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Creative Intervention for Acrophobia Sufferers through AIVE Concept

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Abstract: This research applies exposure to the visual appearance technology of virtual reality (VR). The motivation for this research is to generate a creative intervention by using regular smartphone devices and implementing them in VR using Google Cardboard as a medium visual display for exposure therapy at high altitudes. The VR application in this research is called acrophobia immersive virtual exposure (AIVE), which utilizes the Unity3D software to develop this treatment therapy application. The utilization of exposure therapy was carried out as a therapeutic medium for acrophobia sufferers. A commissioner was given to measure the usefulness of applications and devices in the VR environment created, and as many as 20 users had tested the VR device. The existing questionnaire was revised to develop a questionnaire for acrophobia sufferers, which was then used as an index measurement in the VR environment. The research is expected to be used to design a simulator and as a therapeutic medium using immersive VR devices in future studies.

Keywords: VR; exposure therapy; immersive; creative intervention

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1. Introduction

A VR visualization is a process where users can see the 3D world with different levels of view. VR visualization can give you more control over what therapy you want to visualize. Through computer-generated images displayed by head-mounted display (HMD) devices, therapists can control the vision of patients [1]. VR can also be used to display virtualization images that therapists want patients to realize and feel comfortable with. VR visualization can help to influence the mind to imagine and create positive effects, thus bringing mental strength. Because of this fact, VR has been considered one of the best technologies to alleviate mental disorders used by psychologists [2]. Virtual reality is also now referred to as a transformative technology, as a virtual potential for rational inventions that change individually and clinically [3].

Focused exposure therapy is useful for helping individuals get involved with a feared stimulus to test the predictions of fear instead of building insight into symptoms. The relative contribution of the three components of the therapeutic alliance described previously may be unique in exposure relative to other treatments. In particular, several research have shown that task alliances (compared to bonding and goal alliances) have the most profound effect on anxiety symptom reduction given the exposure emphasis on behavioral change [4–6].

The use of the virtual world as a medium for therapy is expected to help therapists achieve a near-realistic environment for patients. The way it works from acrophobia immersive virtual exposure (AIVE) is a visual display that is produced to be captured by

the eye and transmitted to the brain. The brain will function through two parts, namely: the cognitive and emotional brain. The outcomes of this new condition open up a new field of inquiry that is part of transformative technology, using the potential to improve the process of change in the patient's personality [3,7]. At this time, smartphone media and video graphics technology have made technology cheaper and easier to use.

Visualization is an essential part of the mechanism of human cognition. When receiving incoming information, people rely on visual attention to place an order in their environment. After elaborating events into different components, the visual system draws attention to further specific elements for additional processing [8]. Visual appearances produce virtual worlds in real-time, and produce "real feelings" and are supported by operational definitions of the concept of presence [9], which have several levels, namely: subjective, behavioral, and physiological (changes in rate heart) [10]. Visualization on mobile devices can be more intuitive and creative in realizing a new thing in technological development. It makes it possible to generate virtual stimuli or a whole environment that can be modified for treatment purposes, where patients experience the same sensations as they would in a real environment, yet the environment is computer-generated (and, therefore, virtual) so that there is no need for the patient to move to the real place.

This paper aims to the usage of virtual reality-based mobile devices using immersive exposure therapy and visual techniques to create engaging and meaningful therapies for acrophobic patients. Therefore, the prospect segmentation for future VR development using mobile devices in the medical field is numerous, and the challenges lie in the expected impact of the most profitable application areas.

2. Related Work

Anxiety disorder has the largest group of psychiatric disorders with a 12-month prevalence of 14.0. With a prevalence of 12 months, at 6.4%, 22.7 million people are affected in Europe [11]. Anxiety is essentially an adaptive response to hazards, related anxiety disorders, consisting of a generalized anxiety disorder (GAD), social anxiety disorder (SAD), obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), panic disorder, agoraphobia, health concerns, and certain phobias [12].

Acrophobia is classified as a specific phobia [13], the type of environment, and the effects of this phobia can affect up to 4.9% of patients. Acrophobic patients are concerned that they may fall or lose their balance when they are within a certain distance from the ground. As an outcome, they experience symptoms of anxiety that can increase the onset of panic attacks when in a scary situation [14]; these phobias have a detrimental effect on their health and well-being. For example, they may not go to their doctor's office if the office is on a high floor [15]; acrophobia patients can delay home repairs for fear of using stairs. It is also possible to avoid visiting a friend's house if they have a balcony or picture window upstairs.

However, the reaction of the person experiencing it will cause an overactive reaction to a situation. All anxiety disorders are characterized by constant and excessive fear or overeating that causes anxiety and disrupts daily life. This feeling of excessive fear and anxiety is also called a phobia. The term "phobia disorder" [16,17] is composed of the words "phobia" and "fear."

