PSYC REALITY

White Paper on

CLAUSTROPHOBIA

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Curtin University Dubai

RIT Rochester Institute of Technology of Dubai

UNIVERSITY OF BIRMINGHAM DUBAI

Enhancing Claustrophobia Treatment through Virtual Reality

A White Paper by PsycReality

In Collaboration With

Curtin University Dubai

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Preface

It gives me great pleasure in writing this preface on behalf of PsycReality, regarding a white paper "Enhancing Claustrophobia Treatment Through Virtual Reality" written by brilliant students, Ms. Lara Elsalamouny from Curtin University Dubai and Ms. Sara Anees from University of Birmingham Dubai who completed their literature review in our Middle East (Dubai) office during summer 2025 about the topic.

The publication of this white paper is very timely as up-to 12.5% global population, which equates to roughly 1.01B people who have their daily life affected are suffering because of implications of claustrophobia in their daily lives. The global prevalence of this mental health condition demands an innovative solution in era of digital health, especially digital mental health. Use of Virtual Reality Exposure Therapy (VRET) in conjunction with Artificial Intelligence (AI) and other immersive technologies is inevitable with new scientific findings and methods adopted by subject matter experts, associations and professionals in addition to teachings and learnings of these new methods and techniques at global educational institutes.

PsycReality is innovation centric enterprise, headquartered in Republic of Ireland with Middle East regional office in UAE who believes with innovation and adaption of new technologies, scientific backed changes in therapy and treatment methods are the only practical approach to embrace the technological change today.

I personally believe, an innovation will not stand its weight if not backed up by science and education, as only education will not help students reach new milestones without innovation. With this philosophy, along with my team, since inception of PsycReality we emphasised on collaborating with educational institutes. This white paper is the fruit of that collaborative work between University of Birmingham Dubai, Rochester Institute of Technology Dubai, Curtin University Dubai and PsycReality.

I would take this opportunity to thank the supervisors from participating universities, guest speakers who took their time out of work and gave insight of real practical life to students, students themselves for their dedication against the odds where they stood for their team members and most importantly my team at PsycReality who helped from beginning of the process of gathering interest from the students and all the way to structuring, reviewing and publishing the papers.

Artificial Intelligence will not replace the mental health practitioners, however, practitioners who know Artificial Intelligence, will replace the ones who don't know Artificial Intelligence; Dr. Brigitte Khoury, founding president of Lebanese Psychological Association.

I invite you all to have a cup of tea, sit, relax and enjoy the read of this white paper.

Bilal Shaheen Awan
Founder & CEO
PsycReality

Contents

Understanding Claustrophobia

Claustrophobia is a form of specific phobia, falling under the category of anxiety disorders in the diagnostic and statistical manual of mental disorders (DSM-5-TR; APA, 2022). According to the American Psychological Association (APA), Claustrophobia refers to a persistent and irrational fear occurring in tight and confined spaces for at least a duration of 6 months (APA, 2018; APA, 2022). Tight and confined spaces can include elevators, small rooms, tunnels, backseats of cars, airplanes, public toilets, and rooms with sealed windows (APA, ND; APA, 2022; NHS, 2021). Physical symptoms include rapid heart rate, the feeling of suffocation, shortness of breath, sweating, and dry mouth (Vadakkan & Siddiqui, 2023). On the other hand, psychological symptoms include detachment from the body, fear of death, and losing control of oneself (NHS, 2021).

Claustrophobia can cause several disruptions, impacting one's life in various ways (BjörkmanBurtscher, 2021; Nielsen, 2012). Firstly, Claustrophobia can cause severe disruptions when undergoing medical examinations, for instance, only choosing to undergo MRI scans with sedation or anesthesia due to extreme fear of the procedure can add additional risks to the procedure (Björkman-Burtscher, 2021). Not only that, but this can result in inadequate images or termination of the whole examination, which also disrupts healthcare costs (Björkman-Burtscher, 2021). Moreover, in college environments, Claustrophobia can impact and decrease classroom performance, as students living with Claustrophobia are sometimes preoccupied and anxious about the tight and confined classrooms they are in, shifting attention away during class (Nielsen, 2012). Importantly, some indviduals may be unaware of having clasurophobia which causes indicuals extreme confusion and fear when experiencing anxiety in confined spaces (Nielsen, 2012).

