approach, and the types of disorders that can be treated with VR. Hence, this review aims to synthesize the existing literature on this topic in order to provide additional insights for clinicians interested in this field of intervention.

VR has the potential to revolutionize the assessment and treatment of some mental health disorders. One significant advantage of using VR is that the client can experience an immersive and interactive virtual world controlled by the therapist (Bell et al., 2020). In addition, with VR exposure therapy, clients can experience a variety of situations right in the therapist's office without real-life exposure, thereby saving cost, time, and energy (Bell et al., 2020).

VR has been used successfully for exposure therapy to treat anxiety and related disorders (Bouchard et al., 2017). Individuals with some form of phobia or social anxiety disorder may find it challenging to seek treatment that involves actual real-world exposure to the situation that predisposes them to anxiety, but exposure using VR provides a better alternative to in vivo exposure (Bouchard et al., 2017). Incorporating VR exposure with CBT and other forms of intervention in treating social anxiety disorder is more effective and practical (Bouchard et al., 2017).

In vivo exposure can be significantly expensive as the therapist might be required to be with the client at the feared place. Sometimes, the feared site may not always be available, and imaginal exposures might not be effective (Riva, 2020). Furthermore, clients are less likely to

feel threatened by the virtual environment as they can control what happens in the virtual space. Moreover, VR ensures the client's privacy and confidentiality as everything can be done in the therapist's office (Riva, 2020). In contrast, if the client and therapist were to use in vivo exposure that includes being in a public space together for the intervention, there is the possibility that the client's privacy and confidentiality might not be guaranteed.

Several studies have supported that VR exposure therapy reduces dropout rates, effectively treats various forms of anxiety disorders, and is currently being investigated to treat several other mental disorders such as eating disorders, addictive disorders, autism, sexual disorders, and many others (Riva, 2020). In addition, VR interventions have been used to treat severe pain by using a virtual environment to distract the patient (Riva, 2020). Furthermore, with the advent of less expensive VR hardware and 360-degree videos available on smartphones, clients can access self-help videos and applications (Riva, 2020).

VR exposure therapy is a relatively new technique of psychological intervention. However, as VR begins to gain more popularity and becomes more accessible through the invention of VR headsets that are relatively cheap, there is increased curiosity regarding its use for mental health interventions. This paper will explore three factors related to the use of VR in the treatment of anxiety and related disorders. First, this paper will discuss existing literature on the treatment of anxiety and the efficacy of VR treatment. Next, this paper will identify challenges to implementing VR exposure therapy within treatment settings. Finally, this paper will explore areas of clinical applications.

Self-Positioning Statement

I have always been fascinated by the engineering and technology world, especially with regard to new technological inventions. I usually spend time reading about new innovations and

getting involved as much as possible. My interest in technology was the reason I pursued a master's degree in information technology after my first degree in electrical and electronics engineering. One of the reasons I am transitioning into psychology after 10 years of working as a computer network analyst is my interest in brain science and human behaviour.

This led me to pursue a bachelor's degree in psychology from Athabasca University. Some of the courses that interested me most were Abnormal Psychology, Learning Disabilities: Issues and Interventions, and Assistive Technology for Students with Special Needs. For example, I learned about the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association [APA], 2013) in my abnormal psychology class; it was the first time I learned about anxiety and related disorders and other mental health disorders. Another course that attracted my attention was the Assistive Technology class. In that class, I saw how my knowledge in information technology could help design new interventions or work with existing interventions to work with children with special needs or those with mental health challenges such as autism spectrum disorder (ASD).

But things started to take a new turn when I was admitted to the Master of Counselling program. In one of the classes, I asked one of my colleagues, who said he had a diagnosis of generalized anxiety disorder, to explain to me what people with anxiety disorder really feel. He asked if I remembered how I felt when I was about to write an exam. I said yes, I know that feeling of anxiousness; he said I should imagine feeling like that on a typical day even though I knew that I would not be writing an exam. That explanation gave me a deeper insight into what people with anxiety disorder face in their daily lives. Of course, it is normal for everyone to feel anxious when faced with strange situations or trying something for the first time, or meeting some people for the first time, but to keep having those feelings when there are no apparent

reasons got me thinking and interested in the study of anxiety and how to carry out interventions effectively.

So, as I began to read more about anxiety and other related disorders, I also became more interested in understanding applicable intervention techniques. For example, I began to learn about exposure therapy and how it can effectively treat anxiety. I started to develop an interest in achieving exposure without necessarily moving to an actual physical environment or just doing everything by imagination. Consequently, I began to read about how VR can be a good substitute for in vivo (i.e., real-life exposure) experience. As an IT professional, I have always had a passion for technology and how to apply technology in solving day-to-day problems, so it was natural for me to become interested in how VR can be used as a form of intervention in counselling services.

The first time I experienced a VR environment was when my kids asked that we go to the VR Arcade center in Calgary to play multi-player computer games together as a family. As I put the head-mount on my head, held the two controllers in my hands, and pressed the play button, I found myself taking part in what looked like a real-life battle for survival as I was able to jump from one place to another like a ninja. While I became anxious because of my fear of heights, I kept reminding myself that I was just on a flat surface and not in the outer world, but the more I tried to reason, the more I found it difficult to separate my thinking from the new reality in which I found myself. At one point, what I did to get rid of the fear of falling off the edge of the building on which I was virtually standing, was to remove my head-mount and see the real space I was in again. After the experience that night, I became more interested in the world of VR.

I have met several people with varying degrees of phobias. A particular case I remember was when I had my first local flight in Nigeria several years ago; even though I was a bit nervous

at first, I was able to ground myself by taking some deep breaths and telling myself that I know that air travel is the safest form of travel. However, I saw a man sitting across the aisle, visibly shaking as the aircraft was taking off. Fear was written all over him, and he could not control his display of emotions as he had his head on his knees and was so restless. I noticed he did not enjoy the flight that day. I imagine that people like him could benefit from VR exposure therapy by simulating the aircraft environment and gradually desensitizing him from the fear of flying without even getting to the airport.

My strong background in information technology has prompted my interest in studying VR as an intervention strategy for mental disorders. In addition, I have over 15 years of work experience in information technology implementations and management. So, there is a tendency for me to be overly focused on the technological aspect of the research rather than paying attention to how clients and therapists are going to be impacted using the technology. In doing this research, I am aware of this potential bias. Therefore, it is important for me to address the potential challenges of using VR exposure therapy for treatments by looking for literature that critiques VR as an intervention and not only those promoting VR as an effective psychological intervention tool.

Literature Review

Several works of literature exist on the etiology, prevalence, and treatments of anxiety and anxiety-related disorders. This section reviews some of the existing literature, including the *DSM-5* (APA, 2013). There is a great deal of information on the different techniques of anxiety interventions, but this paper focuses on the exposure therapy techniques, with emphasis on the use of VR as a tool within the therapeutic framework.

Anxiety Disorders

Definition and Prevalence

The *DSM-5* (APA, 2013) describes anxiety disorders as those involving extreme fear, anxiety, and related behaviours. Fear is a normal response when faced with a perceived threat or danger, while anxiety involves anticipation of threats that are yet to occur (APA, 2013; Penninx et al., 2021). Fear often involves a flight, fight, or freeze response due to imminent danger; the autonomic response is needed for survival. In contrast, anxiety is often associated with muscle tension in readiness for a future threat (APA, 2013). Excessive fear and anxieties can require clinical intervention when they occur in such proportion as to cause distress or interfere with normal day-to-day functions (American Psychology Association [APA], 2017; Penninx et al., 2021).

There are several types of anxiety disorders according to the *DSM-5*, which include separation anxiety disorder, generalized anxiety disorder, panic disorder, agoraphobia, substance/medication-induced anxiety disorder, and specific phobia with specifiers: animal, natural environment, blood-injection-injury, situational (APA, 2013). Other disorders related to anxiety disorder include posttraumatic stress disorder (PTSD) and obsessive-compulsive disorder (OCD).

Estimates of cumulative prevalence of anxiety disorders have been placed between 20% and 30% of the general population (Penninx et al., 2021), resulting in significant health care costs (Bandelow & Michaelis, 2015). Three out of five children and adolescents are estimated to experience an anxiety disorder during childhood. Additionally, 10% to 14% of adults are estimated to meet the criteria for anxiety disorders as specified by the *DSM-5* (Penninx et al., 2021). The prevalence rates of anxiety disorders have been found to decrease with older age

(Bandelow & Michaelis, 2015). Anxiety disorders are often comorbid with other types of anxiety and mental disorders, including depressive disorders, substance use, and other disorders. In most cases, comorbidity is linked with higher severity of symptoms, leading to more impairment and treatment seeking (Noyes, 2001).

Theories of Anxiety

Two prevailing theoretical models relating to how exposure therapy reduces anxiety include emotional processing theory and the inhibitory learning model.

Emotional Processing Theory. The emotional processing theory was developed by Foa and Kozak (1986). Emotional processing occurs when memory structures are modified in such a way that the client can develop a new belief or new emotional response to their fears; they are able to cope without experiencing the previous distress attached to the feared stimuli (APA, 2017; Van Hout & Emmelkamp, 2002). The emotional processing model is based on the works of Peter Lang and Jack Rachman. According to Lang (1971), emotion is stored in memory as information regarding the feared stimuli, information regarding the physiological and verbal responses, meanings attached to stimulus, and the responses. As a result, treatment should focus on activating all the prototype fear that is already stored in the memory. As the client processes the information, a new prototype containing less or no fearful response can override the initial fearful stimuli (Van Hout & Emmelkamp, 2002).

Exposure therapy helps to minimize anxiety as a result of feared stimuli by firstly activating the fear structure, then trying to override the fear memory by incorporating new information (Van Hout & Emmelkamp, 2002). Clients who improve with exposure-based treatment often go through this sequence: (1) psychophysiological arousal during initial

exposure; (2) decrease in fear response as exposure progresses, leading to habituation; and (3) decrease in fear response across different sessions (Van Hout & Emmelkamp, 2002).

However, habituation can occur outside the session, which means that the decrease in the fear response due to repeated exposure can occur after the exposure therapy session in the therapist's office; so, the absence of habituation within the session does not mean it will not happen at all (Benito & Walther, 2015). Cognitive avoidance or other forms of distractions can render the exposure treatment ineffective, and incomplete emotional processing can happen if the exposure time is not long enough to allow habituation to take place; furthermore, if the initial fear arousal is extreme, anxiety reduction becomes more challenging (Van Hout & Emmelkamp, 2002).