Therapeutic applications using VR headset media in the medical world are increasingly being used, especially by patients with biopsychosocial models for cognitive disorders. The quality in-depth display allows avoiding stress in the real world while generating real feedback on the physiology of the patient in a virtual environment [18].

Regarding the application of mental health, to achieve the goal of "a sense of presence" in virtual environments is to give the illusion that the user can confirm that he is, in fact, moving in the virtual world and no longer in the real world. The number of sensory modalities in which the user is added to the VE is a major factor contributing to the actual feeling [19]. Therefore, the involvement of "multisensory" on the human body is the key to VR [20].

Application of eye techniques in combination with exposure techniques produces reliable and unobtrusive tools for use as assessment and therapy for a person's phobia and fears [21]. Automated VR interventions have the potential to close a considerable treatment gap for certain phobias through dissemination as a user app, self-help in a clinic, or as a mixed treatment [22].

Exposure therapy requires involvement with the dreaded stimulus, which is usually avoided by patients [21]. The focus of exposure therapy is useful in helping individuals engage with dreaded stimuli to test fear predictions, as opposed to building insight into symptoms [4–6]. The experiment confirmed that the technology effectively reduces anxiety even with the technicians as the device is available for users of low cost and limited therapeutic support [23]. Therapists also see potential in VR technology and state various advantages, such as increased accessibility and control over frightening triggers [24,25].

At present, smartphones have become a huge part of people's lives, which is undeniable. Automated VR interventions have the potential to close a considerable treatment gap for certain phobias through dissemination as a user app, self-help in a clinic, or as a mixed treatment [20]. Exposure therapy focuses on helping individuals involved with a feared stimulus to test the predictions of fear. Compared to building knowledge about the symptoms, allergy therapeutics described previously may be unique in exposure compared with other cognitive treatments [4–6].

The knowledge of immersion and presence often becomes an attachment in creating VR, and some terms have been created with subtle differences in interpreting those terms, for example, immersion, presence, engagement, emotional response, or interest rates. Immersion or presence provides a more technical benefit to image interpretation, such as efficient display of 3D data or spatial objects, ease of spatial cognition [26], nearly infinite space, or dislocation collaboration [27]. Immersive from VR environment simulation allows medical practitioners to practice in their work environment in a hospital or clinic, as well as practice without distraction [28]. Stereoscopic content also allows the therapist to help users practice with a deeper sense of visualization and avoid the possibility of injury being more dangerous than when performing a real situation.

3. The AIVE Concept

3.1. Acrophobia Immersive Virtual Environment (AIVE)

AIVE is a simulation situation concept in therapy with the assistance of VR. It focuses on integrating visual techniques in VR (VR visualization) and exposure therapy (ET) in a deep environment using mobile phones, especially 3D visualization techniques that can test or train someone who has a fear of height. In this context, this therapeutic application interprets the virtual environmental vision. Designing the system contains the basic architecture, modules, implemented implementation, and combining reviewed with controlled by software quality. The supporting system design aspects are:

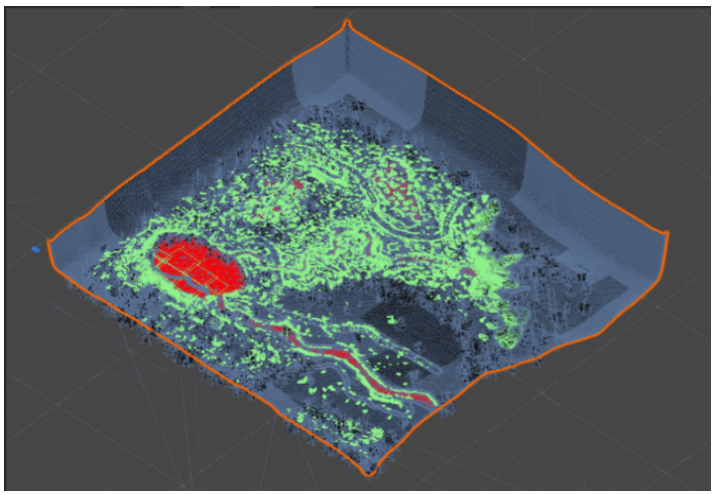
1. Compatibility with standard format;
2. Reliability, cross reference, and the need to design features;
3. Loose modules are combined (where similar routines, modules, functions, and components are only implemented as needed and are not executed during launch and are being used on software applications);
4. The module works cohesively [29].

Nature asset (Figure 1) has been used as a basic model for AIVE. This asset offers conditions for the image of the circumstance in a situation.