Exploring Prevalence

According to a recent journal article, 12.5% of the global population are currently living with claustrophobia, inferring, that roughly 1.01 billion individuals live with this disorder worldwide (Vadakkan & Siddiqui, 2023). Such high global prevalence can only indicate that innovative treatment solutions for Claustrophobia are in need to treat such many individuals. Individuals with claustrophobia can have a very hard time facing their feared stimuli and this avoidance causes significant distress impacting areas of functioning, including occupational and social functioning (APA, 2022). Unfortunately, it appears that the literature surrounding Claustrophobia prevalence in the Middle East and North Africa region (MENA) is insufficient and outdated (Karam et al., 2006; Karam et al., 2008; Ghubash et al., 1992; Alameri et al., 2024). Over the past 30 years, research in the MENA region has been delving into understanding specific phobia prevalence, rather than specifically focusing on Claustrophobia (Karam et al., 2006; Karam et al., 2008; Ghubash et al., 1992; Alameri et al., 2024). In fact, a claim was made in 2009 suggesting that epistemological studies are rare in the Arab world, hence, this may be why Claustrophobia prevalence is under researched and vague to this day in the MENA region (Tanios et al., 2009). The studies were identified to lack temporal validity as some were published more than 30 years ago, ungeneralizable, as child samples were not included, and did not illustrate high prevalence rates for specific phobias (Karam et al., 2006; Karam et al., 2008; Ghubash et al., 1992; Alameri et al., 2024).

Global Prevalence of Claustrophobia

Roughly 1.01 billion individuals live with this disorder worldwide (Vadakkan & Siddiqui, 2023). Such high global prevalence can only indicate that innovative treatment solutions for Claustrophobia are in need to treat such many individuals.

The most recent study testing for anxiety disorders in the UAE, identified a prevalence of 6.5% for specific phobias, indicating that around of 23 participants in the study had a specific phobia,

which is not high prevalence (Alameri et al., 2024). Existing literature has also suggested that fear of certain spaces like lifts, airplanes, tunnels, and even MRI scanning machines, has drastically increased in prevalence due to urbanization, especially in fast, well-developed countries like the United Arab Emirates (Wang et al., 2025; Nassar et al., 2014). Moreover, when attempting to understand why prevalence may be low in the region despite extreme urbanization, sociocultural elements like stigma towards mental health come into play. In highly diverse countries like the United Arab Emirates, with expats covering 85-90% of the population, some expats may come from cultures that view mental health as a taboo; therefore, underreporting may become a contributor to low prevalence (Wang et al., 2025; Al-Yateem et al., 2020).

Available Treatments

According to research, one of the main treatments for claustrophobia management is Cognitive Behavioural Therapy (CBT), which focuses on altering the negative beliefs held by patients towards their feared stimulus (Vadakkan & Siddiqui, 2023). Exposure treatments like interoceptive and in-vivo exposures are popular types of treatments that are also well-researched. In-vivo exposure treatment involves patients encountering their feared stimulus in real life and are found to be quite effective (APA, 2017; Morina et al., 2015). On the other hand, Interoceptive exposures deal with exposing patients to physical sensations of anxiety in a controlled environment, where studies have demonstrated their efficacy in dealing with intrinsic fears (Booth & Rachman, 1992; Boettcher & Barlow, 2019; Vadakkan & Siddiqui, 2023). A focus on intricnsic fear refers to pure concentration on one's bodily sensations during expsoure rather than focusing on extrinsic fears like how others may react to the patient's panic in a social setting (Booth & Rachman, 1992; Boettcher & Barlow, 2019; Vadakkan & Siddiqui, 2023). Moreover, certain medications like benzodiazepines and selective serotonin reuptake inhibitors are also utilised in phobia treatment (Visakan & Siddiqui, 2023).

A Brief Exploration of Virtual Reality Exposure Therapy

In recent times, exposure treatments involving virtual reality have been popularized and commonly used. This type of therapy is known as, Virtual Reality Exposure Therapy (VRET). Virtual Reality Exposure Therapy is a type of exposure therapy that is conducted through digital means and technology, by immersing one to experience artificial exposure therapy through virtual reality (VR) (Hawajri et al., 2023). In such VR environments, individuals are exposed to their feared stimulus in hopes of arousing natural fear reactions. The repetition of exposure over time and the use of higher intensities in VRET is meant to condition one to manage their fears (Hawajri et al., 2023). Although traditional methods like in-vivo exposure aid in symptom reduction, the limitations possessed such as time constraints, costs, and the impracticality in multiple domains, for instance, taking flights or exposure to MRI machines, every session may be very difficult, making in-vivo exposure unfavourable (Morina et al., 2015; Pittig & Hoyer, 2017; Kuleli et al., 2025). To cater to such circumstances and to address the needs of patients and clinicians, VRET is seen to act as a cost-effective alternative exposing patient to difficult--toreplicate scenarios (Maples-Keller et al., 2017). This is where VRET, an emerging paradigm, is beneficial (Pittig & Hoyer, 2017).