Inhibitory Learning. The inhibitory learning model posits that instead of replacing the fear, new learning can prevent the fear from manifesting (Chesham et al., 2018). From the Pavlovian conditioning approach, the inhibitory learning model postulates that the paired conditioned stimulus (CS), which is formerly a neutral stimulus that starts to produce a new stimulus after acquiring the ability to do so from another stimulus, and the unconditioned stimulus (US), which is a stimulus that elicits a natural response, do not get totally erased during extinction but instead remain intact (Craske et al., 2014). What then happens is that secondary inhibitory learning about the CS-US pair develops, which means that the CS ceases to predict the US (Craske et al., 2014).

Neurobiology and Anxiety

Fear generalization from an evolutionary perspective is an adaptive neurobiological process that allows for survival in a complex environment (Asok et al., 2019). When animals or humans are faced with a potential threat, an automatic response of fight, flight, or freeze is

activated based on past experiences that may not be identical to the current situation, thereby providing a sense of safety or danger (Asok et al., 2019). Fear generalization, however, is the cause of many anxieties and stress-related disorders (Asok et al., 2019).

Therefore, understanding the neurobiology of fear acquisition and extinction is necessary to comprehend how exposure therapy in vivo, imaginal, or VR helps as an intervention. The basolateral complex of the amygdala has been found to play a significant role in the acquisition and expression of fear conditioning (Milad et al., 2014). Brain scientists have implicated the amygdala, which is a complex structure of cells in the middle brain, in the fear response (Gale et al., 2004). Furthermore, studies have shown that the basolateral amygdala is responsible for the storage of fear in memory (Gale et al., 2004). Animal studies have also implicated the prelimbic division of the medial prefrontal cortex in regulating acquired fear. Furthermore, functional MRI studies in humans show activation in the amygdala and the dorsal anterior cingulate during the acquisition and expression of fear (Milad et al., 2014). However, fear extinction involves the interaction of the infralimbic system of the medial prefrontal cortex, the hippocampus, and the basolateral complex of the amygdala (Milad et al., 2014).

Evidence-Based Interventions

With the high prevalence of anxiety disorders, a variety of treatment techniques have been employed to support clients. In very severe cases of anxiety, anti-anxiety medications such as benzodiazepines are often prescribed by physicians to reduce the symptoms in addition to therapeutic interventions (Bandelow et al., 2017). Some of the common therapeutic approaches used for anxiety intervention include psychoeducation, cognitive behavioural therapy (CBT), mindfulness-based cognitive therapy (MBCT), and exposure and systemic desensitization (Goshtasbpour, 2015).

Psychoeducation. Psychoeducation is a significant part of evidence-based treatments of anxiety and related disorders. Psychoeducation involves teaching the client about the disorder (Lavell et al., 2020). The aim of psychoeducation is to empower the client to cope with and manage their anxieties (Lavell et al., 2020). Psychoeducation often involves helping the client understand how excessive anxiety behaviours, such as frequent checking of one's body sensations, can increase the risk of more severe anxiety issues (Hedman-Lagerlof & Axelsson, 2019). In most cases, psychoeducation can be the primary intervention and can also be a part of CBT intervention (Hedman-Lagerlof & Axelsson, 2019). Psychoeducation can be delivered directly by the therapist during the session regarding the client's anxiety or can be in the form of additional readings.

CBT. CBT is a form of evidence-based psychotherapy that works within the cognitive framework (Beck, 2021). The basic tenet of CBT is that cognition, emotion, and behaviour influence each other and that human cognition impacts how behaviours are interpreted, thereby affecting how we respond to them (Nichols & Davis, 2021). CBT focuses on changing attitudes and promotes change in behaviour by challenging people's negative or automatic thoughts about themselves or their environment (Nichols & Davis, 2021). Furthermore, automatic thoughts can result in distorted conclusions shaped by people's core beliefs (Nichols & Davis, 2021). CBT takes a proactive approach based on a strong therapeutic alliance between the therapist and the client (CAMH, 2021).

CBT is highly structured and is one of the most used intervention techniques to treat anxieties and related disorders. CBT effectively treats generalized anxiety disorder, panic disorder, social anxiety disorder, specific phobia, PTSD, and OCD (Kaczurkin & Foa, 2015). CBT uses techniques and interventions that promote adaptive thinking and behaviour to reduce

the distressing experience (Curtiss et al., 2021). The type of CBT intervention used often depends on the kind of anxiety; CBT techniques commonly include cognitive and behavioural interventions (Curtiss et al., 2021).

Cognitive Interventions. A cognitive intervention involves the process of *cognitive restructuring* to enhance more adaptive thinking by identifying automatic thoughts that contribute to negative or wrong conclusions (Curtiss et al., 2021). For example, someone with anxiety often engages in *black-and-white thinking* or *overgeneralization* of things and events (Curtiss et al., 2021). So, through cognitive intervention, the therapist helps the client explore any maladaptive beliefs against empirical evidence (Corey, 2017; Curtiss et al., 2021). In addition, the client is often assisted in making alternative interpretations of things in their lives that may be contributing to the anxiety (Corey, 2017; Curtiss et al., 2021).

Cognitive restructuring and behavioural interventions are often used to treat anxiety and related disorders (Curtiss et al., 2021). Other techniques used in cognitive interventions include cognitive restructuring or framing, guided discovery, and journaling or thought records (Pietrangelo, 2019). For example, cognitive restructuring is used in panic disorder intervention by helping clients reinterpret their maladaptive thoughts regarding panic (Curtiss et al., 2021).

Behavioural Interventions. Several behavioural techniques are used in CBT for treating anxiety disorders and other related disorders. These include behaviour activation which involves the use of behaviour (action) to influence one's feelings or emotions, relaxation and stress reduction techniques which focus on relaxation as a way of reducing stress, role-playing which involves practising some roles relating to the client's concern and the intervention, and behavioural experiments such as exposure therapy (Pietrangelo, 2019). These techniques are used in the treatment of different forms of anxiety. For example, in vivo exposure can be used as

a behavioural treatment for specific phobias such as fear of flying, riding a subway, or driving in traffic (Curtiss et al., 2021). Mindfulness and exposure therapy are examples of techniques that can be used to treat generalized anxiety disorder, social anxiety disorder, OCD, and PTSD (Curtiss et al., 2021). Relaxation and stress reduction techniques through meditation and exposure therapy are discussed in further detail in this paper.

MBCT. Mindfulness-based intervention can be employed as part of the CBT intervention or a stand-alone treatment (Curtiss et al., 2021; Navarro-Haro et al., 2019). Mindfulness involves intentionally paying attention to and observing stimuli such as emotions, thoughts, and body sensations without judging or manipulating the experience (Kladnitski et al., 2020). Mindfulness helps the client connect with their body by noticing what is going on in their body and mind; it connects them with the here and now.

Mindfulness is effective as an intervention technique for some underlying anxiety disorders (Helmes & Ward, 2017; Kladnitski et al., 2020; Tahereh et al., 2018). Mindfulness practice can be carried out in the therapist's office. Similarly, the clients can engage in mindfulness alone through guided mechanisms such as the use of audiotapes, YouTube videos, or through the use of VR. In addition, mindfulness techniques such as breathing exercises, body scans, and grounding techniques are often combined with psychoeducation (Kladnitski et al., 2020).

Exposure Therapy. Exposure therapy is a form of behaviour therapy that involves making clients face what makes them anxious or fearful. It is one of the most commonly used interventions in treating anxiety and related disorders such as specific phobias, panic disorder, social anxiety disorder, OCD, PTSD, and generalized anxiety disorder (APA, 2017; Kaczurkin & Foa, 2015). Exposures can be carried out through imagery or visualization or through in vivo

exposure, which can be actual exposure to the dreaded object or situation and can also be done virtually (Cormier et al., 2017).

Exposure therapy works through a series of steps: *habituation* occurs after several repeated exposures, reducing anxiety after a period through a process called *extinction*—a state of significant reductions in the client’s response to the initially feared stimuli. Disconfirming fearful predictions and deeper processing of the feared situation are other processes involved in exposure therapy (Cormier et al., 2017). Exposure to the feared condition, event, or object is usually carried out in a safe environment to help reduce the fear and decrease avoidance (APA, 2017).

The greater the incongruence between the degree of fear that the client expects to experience during the exposure and what the client actually experiences, the greater the chances of learning (Craske, 2015). So, the goal of exposure therapy is to allow the client to have an experience that does not match up with the client’s fear expectancy. One way of achieving this is to let the exposure period exceed the point during which the aversive experience is expected to occur (Craske, 2015). So, by gradually going over the point at which the client often experiences fear in a real-life situation, the client begins to experience new learning about the feared stimuli (Craske, 2015). There are two traditional forms of exposure therapy: *in vivo* exposure and imaginal exposure.

In Vivo Exposure. In this type of exposure, clients are helped to face their fears in real-life situations; for example, someone who is afraid of snakes may be asked to hold a snake, or someone with social anxiety may be asked to deliver a presentation for an audience (APA, 2017). Confronting the fearful stimuli in the absence of escape and avoidance modifies the relationship between the memory structures and the fearful stimuli, thereby reducing the fear

elicited by the stimulus (Reeves et al., 2021). In vivo exposure can be done in the therapist's office or outside the office, accompanied by the therapist, or carried out alone by the client as homework (McMahon, 2017). In vivo exposure appears more real than other forms of exposure, however, it can raise ethical issues around confidentiality when it is carried out in a public space (McMahon, 2017).

Imaginal Exposure. This form of therapy involves asking the client to imagine the feared situation; for example, a client with PTSD might be asked to recall a traumatic experience to minimize the fear (APA, 2017). Imaginal exposure can be done in the office or in the client's home. Another advantage of imaginal exposure is that it does not require any prop or specialized equipment or client training; what is required is the ability for the client to use their power of imagination (McMahon, 2017). One limitation with imaginal exposure is that you cannot directly control the intensity of the exposure, and as a therapist, you can only imagine what your client is seeing but you cannot see it yourself (McMahon, 2017). Another setback is that vividness of imagination can decline with age, so some clients may not be able to create an effective image (McMahon, 2017).