Nature asset-based material rendering validator, using the albedo validate method is an image mode in a scene view, this allows ensuring the material uses values that fall within the proposed reference values for materially based shaders. If the pixel values in a particular material fall outside the reference range, the material validator highlights the pixels in different colors to indicate differences. The red color on the material validator has a minimum luminance value, meaning that this scene is performed with a deeper environment than the other areas. The brightness of the albedo value has a remarkable

impact on the amount of diffuse reflected light that is produced, so it is essential to model techniques of direct and indirect lighting to offer realistic lighting results and ensure that various material types used are in the correct in lighting range, in amount to each other.

(**a**)



(**b**)

Figure 1. Nature Manufacture asset. (**a**). Original environment of Nature manufacture asset. (**b**). Nature Manufacture asset base on an albedo validate renderer.

3.2. Design

To create an immersive virtual environment in this research, several assets that are in the data store on Unity are used, i.e.,:

- Nature Manufacture asset;
- Google VR;
- Digger;
- Toby Fredson.

With the support of these assets, the development of the virtual environment has created an immersive effect. A smoother, neater, and more careful look at the environment. These assets also assist the programmer in creating 3D models (tree trunks, rocks, leaves, water, etc.), as well as light effects (Figure 2). There is also the use of post-processing as a filter and full-screen effect on the camera. At this stage, starting with activating the post-processing package in the menu manager, this package at the beginning of the built research should be installed. This stage can drastically improve the visual display of the

application with little set-up time. The usage of post-processing can simulate physical cameras by using effects. Sound effects are also added to this application to make the user feel the actual condition or situation.

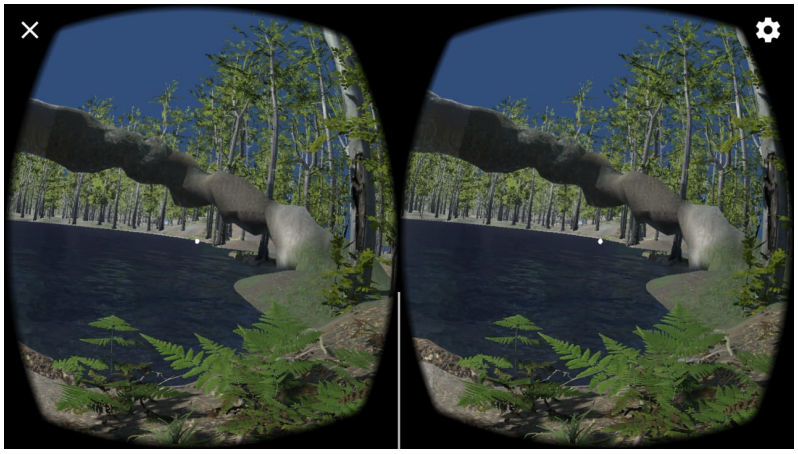


Figure 2. Visualization environment of AIVE.

3.3. Participants

A total of 20 participants participated in providing feedback on the AIVE virtual reality application, which previously had participants running the application that has been developed for this research. Of the total 20 participants, 9 (45%) were male, while 11 (55%) were female. The participants in this research in the age range of 25 to 30 years old were as many as 4 people (20%), in the age range of 19 to 24 years were 3 people (15%), and there were 9 people (45%) aged 31–35 years and participants with age 36 and above were 4 people (20%). Application testing was done by filling out a questionnaire by the participants. The procedure for performing the test on the user was as follows:

1. Firstly, the researcher gave instructions on the safety and health of the prospective participants before using the VR device. The instructions given were, users should be in good health and appropriate physical fitness to avoid unwanted side effects (headaches, dizziness, nausea, etc.);
2. Users tested the application using a mobile device that had been placed in cardboard;
3. While using it, the respondent should have read the instructions in the virtual environment created and executed the instructions comfortably and thoroughly;
4. After using it, participants were asked to answer the questionnaire.

Participants were selected focusing on age limits (15–45), and the current assessment has several limitations. Criteria for participants here who have a productive age, namely 19 years and over. Acrophobia sufferers who are stated through a doctor's diagnosis according to DSM V or the public who subjectively feel that they are acrophobic for at least 6 months and have felt disturbed by these symptoms and acrophobia sufferers who have been willing to be a sample of this research. They also had or had not received previous therapy, with a degree of severity ranging from mild to moderate, for its prevention. The sample size was small because there are groups of people who do not dare to admit that they have a specific phobia, and some patients does not want others to know their identity. They prefer to hide their condition and allow their feelings of anxiety to get worse and, in turn, affect their lives. Further studies are suggested to expand and refine the testing activities used in AIVE.