Importantly, clinical and technical VRET simulation designs hold the upmost importance when it comes to claustrophobia-specific VR scenarios. Current literature exhibits scenarios like elevators of varying sizes and conditions, as well as metros and rooms of various sizes and types, which have proven to be feasible and effective in reducing symptoms (Mayer et al., 2022; Helle et al., 2022; Bruce & Regenbrecht, 2009). Research has also demonstrated that the principle of graded exposure is being utilized in VRET. Graded exposure refers to how the feared situations presented progressively increase in intensity with modifications of intensity based on patient progress levels. It is also important to only advance to further levels when factors like defensive actions and fear have reduced, rather than just monitoring and focusing on momentary reductions in fear (Knowles & Olatunji, 2019). In contrast to traditional exposure therapy like in-

vivo, studies have shown that VRET provides controlled, personalized, and safe environments without exposure to real-life risks (Botella et al., 2017).

Figure 1. Existing VRET Scenarios for Claustrophobia. From Francová, A., Jablonská, M., & Fajnerová, I. (2023). Design and Evaluation of Virtual Reality Environments for Claustrophobia: PRESENCE: Virtual & Augmented Reality. PRESENCE: Virtual & Augmented Reality, 32, 23–34. Https://doi.org/10.1162/pres_a_00385 Reprinted under fair use.

Certain meta-analytic studies showcase likability for VRET in comparison to traditional therapies like in-vivo exposures through the small effect sizes identified (Powers & Emmel Kamp, 2008). Research has also demonstrated evidence that patients who have undergone VRET had significantly better post-treatment results than other individuals undergoing different types of therapy. A key difference between VRET and traditional therapies is the patient presence element. Virtual Reality Exposure Therapy allows patients to have active role in therapy, due to VRET's interactive nature (Rizzo & Koenig, 2017; Mayer et al., 2022).

About Virtual Reality: Exploring Existing Paradigms

Virtual Reality (VR) refers to computer generated, 3rd dimensional artificial simulations that can be experienced through the use of headsets that allow one to hear and view both realistic and imaginative scenarios (Emmelkamp & Meyerbröker, 2021; Iqbal et al., 2024; Fares et al., 2024; Girvan, 2018). Virtual Reality technology is aimed to fully immerse individuals, making them feel present and perceptually situated in the viewed artificial simulations, VR acts like a bridge from the physical to the virtual world (Iqbal et al., 2024; Fares et al., 2024).

On the other hand, Augmented Reality (AR) is a variation of VR, which integrates one's reality with additional virtual information, acting as a technological extension to one's world (Chen et al., 2019; Eckert et al., 2019; Azuma, 1997 as cited in Eckert et al., 2019). One's physical reality is expanded through the addition of digital information, including videos, symbols, audio, and numbers, in the user's view such digital information is viewed in their real world (Arena et al., 2022). Importantly AR is not only utilized in gaming contexts like Mario Cart and Pokémon, but it has also been implemented in medical systems and used to help monitor patients remotely. Augmented Reality systems combined with the Internet of Things (IoT) was shown to also support hospitals in the prevention and identification of critically ill patients (Hu et al., 2013 as cited in Arena et al., 2022). In fact, AR is now being utilized for education, treatment, tourism, and entertainment (Arena et al., 2022). Lastly, mixed reality (MR), from its name, infers a mix or a combination between digital and physical environments (Park et al., 2020). It is different to AR, as in MR objects from the digital world interact and co-exist with objects in the real world, MR devices are considered to be an evolution of AR (Park et al., 2020). Both AR and MR have been used in medical procedures, like interactive radiology, as they are believed to help with image visualization and identifying targeted areas during imaging (Park et al., 2020).