Exposure Methods. Exposure techniques may include *interoceptive exposure*, *graded exposure*, *flooding*, and *systematic desensitization*. Generally, clients are first taught some forms of relaxation techniques and other coping methods before and throughout the procedure (Cormier et al., 2017).

Interoceptive Exposure. Interoceptive exposure aims to reduce people's fear of a physical sensation (Lee et al., 2006). This involves intentionally letting the client experience a harmless physical sensation of a feared stimuli. Interoceptive exposure has been found to be effective in treating panic disorders (Lee et al., 2006). It is unique in the treatment of panic

disorders as the exposure focuses directly on the patient's fear of the physical sensation (Lee et al., 2006). For example, a client with panic disorder can be asked to run or do an exercise that increases their heart rate, so they can learn that the sensation is normal and not dangerous (APA, 2017).

Graded Exposure. This involves exposing the client to the feared stimuli in gradual increments based on difficulty; for example, the therapist might start by making the client look at the feared object briefly before gradually increasing the level of involvement with the object until the client is able to pass every stage of the exposure (APA, 2017). The objective of gradual exposure is for the client to remain in the anxiety-provoking situation long enough until the anxiety starts to diminish (Australian Institute of Professional Counsellors [AIPC], 2010). Using gradual exposure strategies helps the client to learn different ways to handle the feared stimuli (AIPC, 2010). It is also important for the client to practice the skills during their normal daily activities so they can put the skills to use when they are in distress (AIPC, 2010).

Flooding. Rather than a gradual exposure to the feared stimuli, flooding involves exposing the client to the highest hierarchy of the task (APA, 2017). It is used in eliminating unwanted fears by exposing the client directly, either in vivo or imaginal, to the frightening events within a protective environment (Bufford, 1985). The aim of flooding is to make the client discover that no harm occurs when they are fully exposed to the anxiety-provoking situation (Bufford, 1985).

Systematic Desensitization. Systematic desensitization is a type of exposure therapy used for treating anxiety disorders (Thomas et al., 2017). It involves gradual exposure to fear-evoking stimuli (APA, 2017). According to Wolpe (1968), the three steps involved in systematic desensitization include the first phase of treatment, where the therapist and the client work

collaboratively to produce the hierarchy of fears from the lowest to the highest level. The second stage involves the client being taught progressive muscle relaxation or other exercises that can be helpful in calming the client down. Then the final stage involves gradual exposure to the feared stimuli starting from the least anxiety-provoking situation or item while at the same time carrying out some form of progressive muscle relaxation. The treatment is considered successful if the client no longer shows an anxious response to the feared stimuli (Wolpe, 1968).

VR

Definition and Characteristics

VR is a computer interface that allows users to experience a computerized environment in a controlled manner (Maples-Keller et al., 2017). The goal of VR is to trick the user's brain into believing that the task they are performing is happening in the real world, so the technology supplies the brain with information (e.g., images and sounds) that is similar in nature to the actual information it would receive in the real world (Arnaldi et al., 2018). Hence, the user experiences an immersion—a perception that one is really present in an “unreal” world. Furthermore, the sensory information the user experiences is sent through a head-mounted display that allows the user to see through the eye lenses, with a surround sound system delivered to the ears through the earpiece, making the user immersed in a virtual world; therefore, a world is created that is both interactive and immersive (Maples-Keller et al., 2017). VR helps clients to experience certain environments virtually, which may be helpful in resolving their presenting concerns without the need to physically travel to the location or environment. For example, a client who is afraid of spiders or other objects can experience some levels of exposure to the feared object or stimuli through VR as part of the therapeutic intervention without the need to physically touch or come near the real-life object or situation.

The Sense of Presence. The sense of presence in a virtual world has been described as the feeling of being in a place even when the person is physically located in another place (Cooper et al., 2018). Presence is derived through a number of apparatuses that are part of the VR system. The device can include a head-mounted display, motion-sensor hand gloves, surround sound systems, and vibrotactile platforms; these all contribute to the multiple senses experienced by the user in the virtual environment (Maples-Keller et al., 2017).

The human mind is often directed by two types of reasoning: emotional reasoning and rational reasoning (Herbelin et al., 2003). Mental equilibrium is maintained when the two reasonings maintain a balance (Herbelin et al., 2003). The therapist's goal is to help the client balance emotional and rational reasoning regarding the fearful situation (Herbelin et al., 2003). If the client remains in a rational state, a sense of presence in the VR environment will not be achieved. So, a sense of presence depends on the client engaging their emotional reasoning (Herbelin et al., 2003). In the world of VR, users are able to perform tasks similar to what they can do in real life, thereby developing the brain to perform the targeted task or behaviour (Arnaldi et al., 2018). The system allows users to experience feedback in the form of sensory information and also to be able to interact with the environment (Arnaldi et al., 2018).

Augmented Reality. Augmented reality (AR) is an enhanced form of VR; it enriches the user's visual perception by superimposing digital information into the natural environment. The information may be audio, visual, and sometimes haptic (Arnaldi et al., 2018). For example, a client may see the digital image of a family member overlaid on a chair, appearing to be sitting right across from them in the living room.

Efficacy of VR in the Treatment of Anxiety and Related Disorders

Several studies have shown that VR exposure therapy (VRET) is efficient in treating anxiety and related disorders (Bouchard et al., 2017). Apart from therapist-led VRET, self-guided VRET has been found to reduce social anxiety disorder and other related comorbidities (Zainal et al., 2021). However, most of the trials conducted about the efficacy of VRET are led by therapists.

Specific Phobia. Specific phobia is a common disorder worldwide. For example, an estimated 7% to 40% of people in developed countries are afraid of flying (Ferrand et al., 2015). VR is effective in treating specific phobias, such as the fear of flying (Roxana et al., 2017). Ferrand et al. (2015), in a study involving 157 subjects with a fear of flying as confirmed by the self-reported Flight Anxiety Situations (FAS) and the Flight Anxiety Modality (FAM) instruments, examined the efficacy of cognitive and VR treatment programs in treating the fear of flying. The results showed that the participants had a lower level of anxiety after their first flight after the program than before the VR intervention (Ferrand et al., 2015).

Another type of specific phobia that has been successfully treated with VR exposure is acrophobia (fear of heights). Emmelkamp et al. (2002) conducted a study to compare VR treatment with in vivo exposure treatment. The virtual environment used in the intervention was similar to the in vivo exposure natural environment. The Attitude Towards Heights Questionnaire (ATHQ) and the Behavioural Avoidance Test (BAT) instruments were used to screen for acrophobia. Thirty-three subjects took part in the study. The study showed that treatment with VR is equally as effective as in vivo treatment (Emmelkamp et al., 2002).

Social Anxiety Disorder. Although fewer studies have examined the effect of VRET in the treatment of social anxiety disorder (SAD), they have confirmed the efficacy of VRET for

SAD. A common example of SAD that has been effectively managed using VR-based intervention is public speaking anxiety, where clients were exposed to speaking with a virtual audience similar to a real-life audience (Reeves, Curran, et al., 2021; Safir et al., 2012). The researchers, however, did not find any significant difference between using CBT and VRCBT. Conducting the treatment using VR is much more convenient than in vivo and will increase the likelihood of clients with social anxiety to seek treatment (Chesham et al., 2018).

Zainal et al. (2021) conducted a self-guided VRET trial to test the effectiveness of VRET in the treatment of social anxiety and related disorders with 44 subjects diagnosed with a SAD. The Mini-International Neuropsychiatric Interview was used to screen for those with SAD. The VRET lasted for four sessions, and the Social Phobia Diagnostic Questionnaire and Social Interaction Anxiety Scale were used to measure the treatment outcome. The results showed that those subjects treated with VRET had a significant reduction in symptoms of SAD compared to those on the waitlist (Zainal et al., 2021).

Other studies also show a significant difference between VRET and the waitlist for the treatment of SAD; in a meta-analysis of the efficacy of VRET for social anxiety by Chesham et al. (2018), the overall effect size of the use of VRET in the treatment of SAD was significant when compared to the waitlist. And when they compared the treatment method with standard treatments, the researchers found seven studies with a total sample size of 340 that showed extremely small and no significant differences between the use of VRET and standard treatments such as in vivo or imaginal intervention. The various studies support the efficacy of VRET in treating social anxiety with a significant difference with a waitlist and comparable in effectiveness with in vivo and imaginal interventions.

PTSD. Based on the *DSM-5* (APA, 2013), PTSD is a direct result of people witnessing or experiencing an intensive traumatic event such as serious injury or assault, or the death of a loved one (Kothgassner et al., 2019). In a VRET study involving patients with PTSD, the participants reported significant satisfaction with VR treatment (Beck et al., 2007). VRET was used to treat subjects already screened for PTSD. As expected, the results showed a significant reduction in anxiety and depressive symptoms compared to those on the waitlist (Beck et al., 2007). However, results from other studies show no significant change in the outcomes of VRET and those of standard treatments (Chesham et al., 2018). However, it is worth noting that VRET is effective in treating PTSD (Chesham et al., 2018; Wechsler et al., 2019).

Generalized Anxiety Disorder. Generalized anxiety disorder (GAD) is a common form of anxiety disorder (Keshavarz et al., 2021). GAD can also be treated like other types of anxiety using standard treatments and counselling theories. Similar to in vivo and imaginal exposure, GAD can be treated using VRET (Keshavarz et al., 2021). In a study to evaluate the efficacy of VR-based worry exposure therapy as a form of intervention for patients with a GAD, Keshavarz et al. (2021) carried out a single-subject design with different baselines. The Becker and Margraf manual for GAD imaginal exposure was adapted for VR exposure. Three clients with GAD took part in the study which lasted for 15 sessions. The Penn State Worry Questionnaire and The Overall Anxiety Severity and Impairment Scale were used to test for changes in the level of anxiety before and after treatment.