3.4. Instrument

The visualized VR environment is configured using a combination of Google Cardboard and smartphone devices with octa-core processor specifications, 4 GB ROM 128 GB RAM, and Android version 5.1. The screen resolution is 1080 × 1920 for each eye, with

a field of view of 30°. This method of handling controls the movement of the virtual world (pointer driving), equipped with a headset to simulate the sound of the state that is visualized to the user.

4. Method

This assessment was carried out with randomly selected participants asked to perform ET, which was designed in the form of VR with control via head gestures. Therapy was carried out for one session, for 20 to 35 min (depending on one's intelligence in understanding the VE task and appearance). The VR visualized ET therapy in this research is called acrophobia immersive virtual exposure (AIVE) and varies from manually generated terrain displays and VE combined with existing Unity assets. There was a lagging control in the first application, causing dizziness and sometimes nausea felt by the participants. In contrast to the assessment carried out on the second application, the application still has a little lagging while in process, but with the use of post-processing, Unity's assets can have different visual results from the AIVE-beta application. An evaluation of the effect of using mobile devices on the AIVE application using cardboard media has been carried out to see the effects of users on simulated portable VR devices. In questions R2 and R3 there are 70% of the participants stated that this simulation application could help to feel calmer when at altitude situations and more effective than conventional methods in treatment. Around 65% of the participants considered that this application could help therapy on phobias. Amount 13 stands for participant who agreed that this app could assist the phobia treatment, and 7 is the frequency for participant who disagreed with this app for assist phobia treatment (Table 1) as well as better changes to the visual factors in the virtual environment that are produced than before (Figure 3). In Q2, which states that the virtual environment that has been awakened is more effective in feeling the feeling of browsing in this virtual world better than before. Users also stated that this VR media could help in the field of psychological therapy. This is in question Q4. It produces a much smoother process, making the participants feel more relaxed and happier in a challenge on the application.

The pre-test was carried out at the beginning of the experiment. Participants are presented with an application model that visually has a more lagging impression when interacting in it or delays for a while when a movement occurs. Graphically it is also not smoother, and the virtual environment is less palatable to the participants.

The post-test is done on all participants who have undergone the pre-test. Where visually the application model for the post-test differs in terms of:

- Natural conditions around which has been in the fox with the use of the Unity Asset;
- Color, blur level, level of the graphic which is very different from the pre-test application.

Table 1. Effects of AIVE device-based treatment.

Questions	Respond	Frequency	Percentage
R1. Can this application assist your phobia treatment?	Agree	13	65
	Disagree	7	35
R2. Can this application motivate you to relax while in high condition?	Agree	14	70
	Disagree	6	30
R3. Is this application more effective for treatment than by conventional method?	Agree	14	70
	Disagree	6	30
R4. Is the application helpful for you?	Agree	16	80
	Disagree	4	20
R5. I prefer treatment with the Acrophobia Immersive Virtual Exposure (AIVE) application compared to medicine?	Agree	12	60
	Disagree	8	40

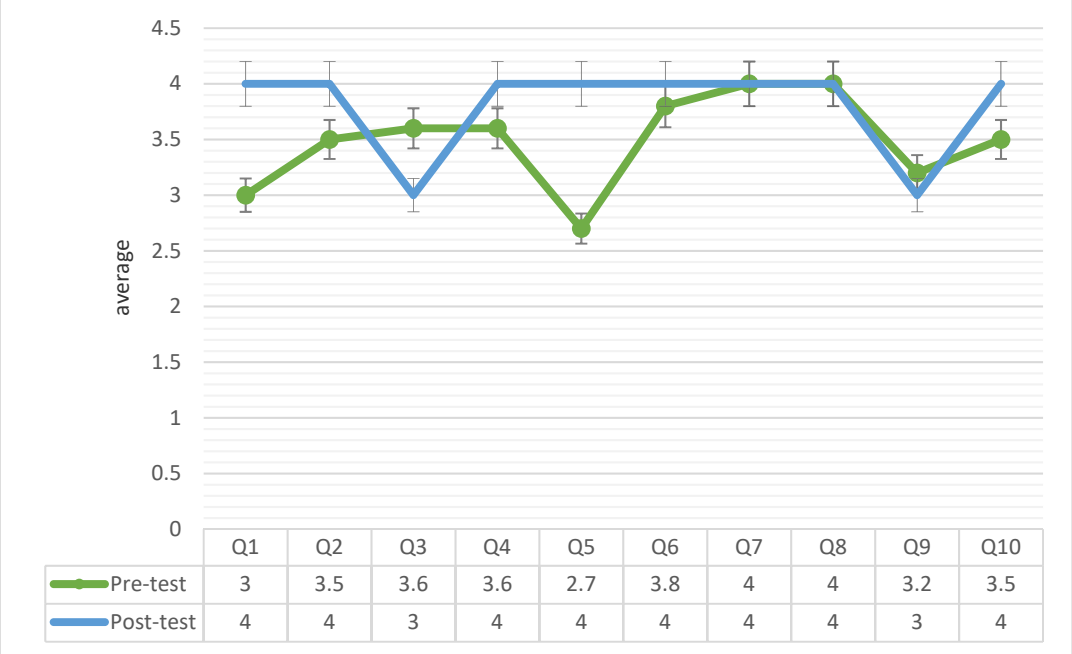


Figure 3. Mean value of the effectiveness test at the pre-test and post-test.