The Implementation of Paradigms in Exposure Therapy

Recently, both VR and AR have been utilized in exposure therapy (ET) for treatment of specific phobias (Suso-Ribera et al., 2019). Terms like Virtual Reality Exposure Therapy (VRET) and Augmented Reality Exposure Therapy (ARET) have been coined due to the integration of VR and AR with ET (Suso-Ribera et al., 2019). Feared stimuli, like elevators, tunnels, and MRI scans, are replicated in the form of virtual simulations with the aim of mimicking real-life feared stimulus, where one can view such simulations using headsets like the Oculus rift (Rahani et al., 2018). Research suggests that VRET was found to trigger fear among patients when presented with their feared stimuli via scenarios (Christofi & Michael-Grigoriou, 2016). Hence, it is evident that VRET could arouse the same emotions that can be aroused in real life during in-vivo exposure.

Figure 2. Mayer, G., Gronewold, N., Polte, K., Hummel, S., Barniske, J., Korbel, J. J., Zarnekow, R., & Schultz, J.-H. (2022). Virtual Experiences of Patients and Therapists Testing a Virtual Reality Exposure for Symptoms of Claustrophobia: A Mixed-Methods Study (Preprint). JMIR Mental Health. Https://doi.org/10.2196/40056

The types of scenarios currently being used in VRET incorporate day-to-day scenarios with varying intensities, for example, a building with different rooms and even the inclusion of tunnels (Christofi & Michael-Grigoriou, 2016). Virtual Reality Exposure Games have also been created and include different locations like houses, corridors, and basements which can be chosen according to the progress of the patient (Malbos et al., 2008; Boeldt et al., 2019). Multiple studies have discussed VRET efficiency and the types of advantages it may offer to both clinicians and patients. Studies have also highlighted psychological factors favouring the use of VRET, such as VRET offering safe and a controlled form of exposure (Botella et al., 2017). Additionally, the ability clinicians must curate personalized sessions by altering simulation intensity and level based on patient progress, appears as a great advantage for VRET (Wang et al., 2025; Wray et al., 2023). Not to mention, the interactive nature of VRET has resulted in lower treatment refusal and dropout rates when compared to in-vivo exposure (Grause et al., 2025; Garcia-Palacios et al., 2007).

Moreover, the private manner in which VRET is carried out can be another factor in support of the necessity of VRET wherein the stigma or the embarrassment patients might face in real world exposures can be diminished (Levy et al., 2023). Indeed, VRET is also seen to give clinicians more control over the treatment process, provide faster results than in-vivo-exposure, and, in return, reduce therapy costs for patients (Rahani et al., 2018). Overall, VRET is considered to be a more practical solution, for instance, if one fears confined airplanes, it is not practical to take a flight every session and expose them to such a confided environment, and this is where VRET fills the gap of practicality (Christofi & Michael-Grigoriou, 2016).

Technological Consideration

Technological disruptions and complications may occur whilst using VRET (Arnfred et al., 2023; Slater et al., 2020; Ong et al., 2022).

However, a few things must be considered when using VRET. Firstly, technological disruptions and complications may occur whilst using VRET (Arnfred et al., 2023; Slater et al., 2020; Ong et al., 2022). Research has been carried out revealing potential barriers to using VRET for the treatment of claustrophobia, such as technological complexity, in which worries regarding the need and use of specialized equipment like VR headsets and controllers are present due to its cost and maintenance (Arnfred et al., 2023; Slater et al., 2020). Some studies have also reported that VR requires necessities like a stable internet connection, which may be disrupted under unforeseen circumstances such as bad weather conditions (Ong et al., 2022).

Importantly, limitations for research based on claustrophobia and VRET include a lack of accountability on how patients personally perceive VRET, as very few studies focus on this phenomenon (Mayer et al., 2022). Another persistent gap in the literature would be small-scale studies (Parsons & Rizzo, 2008). Additionally, only a minimal number of studies with long-term follow-ups were found. Christofi & Michael-Grigoriou (2016) conducted a study which consisted of only (n=18) students, which was also a small pilot study. Similarly, a study conducted in 2008, was based on a VRET game which consisted of only (n=6) patients (**Malbos et al., 2008)**. Studies with small sample sizes serve as a main limitation for VRET research (Francová et al., 2023).