Participants were exposed to three different 360-degree videos through a VR head-mounted display (Keshavarz et al., 2021). The first video was a short film about the loss of a loved one who died in a car accident, showing the body covered with a white cloth on the side of the street. During the exposure, the participants were asked to consider the dead person as their

relative. The second video was about hospitalization, which addressed anxieties around health and illness, while the third video contained the execution of an unidentifiable person who the authority claimed was a brother to the participant. The treatment started with participants monitoring their level of worry, and real exposure started in the 3rd session through the 10th session, while at the same time, issues of avoidance and reassurance behaviours were addressed and reduced gradually. The final session targeted relapse prevention and generalization. The study showed that treatment with VRET resulted in a significant reduction in the Anxiety Severity of the participants compared to the baseline period (Keshavarz et al., 2021).

Panic Disorder and Agoraphobia. Panic disorder and agoraphobia usually involve a sudden intensity of anxiety which often results in cognitive and physiological symptoms such as increased heart rate, sweating, and fear of dying (Maples-Keller et al., 2017). CBT-based exposure therapy helps reduce the symptoms of panic disorder and agoraphobia. Mapples-Keller et al. (2017) found several studies that show evidence that VR-based exposure is equally as effective as traditional CBT. In another study with a sample size of 150, patients with phobias were treated with VRET; the study found the refusal rate for VR (3%) lower than that of in vivo (27%), which shows that VRET may be more preferred for clients with phobias than traditional imaginal or in vivo exposure (Garcia-Palacios et al., 2007). Furthermore, VR-based exposure reduced the time taken for treatment compared to other forms of exposure therapy (Maples-Keller et al., 2017).

Martin et al. (2007), in a study to explore the use of VRET in treating panic disorders and agoraphobia, found a significant reduction in all the clinical measures after the subjects were treated with virtual exposure. Similarly, Malbos et al. (2013) conducted a controlled study involving 18 agoraphobic subjects divided into two groups. One group was treated with VRET

only, and the other group received VRET with cognitive therapy. After nine sessions, the results of the questionnaires and physiological tests indicated a positive outcome for the VRET-only treatment. The second group also showed positive outcomes, but the addition of cognitive therapy to the second group did not result in additional benefits compared to the first group (Malbos et al., 2013).

OCD. Clients with OCD often have intrusive impulses, for example, fear of contamination or excessive arrangement of items or cleaning, in such a way that it induces lots of anxiety (Maples-Keller et al., 2017). Very few studies have examined the efficacy of VR in the treatment of OCD, which may be due to the wide range of possible obsessions and compulsions, so developing a VR application that will cover all the needs of these patients might be challenging to develop (Maples-Keller et al., 2017). Invariably, VR intervention might not be the best intervention approach for treating some clients with some types of OCD, but certain obsessions like exposure to public toilets might benefit from VR-based exposures (Maples-Keller et al., 2017). More research on how VR might be easily incorporated into the treatment of OCD is required (Maples-Keller et al., 2017).

Implications for Counselling Psychology

The use of VR and other simulation technology has added value in different fields of human endeavours, including counselling and clinical psychology. In a survey of 70 therapy experts, asking participants to predict what types of interventions are most likely to be useful in the near future, VR interventions was ranked as the 4th most endorsed item out of 45 (Norcross et al., 2013). Counselling psychologists and others in the mental health field need to reflect on where psychotherapy is heading; this understanding is essential for counsellors and other professionals like teachers, researchers, policymakers, and students (Bouchard & Rizzo, 2019).

VR has significantly expanded how health practitioners, including psychologists, help improve their clients' mental health (Bouchard & Rizzo, 2019). The VR environment allows the therapist to have greater flexibility and control of the environment; factors such as who might be present in the session, the gaze of others, and participants' verbal comments, age, gender, and level of attentiveness can all be manipulated in the digital settings (Bouchard & Rizzo, 2019). These factors can have a significant positive impact on the therapeutic process as they allow therapists to test different environments appropriate to treat people with specific diagnoses (Bouchard & Rizzo, 2019).

Transformed Social Interaction

Good rapport and empathy are essential in the therapeutic alliance between the therapist and the client (Feijt et al., 2018). Some therapists believe that using technologies in therapeutic interventions might not enhance good empathic interactions; however, current advancement in technology offers significant opportunities that enhance empathetic interactions (Feijt et al., 2018). Therapists can create transformed social interaction by manipulating self-representation, sensory abilities, and situational contexts; these variables can be combined to create the digital environment needed for the therapeutic intervention (Bouchard & Rizzo, 2019).

Self-Representation Transformations

The manner in which people perceive themselves reflects how they represent themselves in an immersive virtual environment. Based on self-perception theory, people project their attitudes and behaviours on their avatars (virtual representatives) in a virtual world; consequently, manipulating the avatars can significantly impact clients' behaviour, especially when the avatars have physical similarities with the client (Bouchard & Rizzo, 2019). For example, when participants' avatars were portrayed as gaining or losing weight while the

participants were exercising, it was noted that they performed more exercise during the following experiment (Bouchard & Rizzo, 2019). This implies that clients can identify with their virtual selves and become immersed with other people in their virtual worlds in the same way they would in a grounded reality (Bouchard & Rizzo, 2019).

Sensory Ability Transformations

Clients' sensory abilities in a virtual space can significantly impact them; VR helps to enhance perceptual abilities (Bouchard & Rizzo, 2019). Within the virtual environment, participants can take perspectives from other people's viewpoints (Bouchard & Rizzo, 2019). For example, an autistic child who struggles with making eye contact can be immersed in a virtual environment (Bouchard & Rizzo, 2019). If the child does not make eye contact with other children's avatars, their avatars will start to fade away. The study revealed that when the child notices that the avatars begin to fade away, they increase their eye contact to match up with others within the virtual space (Bailenson et al., 2008; Bouchard & Rizzo, 2019).

Situational Context Transformation

Situational context transformation is a way of manipulating the virtual environment so the user can slow down, rewind, or fast forward a particular action; it alters the spatial structure of an immersive virtual environment (Bouchard & Rizzo, 2019). The virtual environment can also be spatially enhanced to suit the type of intervention the therapist wants to use for the client (Bouchard & Rizzo, 2019). For example, the therapist can control the visual angle of an object as it moves, so a child in counselling or a group setting can analyze the object's distance, size, and motion without being concerned with the angle (Bouchard & Rizzo, 2019).

Advantages of Implementing VRET in Counselling Over In Vivo

The traditional exposure therapy methods are in vivo exposure, where clients directly confront their fears in real-life situations, and imaginal exposure, where they are asked to imagine the feared stimulus, which can be carried out in the counselling office or as homework (McMahon, 2017). However, there are instances where in vivo exposure therapy might become very difficult or problematic to implement; for example, in public speaking anxiety (PSA) treatment, trying to increase the real-life audience size to maintain a gradual increment may become problematic (Reeves, Elliot, et al., 2021). And again, doing in vivo exposure therapy can be very time-consuming, expensive, and difficult to control (Reeves, Elliot, et al., 2021).

VRET provides easy access and flexibility for the therapist working with a client with PSA (Reeves, Elliot, et al., 2021). In addition to the therapist being able to invite the audience virtually into the therapist's office, the therapist can also control the size of the audience by exposing the client to various scenarios and monitoring the outcome (Reeves, Elliot et al., 2021). VRET has also been shown to lower the cost of treatment, help maintain clients' confidentiality, and help reduce the dropout rate, especially for clients who do not like the traditional methods of psychotherapy (Reeves, Elliot, et al., 2021).

Like people with PSA, individuals with a SAD may also be unwilling to seek treatment that involves exposing them to social situations (Bouchard et al., 2017). In a study to show that VR exposure for the treatment of SAD is effective and more practical in therapy than in vivo, Bouchard et al. (2017) randomly assigned 17 subjects to the VR group, 22 to the in vivo exposure, and 20 to the waitlist group. After 14 weeks of treatment using CBT techniques for the VR and the in vivo groups, the results showed a significant improvement for the VR and in vivo

groups over the waitlist. However, the therapist concluded that carrying out exposure with VR is more practical than in vivo (Bouchard et al., 2017).

VRET has been shown to have lower refusal rates than in vivo exposure therapy (Garcia-Palacios et al., 2007). In a survey of 150 subjects with specific phobias to explore how acceptable people are to VR exposure and in vivo exposure for treatment, Garcia-Palacios et al. (2007) found that the refusal rate for in vivo exposure was higher (27%) than for VR exposure (3%). The clinical implication of the result is that VR could help encourage more people that need help with a specific phobia to seek exposure therapy (Bouchard et al., 2017).

Furthermore, immersive virtual environments have been used to treat different forms of phobias, anxiety, PTSD, eating disorders, addictions, pain, hoarding disorder, and other forms of disorders (Bouchard & Rizzo, 2019). In addition to several studies that have shown promising results regarding the efficacy of VRET in the treatment of anxiety and related disorders, VRET has several advantages over other forms of exposure therapy and therapeutic interventions that make it an excellent tool for counselling psychologists and therapists (Bouchard & Rizzo, 2019).

VR exposure has significant advantages over other forms of exposure, such as in vivo or imaginal exposure. VR makes it easier to conduct a controlled, repeatable, and personalized exposure that might be difficult or practically impossible with other forms of exposure (McMahon, 2017). For example, it is impractical to arrange repeated airplane takeoffs for a client with a phobia of flight. In contrast, VRET makes it very possible from the comfort of the therapist's office. One practical advantage of VR in treatment is that the therapist can see exactly what the client sees through the computer monitor. The therapist can control every aspect of the exposure; for example, for a client experiencing fear of public speaking, the therapist can adjust the settings, control the number of people in the audience, and the audience's response

(McMahon, 2017). Furthermore, the therapist can support, guide, and offer prompts to the client during the exposure session (McMahon, 2017).

Making VRET available to clients can impact the therapist's work positively. It implies that the therapist is up to date with evidence-based practices in line with the principle of responsible caring (APA, 2017). In addition, this cutting-edge application of technology to clinical practice can increase the number of referrals for a clinic that offers VRET (McMahon, 2017). VRET is also very cost-effective, efficient, and easier to use with clients than in vivo exposure (McMahon, 2017).