This makes several points to be able to create immersion in this exposure therapy. In the Appendix A of this paper, the AIVE questionnaire was reported (Table A1).

The use of visual interactions was done with Google VR SDK GvrControllerPointer, via the point pointer generated by the SDK. The pointer in this research is used as a virtual control on the path of player interaction in a virtual environment. The pointer had a working principle where at a 30-degree viewing angle, it would run automatically, and if at $\geq$ a 30-degree viewing angle, it would stop walking (Figure 4). The use of frame rates on the camera was <130 fps to produce a comfortable visual appearance when used. The frames per second (fps) is the rate of recurrence at which successive illustrations termed frames appear on the screen. This term has something to do with film and video cameras, computer graphics, and motion capture systems. The fps setting in this simple VR simulation using smartphones and Google Cardboard allows the handphone to become a screen display and graphic rendering device tasked with creating an immersive virtual environment. Additionally, as boosting factor of sophistication and comfort while providing a more robust virtual environment.

Figure 4. Visual control on AIVE application. A display notice to guide the participant.

During developing this visual interaction procedure, a minimum of 3 sensors are required on a smartphone to be able to function as a head controller, namely:

1. The magnetometer works to find out the direction of the user's gaze;
2. The accelerometer is used to determine the direction of the force of gravity;
3. The gyroscope is used as a detector of the acceleration of the rotation of the user's head angle.

Immersive virtual environments are derived from the formation of the unity created in the game engine. Where the generator contains visual data in the form of audio, text, 3D models, SDK, etc. All of these are designed, built, and packaged to produce a virtual environment that can be used as a therapeutic medium (Figure 5).