Analysis of scenarios from existing studies also infer that the absence of changing or unpredictable environments that are exclusively

constructed for long-term interventions are factors to consider in VRET (Francová et al., 2023). This lays emphasis on the necessity for scenarios to include both diverse and provoking stimuli which can also be developed in future randomized controlled trials for testing. Despite such disadvantages, new innovative ways, such as alteration of virtual environments, like changing colours, adjusting space, and even the gamification of these simulations have been tried and tested in attempts to enhance VRET outcomes (Christofi & Michael-Grigoriou, 2016; Rahani et al., 2018). From the current existing literature, it is evident that both VR and AR have gone through multiple technological advancements across the years, which have allowed for such paradigms to become user-friendly and effective in multiple domains, despite some disadvantages (Iqbal et al., 2024; Arena et al., 2022).

Comparisons Between Traditional and Modern Treatments

Exposure therapy is a very well-known therapeutic technique aimed at treating several phobias, it consists of repeated exposure to ones' feared object or situation repeatedly over a period of time, with the objective of decreasing fear towards the object or situation (Wechsler et al., 2019). Moreover, it is important to understand that in-vivo exposure therapy refers to exposing an individual to their feared stimuli directly in real life (APA, 2017). As discussed previously, VRET aims to expose individuals to their feared objects, however through a virtual yet realistic environment, it is an emerging paradigm that is proposed to be a promising treatment for claustrophobia (Rahani et al., 2018; Hidayat et al., 2025). Over the years many studies have been aiming to understand the differences between regular exposure therapy, also known as in-vivo exposure therapy, and VRET (Levy et al., 2023;). Lately, there has also been a trend towards the gamification of certain VRET simulations, gamification in this context refers to adding gaming elements like, reward systems, challenges, and opportunities of exploration in the simulations (Fleming et al., 2016). Such gamification has been shown to provide positive treatment effects and high user engagement with VRET. Research also suggests that displaying feared stimuli in VRET simulations, can arouse deep levels of anxiety and fear, similar to what occurs during in-vivo (Bruce & Regenbrecht, 2009). This infers that if fear can be aroused in virtual and artificial environments, the typical ET process of facing a feared situation or object in real time is being achieved.

Figure 3. Vard, A., Rahani, V., & Najafi, M. (2018). Claustrophobia game: Design and development of a new virtual reality game for treatment of claustrophobia https://doi.org/10.4103/jmss.jmss_27_18 phobia. Journal of Medical Signals & Sensors, 8(4), 231. (Image from a Virtual Reality game made for Claustrophobia)

Exploring Patient Perceptions

Importantly, how patients perceive VRET and in-vivo exposure and the current attitudes they may have towards these different treatments can help identify how likely they are to opt for each type of treatment (Levy et al., 2023). A study conducted in 2023 has shown that many participants had negative attitudes towards in-vivo exposure due to concerns of exacerbation of anxiety symptoms, feelings of embarrassment when encountering the feared situation in public during an ET session, and increased anxiousness (Levy et al., 2023). Contrarily, the same study portrayed that most participants had a preference for VRET due to its safety, comfort, various simulation customization options available, and privacy, meaning that patients do not have to experience social embarrassment during ET sessions (Levy et al., 2023). In fact, a large systematic review conducted in 2021, including a total of 29 studies which explored VRET and its effects on specific phobias, including Claustrophobia, had identified that there was 100% success rate when using VRET for Claustrophobia treatment (Freitas et al., 2021).

In-vivo Versus Virtual Reality Exposure

Interestingly, studies have also shown that differences between in-vivo and VRET may be minor, with no strong evidence that VRET is less effective than in-vivo for the treatment of specific phobias (Wechsler et al., 2019). Analysis of results from recent meta-analyses lays emphasis on the non-significant difference in efficacy between VRET and traditional treatments, such as in-vivo exposure and CBT (Opriş et al., 2011; Carl et al., 2019). Although there is no significant between in-vivo and VRET from the results' or efficacy perspective, VRET is a step ahead when compared to in-vivo, as it also focuses on the planning and different types of simulations for patients, in which clinicians need to take charge of the durations and intensities for personalized treatment (Wray et al., 2023). This form of treatment also enables clinicians to cater to unique fears as well as provide exposure for a prolonged period of time in the session (Wray et al., 2023; Abramowitz et al., 2012). Malbos et al. (2008) provides evidence that VRET used for treating claustrophobia also caters to other comorbid phobias like the fear of height, even though the application did not take such conditions into consideration, which acts as a support for the over-generalizability hypothesis of VRET.