Getting Started With VR

Psious and Virtually Better Inc. (VBI) are two companies that are among the top producers of VR software explicitly designed for therapeutic interventions (McMahon, 2017). They are easy to implement and use in counselling settings as they come with easy-to-read and understand user manuals that can be used as a self-guide, and they also offer training for therapists online and in-person (McMahon, 2017). In addition to the VR software, Amelia Virtual Care platform, Psious also sells VR kits that include head-mounted displays that synchronize with the software and an electrodermal response sensor that fits onto the client's fingers to measure the client's galvanic skin response (Amelia Virtual Care, 2021). Psious provides a virtual environment that can be used to treat agoraphobia, flying phobia, social anxiety, test anxiety, fears of darkness, cockroaches, needles, spiders, and public speaking (McMahon, 2017). Other VR environments can be used for various breathing techniques, progressive muscle relaxation, and mindfulness (McMahon, 2017). The Psious virtual environment works with the Samsung Gear VR headset and android phones which can easily be purchased for use by therapists.

Like Psious, VBI also has virtual environments for treating various forms of phobias like fear of heights, spiders, storms, etc. (McMahon, 2017; Virtuallybetter, 2022). VBI uses both headsets and handheld controllers, which allows the client to control the movement in the virtual environment (McMahon, 2017; Virtuallybetter, 2022). The VBI virtual environment can be used with iPhone or Android phones which therapists can purchase directly (McMahon, 2017; Virtuallybetter, 2022). VBI also provides virtual environments for breathing exercises, image-guided relaxation, progressive muscle relaxation, mindfulness, addictions treatments, and war-related PTSD (McMahon, 2017). In addition to the headset, phone, and handheld controllers, some virtual environment setups may include additional equipment such as a PC on a rolling cart with two screen monitors (McMahon, 2017).

Using smartphones with relatively cheap headsets can make some VR interventions easily accessible by clinicians and clients. For example, there are numerous Apps available on phone App stores for downloads, such as Mindfulness VR, Joy Meditation VR, VR Guided Mindfulness, and other Apps that can be used for mood tracking and breathing exercises. In addition, some VR Apps can be used as a form of self-treatment for some phobias and other types of treatments (McMahon, 2017).

Virtual Reality: The Future of Mental Health Care

Psious produces over 70 different VR environments for treating anxiety, specific phobias, and ADHD (Hooper, 2019). One significant advantage of VRET is the ability for the client to receive real-time feedback; the psychologist can support and guide the client as the therapist can also see what the client sees (Hooper, 2019). VR also helps the therapist gain deeper insights and understanding of the client's behaviour and reaction in certain situations to help them effectively (Hooper, 2019). Several types of research as published in renowned journals such as *The Lancet*

and the *Harvard Review of Psychiatry* have found that the use of VR for psychological intervention has come to stay and is as effective as traditional psychotherapy interventions in the treatment of schizophrenia, anxiety, depression, and some other mental health conditions (Hooper, 2019).

Limitations of VRET

The use of VRET has a few limitations. Clients with seizures may have their symptoms aggravated with VR, so a physician's clearance may be required before using VR interventions for clients (McMahon, 2017). Another limitation that may also apply to in vivo exposure is that VRET can induce severe flashbacks or panic attacks due to its immersive nature. As a result, the therapist must work at a tolerable pace and constantly monitor the client and be ready to terminate the VRET session if any complications arise (McMahon, 2017). Moreover, the limited access to VRET training for therapists is another setback for VR-based interventions. Unfortunately, there are still relatively few places that offer training and services on VRET. VR tools are becoming more affordable, but they still require some additional expenses in getting the appropriate virtual environment for the type of intervention the therapist may want to carry out.

Fundamental Next Steps for Research

The current wave in VR started in 2012 with a company named Oculus, later purchased by Facebook. The company developed and released a new VR head-mount display (HMD) for the primary purpose of gaming (Lindner, 2020). The release of Oculus Quest 1 VR and now Quest 2 VR has revolutionized the VR world. By 2014, the Oculus Rift HMD was adopted for clinical research, as well as other products, such as the Samsung Gear VR platform, which integrates mobile devices into the HMD (Lindner, 2020). With the Samsung Gear VR platforms,

individuals can use VR-compatible therapy applications on their phones, such as guided meditations and other mindfulness practices, to treat anxieties and related issues.

Virtual Embodiment

One area that requires additional research is the use of virtual embodiments in the treatment of psychological disorders. Virtual embodiment involves the creation of external representatives such as avatars to represent the virtual body of the client. The client can then interact with the virtual body as an externalized version of themselves (Lindner, 2020). For example, a VR full-body illusion has been used to treat anorexia nervosa, depression, and anxiety and has also been used to increase self-compassion and reduce self-criticism (Lindner, 2020).

VR as a Prevention Tool

Ongoing research on the use of VR for psychological intervention also includes using it as a tool to correct problematic ways of thinking before they become a concern (Hooper, 2019). In addition, VR makes it possible to measure and assess the things that influence behaviour, so knowing how things are processed can provide helpful information for treatment; for example, researchers are working on how to use VR in updating people's perception of themselves by feeding the brain with different information (Hooper, 2019). Similarly, the military is using VR exposure to prepare soldiers for war by exposing them to virtual wars so they can start building resilience (Hooper, 2019).

Augmented Reality

A variant of VR, augmented reality (AR) superimposes virtual objects on the real world. An example of AR for spider phobia might involve looking through the VR device to look at your table and seeing your desk and at the same time seeing a virtual spider on the desk

(McMahon, 2017). AR adds virtual information to physical reality (Giglioli et al., 2015).

Currently, AR has been used in many fields such as architecture, medicine, and education, but there are very few studies and applications of the use of AR in treating psychological disorders and generally in the field of counselling psychology (Giglioli et al., 2015). There is a need for further research and development of AR as an intervention tool for use in counselling and clinical psychology.

Therapeutic Storytelling

Besides being used as a platform for entertainment and gaming, VR has the potential to be used to share great storytelling experiences that are therapeutic (Lindner, 2021). Storytelling can reduce anxiety and behavioural disorders in children and adults (Sekhavatpour et al., 2019). Therefore, it is possible to develop more interactive and passive VR experiences that tell stories that can significantly impact individuals experiencing some forms of anxiety or other disorders (Lindner, 2021). However, there are only very few preliminary studies to support the effect of VR therapeutic storytelling, especially such stories that evoke traumatic memories (Lindner, 2021). Further research is needed to ascertain whether VR can be effective in this regard.

Other Areas of Future Research

Most of the research on VR in psychological interventions has focused on the clients without thorough consideration of how it can impact the therapist. There is a need for further research on the impacts of VR on future psychologists and other health care professionals (Lindner, 2021). Other areas of future research in VRET include improving on some of the existing technology to enhance better therapeutic interventions; for example, current VR interventions for treating PTSD have created specific traumatic scenarios using the Iraq/Afghanistan virtual environment (Lindner, 2021). Further research is required to ascertain to

what degree should a virtual environment be configured to replicate the exact catastrophic environment (Lindner, 2021). More studies are required to know what method works best for individuals in an adaptive virtual environment (Lindner, 2021). The clinical benefits of investing more in tailoring virtual scenarios for individual needs require additional research (Lindner, 2021).

Over a dozen efficacy trials have been carried out on VR in anxiety treatment over the last two decades. The results have consistently proved that VRET is effective in treating anxiety (Carl et al., 2019). However, the future of VRET in the treatment of anxiety and related disorders will continue to depend on advancement in VR technology (Lindner, 2021). Therefore, the health care community requires more research and adaptations to understand how best to adapt VR in clinical practice (Carl et al., 2019).

One major development area in VR use for mental health intervention is clinical biofeedback. Clinical biofeedback is effective in treating anxiety and related disorders (Yang, 2019). VR could be integrated to provide a more immersive biofeedback experience (Yang, 2019). There is ongoing research by VR developers to enhance biofeedback by integrating it with the user interaction and immersion experience of VR (Yang, 2019).

Recommendations for Practice

Several research works have proved the efficacy of VRET, and VR devices and software are becoming more affordable and easier to use. A quick search for VR Apps for therapy on a phone App store reveals many currently available VR applications. But clinicians also need to be aware that VR systems are only tools and not the therapy itself (McMahon, 2017). Furthermore, the pressure for VR software developers to release products into the market can make them compromise standards; as a result, therapists must ensure they test for the safety and efficacy of

the products they use, which can be very challenging if the App or product does not have any research evidence (McMahon, 2017).

Implementing VR in the Counselling Clinic

Incorporating VRET into clinical practice for therapists who have used any form of exposure to treat anxiety disorders should be pretty straightforward. Some VR environments designed for a particular intervention can be used for similar interventions; for example, a night virtual environment designed to treat the fear of darkness can also be used for someone with PTSD (McMahon, 2017).

While using VRET with clients, the informed consent process must reflect the use of VR in the sessions and what that might look like, such as recording galvanic skin response, and the client's level of anxiety should be monitored before and during treatment (McMahon, 2017). Risks and benefits related to VRET must also be clearly communicated. For example, the possibility of experiencing nausea during a VRET session should be discussed with the client (McMahon, 2017). Also, the environment must be safe from injury if the client is expected to move around during the VRET session (McMahon, 2017). The therapist monitors the client's anxiety level from 0 to 10 during the session and sometimes monitors their galvanic skin response (McMahon, 2017). If the client becomes too anxious, the therapist can reduce the stimuli responsible for the anxiety or shorten the length of the exposure, pause it, or simply stop it (McMahon, 2017). It is also good for therapists to be aware that the VRET can uncover some fears not earlier discovered, which can also be addressed (McMahon, 2017).

Therapists who are already treating anxieties using systematic desensitization and exposure therapy and those that teach mindfulness and other relaxation skills can easily incorporate the use of VR into their practice (McMahon, 2017). But therapists must be familiar

with the various virtual environments and the variables by first testing the equipment and immersing themselves in the experience to be familiar with what the client would experience (McMahon, 2017).

Implementing VRET requires the therapist to follow the best ethical standards specified by the code of conduct guiding the psychology profession (McMahon, 2017). Therapists should also be cautious about using their personal phones in the client's headset if the client's information would be stored on the phone (McMahon, 2017). And similarly, the client's information must be well protected when logging into VR software on the internet to prevent a breach of privacy and confidentiality (McMahon, 2017). The therapist should also ensure that VR does not interfere with the therapeutic alliance as VR is just a tool; the therapist can test the extent to which the use of VR interferes with the alliance with their clients (McMahon, 2017). Studies have shown that there is no inherent disadvantage in the use of VR concerning the therapeutic alliance (Ngai et al., 2015).