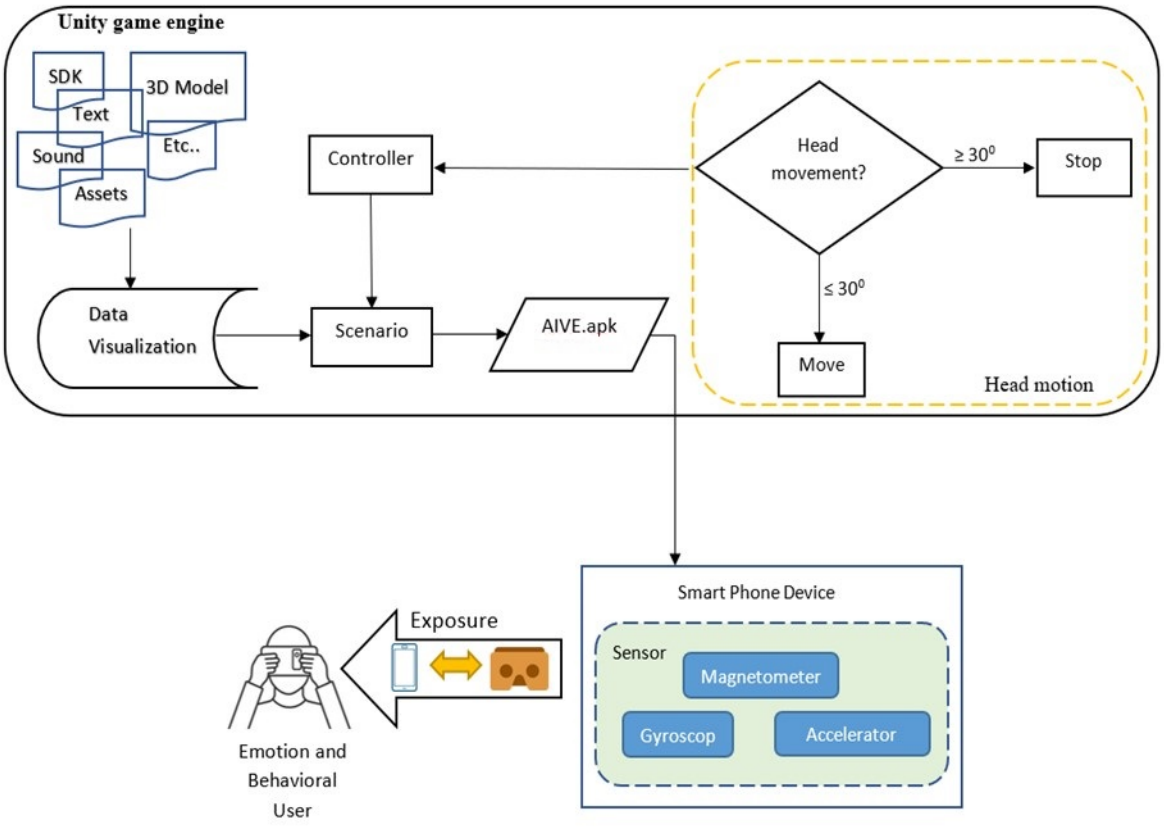


Figure 5. AIVE experimental framework.

This AIVE application is made by configuring the platform used in this project using the Android platform as a media project. The player menu in project settings is enabled with VR supported in XR Settings. The Lightmap encoding menu is in the configuration with a high-quality option, this functions as the activation of HDR lightmap support. For the android project target, can override the default texture compression format from Build Settings to one of the following formats: DXT1, PVRTC, ETC2, ASTC. The default format is ETC for RGB textures and ETC2 for RGBA textures. However, we chose to configure the default for this project. The next step is to create a terrain that is useful as a place or environment in the application. Assistance from the Unity game engine assets is very useful in creating and modifying an environment or state that you want to design and develop. The use of post-process is also chosen and is used as a filter and full-screen image of the camera, post-processing package with version 2.1.7 contained in the Unity engine which functions as a post-processing effect to simulate the physical camera and improve the visuals. The position of the camera is useful as the placement of the user's vision on the virtual environment and for adapting the exposure to the virtual environment that has

been developed as a space of interaction between the user and other objects. The next stage of building a virtual player is called Rigidbody. Rigidbody is a component that allows game objects to react to real-time physics. These include responses to forces and gravity, mass, drag, and momentum in the built environment.

5. Discussion

VR visualization is presented as an intervention in a suitable therapeutic method to be applied in assisting therapists. The research used a sample in a specific community, who tried to use VR as a creative intervention in therapies. Patients find the headset easy to use during treatments. The intervention was unobtrusive and cost-effective. The assumption in this research was that smartphone and Google Cardboard could be used as therapeutic media. The development of this research system has several things that make it the focus of creative applications: Low-cost consumption, Usage of mobile devices, and has an immersive visual appearance. Consuming the cost of having a Google Cardboard is very affordable, ranging from around USD$9–$17.50. It can even be cheaper if you can make it by yourself and make a creative intervention in the media treatment with this equipment. Wearing a smartphone and Google Cardboard mounted on the head has the effect of saving time, as well as helping to validate one's ability to interact in the virtual world. The assessment of the intervention showed that the head-mounted device was easy to use and that more than 82% of patients were able to navigate the environment more effectively. Subjective data and patient evaluations of VR experiences support the hypothesis that creative interventions make therapeutic treatments more acceptable. Thus, it can help users concentrate more on pleasurable scenarios and assist in the use of therapy time. It is a more realistic option for a vulnerable group receiving treatment for height fear therapy and creating creative interference with the usual smartphone device, which can visualize a comfortable VE when used.

Our data analysis validates the significant use of modified Unity assets from the visual effects of Nature Manufacture assets. Individuals who used VR during the second AIVE trial had a much better level of comfort compared to the visual state during the first AIVE-beta test. This research shows that using surgical interventions assisted by assets in Unity is more effective during the second application testing, namely in the first trial, the users felt anxious, annoyed when controlling movements in cyberspace, and were less likely to develop skills in coping with situations that were causing the stress by AIVE-beta visualization. Future research needs to explore the level of memory and graphics chipsets in hardware. The resulting AIVE related to a creative intervention is the usage of hardware that has limited specifications, is able to display a simulation that is felt by the user with a more "real" feeling when using it. Useful as a cognitive-behavioral intervention to increase the user's self-efficacy in visualizing a situation. The inventions also identify a sense between higher levels of presence in the virtual environment and lower levels of fatigue and anxiety. In addition, the therapists can also be assisted in simulating a situation by using only a makeshift device to their patients without endangering the situation of the patient or the therapist himself. The negative correlation suggests that more involvement with the disorder intervention is associated with lower rates of symptom disorder.