Advantages of Virtual Reality Exposure Therapy

Undoubtedly, Virtual Reality Exposure Therapy has been praised over the years for its safety element, in fact, studies have portrayed that VRET has a higher rate of user-acceptance due to the control and safety elements, which are vital aspects that cannot be guarantee during in-vivo exposure (Botella et al., 2017). The safety and level of control that elements come with in VRET are seen as ideal advantages for child and elderly populations who require safer and protected environments for ET (Botella et al., 2017). Since VRET is also conducted from the comfort of a clinician's office this is seen to offer more freedom and less restriction for clinicians since they do not have to accompany clients in different locations and situations during every session (Horvathova et al., 2015). Numerous studies also highlight the cost effectiveness of VRET and how efficacious it can be for specific phobia treatments, including Claustrophobia (Rahani et al., 2018; Bruce & Regenbrecht, 2009; Freitas et al., 2021). Expectedly, treatment results are found to be the same as in-vivo exposure, with VRET requiring less costs and reducing fear and avoidance behaviours effectively. Earlier studies, such as Botella et al. (1998), serve as one of the foundational studies exploring VRET and claustrophobia in which exposures were carried through 8 individual VR sessions, after which a significant reduction in anxiety symptoms was noticed post self-reported measures even at a one-month follow-up. Botella et al. (2000) once again, carried out an intervention with (n=4) participants, with the treatment lasting for 8 individual VR exposure sessions. Analysis of data obtained at pre-treatment, post-treatment, and at a 3-month follow-up all revealed that VR exposure was effective in reducing fear and avoidance symptoms. Another study, Malbos et al. (2008), involved (n=6) claustrophobic patients, who were exposed to VR sessions in which the initial sessions consisted of psychoeducation and relaxation techniques. An improvement from pre-test to post-test was observed, which was also consistent at a 6-month follow-up, elaborating on the positive outcomes of using VRET for claustrophobia. Recent studies have continued to show a desired consistency in the reduction of symptoms through examination from pre-intervention to postintervention.

Helle et al. (2022) included (n=7) clinical professionals who examined the effectiveness of VR in treating claustrophobia through 8 sessions. Six different sessions were conducted with customizable scenarios. The therapists' screen contained options that possessed the ability to manipulate the environment, such as control of elevator doors, directions, and size. Results based on the clinicians' perspective emphasize that VRET, especially the elevator simulator, has the potential to serve as a treatment for claustrophobia. Another study by Mayer et al. (2022), examined the effectiveness of VRET through an application. This mixed methods study involving (n=15) patients and (n=15) experts tested elevators of gradual intensities of five levels that varied with reference to size, duration, and addition of virtual humans.

Think-aloud protocols, self-reported measures, along semi-structured interviews exhibited that VRET was effectively identified through the difference between pre-test vs post-test. Studies highlight factors that may contribute to low dropout rates and high therapy completion, such as a sense of realness incorporated in a safe manner through guided exposure by the therapist, ultimately enhancing patient outcomes (Freeman et al., 2017). Outcome analyses carried out across studies incorporating VRET for claustrophobia has all statistically provided significant results demonstrating improvements from pre-treatment to post-treatment. Studies based on VRET on claustrophobia have incorporated widely used assessment tools such as the Claustrophobia Questionnaire, State-Trait Anxiety Inventory, and Behavioural Avoidance Test, to evaluate participants' symptoms as a pre- vs. post-measure (Malbos et al., 2008). Persistent limitations reported, such as low sample sizes, absence of long-term follow-ups, and randomized controlled trials in earlier studies were also acknowledged in recent studies possessing similar drawbacks, targeting these points (Francová et al., 2023; Nuru Jingili et al., 2023).

About PsycReality

PsycReality is a company aimed at helping clinicians provide better personal, social, and family lives for their patients. Through cutting edge technology and the most recent mental health research, PsycReality treats different anxiety disorders and phobias utilizing VR, AI, and 360-degree video-based interventions. PsycReality had realized and identified that clinicians often find it difficult to replicate real phobia experience in clinics, hence, decided to address that gap by providing VR solutions that replicate realistic phobic experiences. Now, clinicians can use VR solutions alongside psychotherapy to enhance and speed up therapeutic outcomes.

Founded late 2020, by tech entrepreneur, Bilal Awan, the company now operates in Ireland (Headquarter), United Arab Emirates (Regional Office for MENA), Kuwait, Oman, Pakistan, Lebanon and Brazil (Regional Office for South America). Only a year after establishment, PsycReality had won European best Start -Up award in the LEAP summit Zagreb, Croatia, along with forming strong parentships with FDA approved global companies fostering connections that grow innovation and invention.