In clinical practice, VRET typically starts with 2 to 3 initial sessions, which include psychoeducation regarding the disorder, rationale for exposure, the VRET process, and the overall treatment plan (Maples-Keller et al., 2017). Then, exposure to the fear stimuli is paced to match the client's progress and customized to meet individual clients' needs (Maples-Keller et al., 2017). Each exposure step can be repeated until there is a significant decrease in the client's anxiety as observed by the therapist or through the client's subjective units of distress ratings. Moving through the stages of exposure follows a collaborative approach between the client and the therapist, which allows the therapist to know what next step to introduce to the client (Maples-Keller et al., 2017). For example, there are eight steps in the hierarchy of dealing with the fear of flying, including walking through the airport's doors to flying through turbulent

weather (Maples-Keller et al., 2017). The specific need of the client is also taken into consideration while administering the VR intervention; for example, in the case of a client with a fear of flying due to fear of crashing, going through turbulent weather might be the major focus of the VR exposure (Maples-Keller et al., 2017).

A quality VR intervention will also require that the therapist is skillful in engaging the client as the therapist activates the fear stimuli, such as discussing how the client is feeling during the exposure and ensuring the safety of the client. In addition, it may be helpful to allow the client to repeat some positive mantras as the virtual plane takes off, and sometimes the client can also use some forms of distractions or coping strategies (Maples-Keller et al., 2017).

Clinical Challenges With VRET Use in the Clinic

The major challenge to implementing VR in a clinic in the past was the cost associated with the devices, coupled with the fact that it may be challenging to set up (Maples-Keller et al., 2017). However, in recent years the price has reduced significantly with the proliferation of smartphone-based VR, which can cost as low as about \$50 on Amazon (www.amazon.ca).

VR technology is also very user-friendly. However, there is still the possibility of glitches that must be considered while implementing VR in clinical practice (Maples-Keller et al., 2017). As a result, therapists might need some in-depth training and practice with VR to ensure the ability to troubleshoot any glitch during usage before implementing it in clinical settings (Maples-Keller et al., 2017). One primary challenge is the lack of enough training centers or facilities for therapists who might be interested in implementing VR in their clinical practice. Graduate students going into clinical practice might not have the adequate VR exposure needed to foster their interest in VRET. So, therapists interested in VRET may need to rely on self-help in order to gain the needed competencies due to the lack of readily available training centers.

It is also worth noting that there is no special billing code for using VR treatment; VRET is simply treated as a regular therapy session despite the investment that may go into the implementation (McMahon, 2017). Some therapists might not be interested in investing extra funds to acquire the VR tools as it might increase their overhead costs and expenses.

Cybersickness like nausea or discomfort in response to VR use can be an obstacle to its use and limit the immersive experience that the client is supposed to have (Boeldt et al., 2019). Individual characteristics such as attitude, gender, technical skills, and psychological differences may directly impact the types and level of side effects experienced by the client (Baniyadi et al., 2020). As a result, the therapist faces the challenge of trying to understand how individuals will react to the VR treatment (Baniyadi et al., 2020). Furthermore, clients who do not like wearing things over their heads and covering their eyes might not like the idea of wearing a mounted headset. However, technology enthusiasts might be easily attracted to the use of VR in addition to the numerous advantages that VR provides when compared to in vivo exposure.

Reflexive Self-Statement

Excessive worry, fear of the unknown, and anxiety are my clients' most frequently presented concerns at the clinic where I am currently doing my practicum. I have used narrative therapy, solution-focused therapy, and CBT as the main theories in my practice. However, this capstone project has expanded my understanding of anxiety and related disorders and some of the best practices for intervention. I have had the opportunity to use some forms of marginal exposure as interventions for some of my clients. I have also found mindfulness practice very effective in treating anxiety issues.

In the course of this project, I also found out that many people are often afraid to confront what makes them anxious or fearful; as a result, exposure therapy helps them face the fear

through visualization or in vivo exposure. Even though I have not been able to carry out in vivo exposure as a form of intervention for any of my clients, it has increased my curiosity about how exposure therapy can treat anxiety, especially specific phobias. As a result, I have been able to practice imaginal exposure with my supervisor to gain the experience of how to carry out imaginal exposure for someone with the fear of flying. One of the things that stood out for me in practice is constantly monitoring the client for dissociation as flooding may occur, which can lead the client to dissociate. The same applies to the use of VR in exposure therapy.

Another thing this project has taught me is how exposure therapy helps to minimize anxiety. My initial reaction was that one should always avoid anything that elicits fear as much as possible, so the idea of exposing a client to what they feared did not make complete sense to me until I understood how by firstly activating the fear structure and then overriding it with new information that incorporates a sense of safety, the associated anxiety and fear can be overcome.

My interest in using VR for treating mental health issues has dramatically increased as a result of this project. One area I am also looking forward to is being able to integrate real familiar faces into the virtual world; for example, someone with anxiety as a result of grief due to the loss of someone very dear to them can see the actual face of the dead person and interact with them in a virtual world. I have understood most of what is required to set up a VR-based clinic with all the technical and skills requirements. I am looking forward to implementing the information and skills I have acquired while writing this project to set up a fully functional VR intervention center.

One other way the project has impacted me is it has helped me to lay my hands on actual VR headsets and the necessary gadgets that have allowed me to get familiar with the use of the tools. And later in the future, I also plan to build on my existing information technology skills to

get additional training on how to create virtual environments that can be customized for clients. I am also hopeful that I will be able to expand this project beyond anxiety disorders into other therapeutic practices that can include creating relaxation techniques and treating vicarious traumas for fellow therapists and others in the health care industry. I would like to explore further research on the use of VR in every aspect of the counselling field and how to incorporate it into clinical practice across multiple cultures and environments.

Conclusion

Anxiety undoubtedly constitutes one of the most prevalent mental disorders and among those frequently seen by therapists. Specific forms of anxiety include GAD, SAD, and specific phobias such as fear of flying, fear of spiders, and fear of public speaking (Baghaei et al., 2021). The prevalence of anxiety disorders among children and adults has a noteworthy impact on public healthcare costs (Bandelow & Michaelis, 2015). Anxiety can be treated with different therapeutic techniques, including anti-anxiety medications such as benzodiazepines which physicians often prescribe to reduce anxiety symptoms (Bandelow et al., 2017).

Some of the popular techniques for anxiety intervention include psychoeducation, CBT, mindfulness, and exposure therapy. With psychoeducation, clients are often helped to understand how the brain and the autonomic systems work in relation to the fight, flight, or freeze response and how anxiety behaviours can increase the risk for higher anxiety issues (Hedman-Lagerlof & Axelsson, 2019). CBT is very structured and is one of the most used interventions for treating anxiety; it focuses on changing behaviour by challenging people's automatic and negative thoughts (Nichols & Davis, 2021). Mindfulness-based interventions are also commonly used to treat anxiety disorders. They involve paying attention to body stimuli without judging the experience (Kladnitski et al., 2020).

Exposure therapy is a form of behavioural therapy widely used to treat anxiety and specific phobias such as the fear of spiders, flying, elevators, and public places (Cormier et al., 2017). Exposure therapy has also been effective in treating other mental disorders such as OCD and PTSD (Kaczurkin & Foa, 2015). Exposure therapy can be in the form of imaginal exposure where the client is made to imagine the feared stimulus; for example, someone with the fear of flying may be asked to imagine going to the airport, checking in their luggage, going through the boarding gate, entering the aircraft, fastening their seatbelt, up to taking off and sometimes imagining some turbulence.

Another form of exposure therapy is called in vivo exposure which involves the clients being helped to face their fears in real-life situations. For example, a client who has anxiety around elevators may be gradually exposed to one with the therapist's assistance, who monitors the client's reactions and helps to regulate in case the anxiety level gets more intense. In vivo exposure, unlike imaginal and VR exposure, appears more real; however, it can be more difficult and expensive to achieve depending on the situation. For example, treating the fear of flying in vivo will be more costly than other forms of exposure therapy.

VRET uses a computer interface that allows users to experience the virtual environment in a controlled manner (Maples-Keller et al., 2017). VRET has been used to treat anxiety and related disorders effectively. Several studies have attested to the efficacy of VRET in treating anxiety (Bouchard et al., 2017). Self-guided VR therapy has been made possible with the advent of a very affordable VR head-mounted display that uses Apps available on smartphones (Zainal et al., 2021). VRET is also effective in treating SAD, PTSD, GAD, OCD, panic disorder, and agoraphobia (Maples-Keller et al., 2017).

The significant impact of VR as an intervention tool for therapy cannot be overemphasized. It is expected that VR will be revolutionary, especially in treating anxiety and related disorders. In addition, VR technology is becoming more affordable, with tech giants like Sony, Samsung, and Facebook contributing their quotas to the rapid developments of more sophisticated yet affordable head-mounted displays. VRET has shown a significant advantage over in vivo exposure as VRET can be done conveniently in the therapist's office. In addition, the virtual environment can easily be controlled by slowing down the exposure, pausing, or stopping it. VRET has also shown a significantly lower cost of treatment, lower dropout rate, and better maintains client confidentiality than in vivo exposure.

Despite the efficacy of VRET, there are still some inherent challenges posed by the use of technology which may vary based on the therapist's quest for technical knowledge and skills. Therapists who want to use VR interventions must be familiar with and be ready to experience it themselves to work with clients effectively. The additional cost of acquiring the VR tools is not passed to the client as it is treated as part of the therapeutic tools. It is also good to note that VR is just a tool, not the therapy itself. The therapist is still responsible for providing the therapeutic interventions and has the required intervention skills to help the client. And the therapist is still needed to follow best ethical practices in implementing VR for clinical interventions.