Immersion in a virtual environment is then achieved by rendering the created state on a computer device which then takes the perspective of the process by the API, graphics card, processor, and internal sensors on the mobile device. These outcomes support the assumption that the immersive and interactive quality of VR makes it an effective intervention for the management of acrophobia-related symptomatic disorders. Limitations of the research include the hardware as media therapy is available during the research and the lack of standard measures to capture satisfaction with VR usage during this experiment. The intervention used only two encounters per user and determined whether the user had sufficient descriptions to produce an effect on unlikely symptoms. Such as an impression when some users are not aware that they have a phobia of heights, or some of them do not realize they have astigmatism while using a VR cardboard. Immersive visualization

can consider the visual stimuli by providing a concatenation with various and unique environments. Therefore, the outcome of this research can be used as a simulation medium to test whether someone has a phobia or not and confirmations the capabilities of the mid-range smartphone are able to visualize a VE that is comfortable for participants to use.

6. Conclusions

Creative interventions by creating an environment based on reality, interaction, as well as emotional elements from relationships with participants in a virtual environment are clearly imaginary. The illusion of this perception invites the participants to enter the mindset mentioned in the psychological literature as a therapy. This technique was developed by leveraging Unity assets, cardboard devices, and Unity3D software. This technique was developed by tracking the movement of the head and visualizing the patient's sense of sight and programming the interaction between the virtual controller by following the patient's head movement to the virtual environment.

Immersive VR technology works when capable of sensory estrangement with the user from the physical world and replacing the sensory flow with simulation circumstances generated by the computer [30]. Immersive content in the form of graphics, voice, scenarios, emotional involvement, and visual depth have created a second objective in producing immersive feelings, as well as control with visual techniques for acrophobia therapy. Immersive or, in other words, immersion is a word commonly used in the field of virtual environments. This term comes from the moving area in the picture or movie. The word "soak" is used to refer to the act of self-absorption or to dive into another (virtual) world. The definition of immersive in VR AIVE exposure therapy system is: "Immersive is part of effective VR technology to a sense of presence in holonogic cognitive (various tastes of sensations/feelings) VR."

The outcome showed that VR guided by the symptoms of acrophobia is feasible, effective, and it follows the same general pattern in terms of reducing the reported fears of users or participants, as expected. It shows that participants involved in the VR exposure assessments can be seen by the majority of them through all stages at the time of VR exposure. Overall, the visual and immersive levels produced have progressed through stages. Finally, the importance of an immersive feeling ("present in the environment") through VR is emphasized because the reported "presence" is higher associated with better visual outcomes and effects. Further research is needed to see if the benefits of VR exposure can be a long-term outcome, both in virtual reality and in real life.

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Ethical Approval: All objectives of the experiment were achieved with low ethics level, according to the Universiti Kebangsaan Malaysia Code of Ethics. Participants were informed (1) about the purpose of the study, (2) that they had the right to stop the experiment at any time without providing any reason and (3) that they can stop the experiment if they felt sick or any discomfort. All the training sessions were performed under the supervision of a researcher in case there was any emergency.

Informed Consent Statement: An information sheet and consent has been approved by all participants before undertaking the VR or simulation.

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Conflicts of Interest: The authors publish that this research was conducted in the absence of commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A

Table A1. The AIVE effectiveness questionnaire.

Questions	Extremely Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Extremely Agree (5)
I can navigate the application easily					
I can explore the environment more effectively.					
I feel comfortable while using the application.					
The use of virtual reality media is beneficial in therapy					
I am quite satisfied with the speed of the application displays while processing.					
The environment and objects are consistent.					
I am satisfied because the application can be used offline mode.					
Presenting material in the application does not make me confused.					
I will always use this application.					
The visualization result is comfortable.					