Partnering up with reputable universities with their main and regional campuses in the United Kingdom, United Arab Emirates, Croatia, Brazil, Pakistan, Kosovo, United States of America, Australia, Singapore, Malaysia and Sri Lanka has allowed PsycReality to expand its simulations based on up-to-date evidence and rigorous research. PsycReality targets several communities and professionals including clinics, psychologists, hospitals, and even health issuers. PsycReality's invention aims to reduce sessions needed to get rid of the phobia, allow clinicians to see more clients by reducing waiting time, and provide flexibility and customizations in the simulations provided. This is not about computer graphics, this is about real-time interactive content enhanced with data available for machine learning and large language models (Artificial Intelligence) technology, to bring the whole experience right at the clinician's office.

Recommendations Based on Recent Literature

As previously discussed, head mounted displays allow for ecological validity to take place, as if one is truly in a real simulation, with full immersion and engagement with the feared stimulus (Bruce & Regenbrecht, 2009). It is also important to understand that the types of videos, graphics, colours and interaction metaphors utilized in any simulation can influence the sense of presence a patient feels. The sense of presence refers to the

extent of anxiousness one experiences when encountering the feared situation or object (Christofi & Michael-Grigoriou, 2016; Wrzesien et al., 2014). Even the colours used can impact how patients feel, indeed, a study portrayed that using paler colours was seen to be more anxiety inducing for patients in comparison to brighter colours (Christofi & Michael-Grigoriou, 2016). Additionally, adding interactive elements in the simulations, such as realistic sounds, for instance of an elevator shutting and opening, and a guiding voice to instruct patients on what to do, can increase engagement and realism during VRET (Rahani et al., 2018). Whilst using VR technology, one may be susceptible to experience Cybersickness. Cybersickness or Visually Induced Motion Sickness (VIMS) refers to negative consequences that occur as a result of virtual reality exposure, such as nausea, dizziness, and headache (Keshavarz et al., 2022). Research has identified techniques for cybersickness management, such as progressive acclimatization of patients to virtual environments as well as short, repetitive exposure sessions (Lysenko et al., 2023).

It also important to take technological breakdowns into consideration. Technological breakdowns are seen to disrupt the presence aspect of the therapy session, holding patients back from experiencing the fear they would if they were to encounter the situation in real life (Christofi & Michael-Grigoriou, 2016). To overcome technological breakdown barriers, clinicians should be given a manual with instructions on how to appropriately use the VR headset and start the simulation program. Clinicians must ensure that patients are familiar with the same, and that internet connection is stable prior to starting the VRET session to avoid any unnecessary risks of breakdown. With reference to barriers that have been reported, PsycReality caters to addressing the issues through accessibility by providing support services in case of any malfunction and comprehensive user manuals consisting of troubleshooting guidelines and Frequently Asked Questions (FAQ's) to enable clinicians to carry out smooth sessions.

Furthermore, based on the literature, it would be vital for simulation creators to consider the quality of videos and graphics utilized, incorporating realistic locations and scenarios, ensuring mundane realism. It is also important to make the simulations as interactive as possible via a guiding voice, and the incorporation of realistic sounds that have the ability to arouse aversive feelings in patients. Studies have also reiterated the importance of using applications that enable the therapists' hands-on modification of the game or exposure, such as altering the size of elements, for example, doors or windows, that would install a sense of transition for the patient (Helle et al., 2022). It is also important to incorporate this strategy without complicating the therapists' screen, so the quality of the session is not compromised for both the patient and the clinician (Helle et al., 2022). A growing sense of importance for research based on the gamification of VRET is prevalent, in which factors like intrinsic motivation are given importance (Castellano-Tejedor & Andrés Cencerrado, 2024).
Research exhibits that incorporating gamification along with VRET has profound effects like better engagement and interaction (Nuru Jingili et al., 2023). Furthermore, studies have highlighted that phobias are intertwined with factors like avoidance behaviours, for example, the unwillingness to take part in every activity, leading to social and occupational consequences (Gaina et al., 2024).