References

- Amelia Virtual Care. (2021). *Virtual reality for mental health professionals*.
<https://ameliavirtualcare.com/home-professional/>
- American Psychiatric Association [APA]. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>
- American Psychology Association [APA]. (2017). *What is exposure therapy?*
<https://www.apa.org/ptsd-guideline/patients-and-families/exposure-therapy>
- Arnaldi, B., Guitton, P., Moreau, G., & Arnaldi, B. (2018). *Virtual reality and augmented reality: Myths and realities*. ISTE Ltd.
- Asok, A., Kandel, E. R., & Rayman, J. B. (2019). The neurobiology of fear generalization. *Frontiers in Behavioral Neuroscience*, 12, Article 329.
<https://doi.org/10.3389/fnbeh.2018.00329>
- Australian Institute of Professional Counsellors [AIPC]. (2010). *Graded exposure with anxiety*.
 Counselling Connection.
<https://www.counsellingconnection.com/index.php/2010/03/29/graded-exposure-with-anxiety/>
- Axelsson, E., & Hedman-Lagerlöf, E. (2019). Cognitive behavioral therapy for health anxiety: Systematic review and meta-analysis of clinical efficacy and health economic outcomes. *Expert Review of Pharmacoeconomics & Outcomes Research*, 19(6), 663–676.
<https://doi.org/10.1080/14737167.2019.1703182>
- Baghaei, N., Chitale, V., Hlasnik, A., Stemmet, L., Liang, H., & Porter, R. (2021). Virtual reality for supporting the treatment of depression and anxiety: Scoping review. *JMIR Mental Health*, 8(9). <https://doi.org/10.2196/29681>

- Bailenson, J. N., Yee, N., Blascovich, J., Beall, A. C., Lundblad, N., & Jin, M. (2008). The use of immersive virtual reality in the learning sciences: Digital transformations of teachers, students, and social context. *Journal of the Learning Sciences, 17*(1), 102–141.
<https://doi.org/10.1080/10508400701793141>
- Bandelow, B., & Michaelis, S. (2015). Epidemiology of anxiety disorders in the 21st century. *Dialogues in Clinical Neuroscience, 17*(3), 327–335.
<https://doi.org/10.31887/DCNS.2015.17.3/bbandelow>
- Bandelow, B., Michaelis, S., & Wedekind, D. (2017). Treatment of anxiety disorders. *Dialogues in Clinical Neuroscience, 19*(2), 93–107.
<https://doi.org/10.31887/DCNS.2017.19.2/bbandelow>
- Baniasadi, T., Ayyoubzadeh, S. M., & Mohammadzadeh, N. (2020). Challenges and practical considerations in applying virtual reality in medical education and treatment. *Oman Medical Journal, 35*(3). <https://doi.org/10.5001/omj.2020.43>
- Beck, J. G., Palyo, S. A., Winer, E. H., Schwagler, B. E., & Ang, E. J. (2007). Virtual reality exposure therapy for PTSD symptoms after a road accident: An uncontrolled case series. *Behavior Therapy, 38*(1), 39–48. <https://doi.org/10.1016/j.beth.2006.04.001>
- Beck, J. S. (2021). *Cognitive behaviour therapy: Basics and beyond* (3rd ed.). Guilford Press.
- Bell, I. H., Nicholas, J., Alvarez-Jimenez, M., Thompson, A., & Valmaggia, L. (2020). Virtual reality as a clinical tool in mental health research and practice. *Dialogues in Clinical Neuroscience, 22*(2), 169–177. <https://doi.org/10.31887/DCNS.2020.22.2/lvalmaggia>
- Benito, K. G., & Walther, M. (2015). Therapeutic process during exposure: Habituation model. *Journal Of Obsessive-Compulsive and Related Disorders, 6*, 147–157.
<https://doi.org/10.1016/j.jocrd.2015.01.006>

- Boeldt, D., McMahon, E., McFaul, M., & Greenleaf, W. (2019). Using virtual reality exposure therapy to enhance treatment of anxiety disorders: Identifying areas of clinical adoption and potential obstacles. *Frontiers in Psychiatry, 10*, Article 773.
<https://doi.org/10.3389/fpsy.2019.00773>
- Bouchard, S., & Rizzo, A. (Eds.). (2019). *Virtual reality for psychological and neurocognitive interventions*. https://doi.org/10.1007/978-1-4939-9482-3_1
- Bouchard, S., Dumoulin, S., Robillard, G., Guitard, T., Klinger, É., Forget, H., Loranger, C., & Roucaut, F. (2017). Virtual reality compared with in vivo exposure in the treatment of social anxiety disorder: A three-arm randomised controlled trial. *British Journal of Psychiatry, 210*(4), 276–283. <https://doi.org/10.1192/bjp.bp.116.184234>
- Bufford, R. K. (1985). Flooding. In D. G. Benner (Ed.), *Baker encyclopedia of psychology* (pp. 417). Baker.
- CAMH. (2021). *What is cognitive behavioural therapy?* <https://www.camh.ca/en/health-info/mental-illness-and-addiction-index/cognitive-behavioural-therapy>
- Carl, E., Stein, A. T., Levihn-Coon, A., Pogue, J. R., Rothbaum, B., Emmelkamp, P., Asmundson, G. J. G., & Power, M. B. (2019). Virtual reality exposure therapy for anxiety and related disorders: A meta-analysis of randomized controlled trials. *Journal of Anxiety Disorders, 61*, 27–36. <https://doi.org/10.1016/j.janxdis.2018.08.003>
- Chesham, R. K., Malouf, J. M., & Schutte, N. S. (2018). Meta-analysis of the efficacy of virtual reality exposure therapy for social anxiety. *Behaviour Change, 35*, 152–166.
<https://doi.org/10.1017/bec.2018.15>
- Cooper, N., Milella, F., Pinto, C., Cant, I., White, M., & Meyer, G. (2018). The effects of substitute multisensory feedback on task performance and the sense of presence in a

virtual reality environment. *PLoS One*, 13(2).

<http://doi.org/10.1371/journal.pone.0191846>

Corey, G. (2017). *Theory and practice of counseling and psychotherapy* (10th ed.). Cengage Learning.

Cormier, S., Nurus, P. S., & Osborn, C. J. (2017). *Interviewing and change strategies for helpers* (8th ed.). Cengage Learning.

Craske, M. G. (2015). Optimizing exposure therapy for anxiety disorders: An inhibitory learning and inhibitory regulation approach. *Verhaltenstherapie*, 25(2), 134–143.

<https://doi.org/10.1159/000381574>

Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy*, 58, 10–23. <https://doi.org/10.1016/j.brat.2014.04.006>

Curtiss, J. E., Levine, D. S., Ander, I., & Baker, A. W. (2021). Cognitive-behavioral treatments for anxiety and stress-related disorders. *Focus*, 19(2), 184–189.

<https://doi.org/10.1176/appi.focus.20200045>

Emmelkamp, P. M. G., Krijn, M., Hulsbosch, A. M., de Vries, S., Schuemie, M. J., & van der Mast, C. A. P. G. (2002). Virtual reality treatment versus exposure in vivo: A comparative evaluation in acrophobia. *Behaviour Research and Therapy*, 40(5), 509–516.

[https://doi.org/10.1016/S0005-7967\(01\)00023-7](https://doi.org/10.1016/S0005-7967(01)00023-7)

Feijt, M. A., De Kort, Y. A. W., Westerink, J. W. D., & Ijsselstein, W. A. (2018). Enhancing empathic interactions in mental health care: Opportunities offered through social interaction technologies. *Annual Review of CyberTherapy and Telemedicine*, 16, 25–31.

<https://psycnet.apa.org/record/2019-27383-004>

- Ferrand, M., Ruffault, A., Tytelman, X., Flahault, C., & Négovanska, V. (2015). A cognitive and virtual reality treatment program for the fear of flying. *Aerospace Medicine and Human Performance*, 86(8), 723–727. <https://doi.org/10.3357/AMHP.4211.2015>
- Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, 99(1), 20–35. <https://doi.org/10.1037/0033-2909.99.1.20>
- Gale, G. D., Anagnostaras, S. G., Godsil, B. P., Mitchell, S., Nozawa, T., Sage, J. R., Wiltgen, B., & Fanselow, M. S. (2004). Role of the basolateral amygdala in the storage of fear memories across the adult lifetime of rats. *The Journal of Neuroscience*, 24(15), 3810–3815. <https://doi.org/10.1523/JNEUROSCI.4100-03.2004>
- Garcia-Palacios, A., Botella, C., Hoffman, H., & Fabregat, S. (2007). Comparing acceptance and refusal rates of virtual reality exposure vs. in vivo exposure by patients with specific phobias. *Cyberpsychology & Behavior*, 10(5), 722–724. <https://doi.org/10.1089/cpb.2007.9962>
- Giglioli, I. A. C., Pallavicini, F., Pedroli, E., Serino, S., & Riva, G. (2015). Augmented reality: A brand new challenge for the assessment and treatment of psychological disorders. *Computational and Mathematical Methods in Medicine*, Article 862942. <https://doi.org/10.1155/2015/862942>
- Goshtasbpour, F. (2015). Evidence-based treatment of anxiety disorders. In W. S. Craig (Ed.), *Integrated psychological services in primary care* (pp. 189–202). Nova Science Publishers.

- Hedman-Lagerlöf, E., & Axelsson, E. (2019). Cognitive behavioral therapy for health anxiety. In E. Hedman-Lagerlöf (Ed.), *The clinician's guide to treating health anxiety* (pp. 79–122). Academic Press. <https://doi.org/10.1016/B978-0-12-811806-1.00006-8>
- Helmes, E., & Ward, B. G. (2017) Mindfulness-based cognitive therapy for anxiety symptoms in older adults in residential care. *Aging & Mental Health, 21*(3), 272–278.
<https://doi.org/10.1080/13607863.2015.1111862>
- Herbelin, B., Vexo, F., & Thalmann, D. (2003). Sense of presence in virtual reality exposures therapy.
https://www.researchgate.net/publication/229051732_Sense_of_presence_in_virtual_reality_exposures_therapy/citations
- Hooper, J. (2019, September 22). Why virtual reality is the future of mental health care. *Herald Sun*. <https://www.proquest.com/newspapers/why-virtual-reality-is-future-mental-health-care/docview/2294630913/se-2?accountid=1230>
- Kaczurkin, A. N., & Foa, E. B. (2015). Cognitive-behavioral therapy for anxiety disorders: An update on the empirical evidence. *Dialogues in Clinical Neuroscience, 17*(3), 337–346.
<https://doi.org/10.31887/DCNS.2015.17.3/akaczurkin>
- Keshavarz, N., Abad, T. H. N., Beyrami, M., Alilou, M. M., & Roudsari, A. B. (2021). Efficacy of virtual reality based worry exposure therapy on the anxiety severity and worry in generalized anxiety disorder. *Advances in Biosciences & Clinical Medicine, 9*(2), 21–26.
<http://doi.org/10.7575/aiac.abcm.v.9n.2p.21>
- Kim, S., & Kim, E. (2020). The use of virtual reality in psychiatry: A review. *Journal of Korean Academy of Child and Adolescent Psychiatry, 31*(1), 26–32.
<https://doi.org/10.5765/jkacap.190037>