Hence, incorporating gamification elements enhances a sense of motivation even in challenging scenarios, preventing the possibility of dropout (Cheng & Ebrahimi, 2023). It might also be beneficial to incorporate unforeseen scenarios and circumstances, for example, breakdown of a metro, wherein patients are exposed to the worst-case scenario, so they are equipped even for situations that are highly unlikely and fearful. It is also vital to consider that, anxiety disorders such as Claustrophobia are associated with elevated physiological arousal that is expressed through factors such as skin conductance and respiratory rate (Kenwood et al., 2022; Wilhelm et al., 2001; GLOBISCH et al., 1999). These biomarkers can be used as an indicator in the detection of disorders or even therapeutic choices (Perez et al., 2014). These biomarkers also aid in providing feedback post-intervention and are referred to as monitoring biomarkers (Califf, 2018). Through analysis of existing literature, it can also be

recommended to include such physiological responses as studies have shown moderate consistency of biomarkers such as heart rate, and in combination with questionnaires, factors like skin conductance show accurate testing results (Ernst et al., 2024).

Although studies have highlighted low dropout rates for VRET when compared to in-vivo, some studies have exhibited that the dropout rates for VRET are not much different when in comparison to exposures like in-vivo (Opriş et al., 2011). These differences in results could be due to the low sample size limitation. Earlier studies, such as Botella et al. (2000), have also presented the need to conduct more randomized controlled trials of VRET with its comparison to standard methods of exposure, in which there is still a lack of studies. Lastly, certain populations, such as the Asian population, are more prone to the development of anxiety but not depression, so concentrating on more vulnerable populations by curating culturally relevant exposures enables transcultural consideration, helping alleviate potential chances and symptoms of anxiety (Gaina et al., 2024).

Scenario Development at PsycReality:

The Three Phases:

Before developing scenarios, PsycReality engages in rigorous review of literature, deep market research, and multidisciplinary meetings with both tech and psychology professionals to discuss the best way the scenarios can come to life for treatment optimization. PsycReality's scenario development consists of three different phases, Phase 1, focusing on academic research, Phase 2 generation of immersive visuals for scenarios, and phase 3, consisting of clinical.

Phase 1

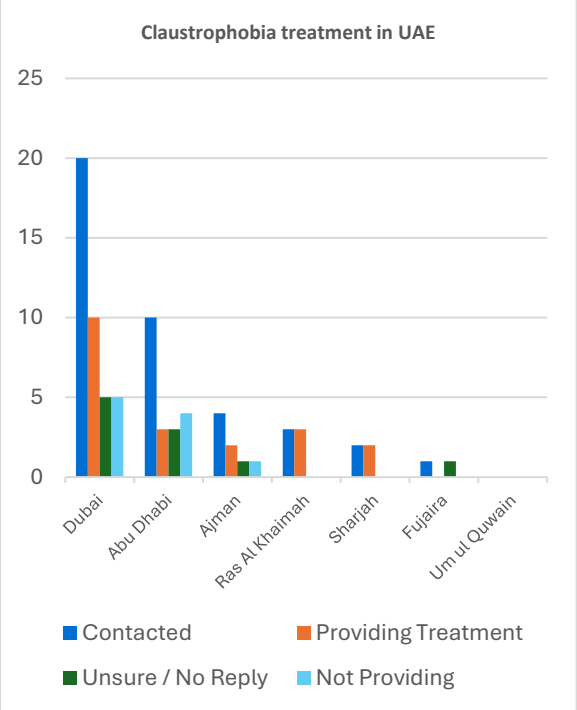
Firstly, Phase 1 consists of deep academic research including literature reviews, deep market analysis, and randomized controlled trials. Based on the deep research gathered, PsycReality publishes scientific and academic papers to assist the designated technology team to develop the scenarios and VR solutions. Importantly, topics of research are chosen based on market feedback, prevalence, and demand.

Phase 2

Furthermore, Phase 2 is where the technology team is involved in developing the scenarios using immersive technologies i.e. 360-degree content that is realistic, culturally appropriate, with use of real videos of different feared stimuli instead of using unrealistic computer graphics or avatars.

Phase 3

Once technology is developed and all the parameters of scientific research have been incorporated, developed scenarios are provided to clinical psychologists to conduct clinical tests and clinical trials. Based on feedback from clinicians, it is determined whether there are changes to be made to the developed solution and if it is commercially appropriate to be made available in the market.



***Note**: Due to the lack of Claustrophobia prevalence studies found in the United Arab Emirates, the authors of this paper have taken it upon themselves to contact a randomized list of 40 clinics. Based on the 40 clinics that have been contacted, 50% of them confirmed that treatments for Claustrophobia are available. This implies that many clinics around the UAE offer claustrophobia treatment, meaning there may be a high demand for such a type of treatment.*

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