- Kladnitski, N., Smith, J., Uppal, S., James, M. A., Allen, A. R., Andrews, G., & Newby, J. M. (2020). Transdiagnostic internet-delivered CBT and mindfulness-based treatment for depression and anxiety: A randomised controlled trial. *Internet Interventions, 20*, 100310. <https://doi.org/10.1016/j.invent.2020.100310>
- Kothgassner, O. D., Goreis, A., Kafka, J. X., Van Eickels, R. L., Plener, P. L., & Felnhofer, A. (2019). Virtual reality exposure therapy for posttraumatic stress disorder (PTSD): A meta-analysis. *European Journal of Psychotraumatology, 10*(1). <http://doi.org/10.1080/20008198.2019.1654782>
- Lang, P. (1971). The application of psychophysiological methods. In S. L. Garfield, & E. A. Bergin, (Eds.), *Handbook of psychotherapy and behaviour change* (pp. 301–323). Wiley
- Lavell, C., Cadman, J., Waters, A., & Farrell, L. (2020). Psychoeducation for exposure therapy. In T. S. Peris, E. A. Storch, & J. F. McGuire (Eds.), *Exposure therapy for children with anxiety and OCD* (pp. 39–67). Academic Press. <https://doi.org/10.1016/B978-0-12-815915-6.00003-2>
- Lee, K., Noda, Y., Nakano, Y., Ogawa, S., Kinoshita, Y., Funayama, T., & Furukawa, T. A. (2006). Interoceptive hypersensitivity and interoceptive exposure in patients with panic disorder: Specificity and effectiveness. *BMC Psychiatry, 6*, 32. <https://doi.org/10.1186/1471-244X-6-32>
- Lindner, P. (2021). Better, virtually: The past, present, and future of virtual reality cognitive behavior therapy. *International Journal of Cognitive Therapy, 14*, 23–46. <https://doi.org/10.1007/s41811-020-00090-7>

- Malbos, E., Rapee, R. M., & Kavakli, M. (2013). A controlled study of agoraphobia and the independent effect of virtual reality exposure therapy. *Australian & New Zealand Journal of Psychiatry*, 47(2), 160–168. <https://doi.org/10.1177/0004867412453626>
- Maples-Keller, J. L., Bunnell, B. E., Kim, S. J., & Rothbaum, B. O. (2017). The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. *Harvard Review of Psychiatry*, 25(3), 103–113. <https://doi.org/10.1097/HRP.0000000000000138>
- Martin, H. V., Botella, C., Garcia-Palacios, A., & Osa, J. (2007). Virtual reality exposure in the treatment of panic disorder with agoraphobia: A case study. *Cognitive and Behavioral Practice*, 14(1), 58–69. <https://www.learntechlib.org/p/72635/>
- McMahon, E. (2017). Virtual reality exposure therapy: Bringing ‘in vivo’ into the office. *Journal of Health Service Psychology*, 43(1), 46–49. <https://doi.org/10.1007/BF03544649>
- Meyerbröker, K., & Morina, N. (2021). The use of virtual reality in assessment and treatment of anxiety and related disorders. *Clinical Psychology & Psychotherapy*, 28(3), 466–476. <https://doi.org/10.1002/cpp.2623>
- Milad, M. R., Rosenbaum, B. L., & Simon, N. M. (2014). Neuroscience of fear extinction: Implications for assessment and treatment of fear-based and anxiety related disorders. *Behaviour Research and Therapy*, 62, 17–23. <https://doi.org/10.1016/j.brat.2014.08.006>
- Navarro-Haro, M. V., Modrego-Alarcón, M., Hoffman, H. G., López-Montoyo, A., Navarro-Gil, M., Montero-Marin, J., García-Palacios, A., Borao, L., & García-Campayo, J. (2019). Evaluation of a mindfulness-based intervention with and without virtual reality, dialectical behavior therapy, mindfulness skills training for the treatment of generalized

- anxiety disorder in primary care: A pilot study. *Frontiers in Psychology*, *10*, Article 55.
<https://doi.org/10.3389/fpsyg.2019.00055>
- Ngai, I., Tully, E. C., & Anderson, P. L. (2015). The course of the working alliance during virtual reality and exposure group therapy for social anxiety disorder. *Behavioural and Cognitive Psychotherapy*, *43*(2), 167–181. <https://doi.org/10.1017/S135246581300088X>
- Nichols, M. P., & Davis, S. (2021). *Family therapy: Concepts and methods*. Pearson.
- Norcross, J. C., Pfund, R. A., & Prochaska, J. O. (2013). Psychotherapy in 2022: A Delphi poll on its future. *Professional Psychology: Research and Practice*, *44*(5), 363–370.
<https://doi.org/10.1037/a0034633>
- Noyes, R., Jr. (2001). Comorbidity in generalized anxiety disorder. *The Psychiatric Clinics of North America*, *24*(1), 41–55. [https://doi.org/10.1016/s0193-953x\(05\)70205-7](https://doi.org/10.1016/s0193-953x(05)70205-7)
- Penninx, B. W. J. H., Pine, D. S., Holmes, E. A., & Reif, A. (2021). Anxiety disorders. *The Lancet*, *397*(10277), 914–927. [https://doi.org/10.1016/S0140-6736\(21\)00359-7](https://doi.org/10.1016/S0140-6736(21)00359-7)
- Pietrangolo, A. (2019). *9 CBT techniques for better mental health*. Healthline.
<https://www.healthline.com/health/cbt-techniques>
- Reeves, R., Curran, D., Gleeson, A., & Hanna, D. (2021). A meta-analysis of the efficacy of virtual reality and in vivo exposure therapy as psychological interventions for public speaking anxiety. *Behavior Modification*, *46*(4), 937–965.
<https://doi.org/10.1177/0145445521991102>
- Reeves, R., Elliott, A., Curran, D., Dyer, K., & Hanna, D. (2021). 360° Video virtual reality exposure therapy for public speaking anxiety: A randomized controlled trial. *Journal of Anxiety Disorders*, *83*. <https://doi.org/10.1016/j.janxdis.2021.102451>

- Riva, G. (2020). Virtual reality in clinical psychology. In *Reference module in neuroscience and biobehavioral psychology*. Elsevier. <https://doi.org/10.1016/B978-0-12-818697-8.00006-6>
- Roxana, A. I. C., Oana, A. D., & Daniel, O. D. (2017). Virtual reality exposure therapy in flight anxiety: A quantitative meta-analysis. *Computers in Human Behavior*, 72, 371–380. <https://doi.org/10.1016/j.chb.2017.03.007>
- Safir, M. P., Wallach, H. S., & Bar-Zvi, M. (2012). Virtual reality cognitive-behavior therapy for public speaking anxiety: One-year follow-up. *Behavior Modification*, 36(2), 235–246. <https://doi.org/10.1177/0145445511429999>
- Sekhvatpour, Z., Khanjani, N., Reyhani, T., Ghaffari, S., & Dastoorpoor, M. (2019). The effect of storytelling on anxiety and behavioral disorders in children undergoing surgery: A randomized controlled trial. *Pediatric Health, Medicine and Therapeutics*, 10, 61–68. <https://doi.org/10.2147/PHMT.S201653>
- Tahereh Haji, S. J., Tajikzadeh, F., Bayat, H., Eshraghi, N., Roshandel, Z., & Rahmani, S. (2018). Comparison of effectiveness of the mindfulness-based cognitive therapy and the metacognition treatment on anxiety, depression and stress among breast cancer patients. *International Clinical Neuroscience Journal*, 5(2), 62–66. <https://doi.org/10.15171/icnj.2018.12>
- Thomas, K., Dowd, C., & Broman-Fulks, J. J. (2017). Systematic desensitization. In V. Ziegler-Hill & T. Shackelford (Eds.), *Encyclopedia of personality and individual differences* (pp. 1–3). Springer. https://doi.org/10.1007/978-3-319-28099-8_952-1

Van Hout, W. J., & Emmelkamp, P. M. (2002). Exposure in vivo therapy. In M. Hersen, & W. Sledge (Eds.), *Encyclopedia of psychotherapy* (pp. 761–768).

<https://www.sciencedirect.com/topics/psychology/emotional-processing>

Wechsler, T. F., Kämpers, F., & Mühlberger, A. (2019). Inferiority or even superiority of virtual reality exposure therapy in phobias? A systematic review and quantitative meta-analysis on randomized controlled trials specifically comparing the efficacy of virtual reality exposure to gold standard in vivo exposure in agoraphobia, specific phobia, and social phobia. *Frontiers in Psychology, 10*, Article 1758.

<https://doi.org/10.3389/fpsyg.2019.01758>

Wolpe, J. (1968). Psychotherapy by reciprocal inhibition. *Conditional Reflex, 3*, 234–240.

<https://doi.org/10.1007/BF03000093>

Yang, J. (2019). *Using VR to creatively enhance biofeedback treatments*. Medium.

<https://medium.com/xratberkeley/using-vr-to-creatively-enhance-biofeedback-treatments-d86b8fdec48a>

Zainal, N. H., Chan, W. W., Saxena, A. P., Taylor, C. B., & Newman, M. G. (2021). Pilot randomized trial of self-guided virtual reality exposure therapy for social anxiety disorder. *Behaviour Research and Therapy, 147*.

<https://doi.org/10.1016/j.brat.2021.103984>

Zhang, W., Paudel, D., Shi, R., Liang, J., Liu, J., Zeng, X., Zhou, Y., & Zhang, B. (2020). Virtual reality exposure therapy (VRET) for anxiety due to fear of covid-19 infection: A case series. *Neuropsychiatric Disease and Treatment*.

<https://doi.org/10.2147/NDT.S276203>

Appendix

List of Terms and Abbreviations

Imaginal – The act of intentionally imagining a situation

In vivo – In real-life

VR – Virtual reality

VRCBT – Virtual reality cognitive behavioural therapy

VRE – Virtual reality exposure

VRET – Virtual reality exposure therapy