References

1. Mahalil, I.; Rusli, M.E.; Yusof, A.M.; Yusof, M.Z.M.; Zainudin, A.R.R. Virtual reality-based technique for stress therapy. In Proceedings of the Engineering Technology and Technopreneuship (ICE2T), 2014 4th International Conference, Kuala Lumpur, Malaysia, 27–29 August 2014; pp. 295–300.
2. Aboalsamh, H.; Hashim, H.A.; Alrashed, F.; Alkhamis, N. Virtual Reality System Specifications for Pain Management Therapy. In Proceedings of the Bioinformatics and Bioengineering (BIBE), 2011 IEEE 11th International Conference, Los Alamitos, CA, USA, 24–26 October 2011; pp. 143–147.
3. Riva, G.; Baños, R.M.; Botella, C.; Mantovani, F.; Gaggioli, A. Transforming Experience: The Potential of Augmented Reality and Virtual Reality for Enhancing Personal and Clinical Change. *Front. Psychiatry* **2016**, *7*, 164. [CrossRef]
4. Hagen, K.; Solem, S.; Opstad, H.B.; Vogel, P.A.; Kennair, L.E.O.; Kvale, G.; Hansen, B. Therapist variability in the task/goal dimension of the early working alliance predicts outcome in exposure and response prevention treatment for obsessive-compulsive disorder. *Clin. Neuropsychiatry J. Treat. Eval.* **2016**, *13*, 94–99.
5. Hoffart, A.; Øktedalen, T.; Langkaas, T.F.; Wampold, B.E. Alliance and outcome in varying imagery procedures for PTSD: A study of within-person processes. *J. Couns. Psychol.* **2013**, *60*, 471–482. [CrossRef] [PubMed]
6. Wheaton, M.G.; Huppert, J.D.; Foa, E.B.; Simpson, H.B. how important is the therapeutic alliance in treating obsessive-compulsive disorder with exposure and response prevention? An empirical report. *Clin. Neuropsychiatry J. Treat. Eval.* **2016**, *13*, 88–93.
7. Gaggioli, A.; Ferscha, A.; Riva, G.; Dunne, S.; Viaud-Delmon, I. *Human Computer Confluence: Transforming Human Experience Through Symbiotic Technologies*; De Gruyter: Berlin, Germany, 2016.
8. Müller, H.J.; Krummenacher, J. Visual search and selective attention. *Vis. Cogn.* **2006**, *14*, 389–410. [CrossRef]
9. Sanchez-Vives, M.; Slater, M. From presence to consciousness through virtual reality. *Nat. Rev. Neurosci.* **2005**, *6*, 332–339. [CrossRef]
10. Slater, M. Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philos. Trans. R. Soc. B Biol. Sci.* **2009**, *364*, 3549–3557. [CrossRef]
11. Depla, M.F.I.A.; Have, M.L.T.; Van Balkom, A.J.L.M.; De Graaf, R. Specific fears and phobias in the general population: Results from the Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Soc. Psychiatry Psychiatr. Epidemiol.* **2008**, *43*, 200–208. [CrossRef] [PubMed]
12. Milosevic., I.; McCabe., R.E. *Phobias: The Psychology of Irrational Fear: The Psychology of Irrational Fear*; ABC-CLIO: Santa Barbara, CA, USA, 2015; p. 444.
13. Park, S.-C.; Kim, Y.-K. Anxiety Disorders in the DSM-5: Changes, Controversies, and Future Directions. In *Anxiety Disorders: Rethinking and Understanding Recent Discoveries*; Kim, Y.-K., Ed.; Springer: Singapore, 2020; pp. 187–196.
14. Choy, Y.; Fyer, A.J.; Lipsitz, J.D. Treatment of specific phobia in adults. *Clin. Psychol. Rev.* **2007**, *27*, 266–286. [CrossRef] [PubMed]
15. Teo, A.R. Phobias. In *Encyclopedia of the Neurological Sciences*, 2nd ed.; Aminoff, M.J., Daroff, R.B., Eds.; Academic Press: Cambridge, MA, USA, 2014; pp. 890–891.

16. Riddle-Walker, L.; Veale, D.; Chapman, C.; Ogle, F.; Rosko, D.; Najmi, S.; Walker, L.M.; MacEachern, P.; Hicks, T. Cognitive behaviour therapy for specific phobia of vomiting (Emetophobia): A pilot randomized controlled trial. *J. Anxiety Disord.* **2016**, *43*, 14–22. [CrossRef] [PubMed]
17. Joseph, A.; Chapman, M. *Visual CBT: Using Pictures to Help You Apply Cognitive Behaviour Therapy to Change Your Life*; Capstone: Mankato, MN, USA, 2013.
18. Londero, A.; Viaud-Delmon, I.; Baskind, A.; Delerue, O.; Bertet, S.; Bonfils, P.; Warusfel, O. Auditory and visual 3D virtual reality therapy for chronic subjective tinnitus: Theoretical framework. *Virtual Real.* **2010**, *14*, 143–151. [CrossRef]
19. Rosa, P.J.; Esteves, F.; Arriaga, P. Beyond Traditional Clinical Measurements for Screening Fears and Phobias. *IEEE Trans. Instrum. Meas.* **2015**, *64*, 3396–3404. [CrossRef]
20. Lindner, P.; Miloff, A.; Bergman, C.; Andersson, G.; Hamilton, W.; Carlbring, P. Gamified, Automated Virtual Reality Exposure Therapy for Fear of Spiders: A Single-Subject Trial Under Simulated Real-World Conditions. *Front. Psychiatry* **2020**, *11*, 116. [CrossRef] [PubMed]
21. Langhoff, C.; Baer, T.; Zubraegel, D.; Linden, M. Therapist–Patient Alliance, Patient–Therapist Alliance, Mutual Therapeutic Alliance, Therapist–Patient Concordance, and Outcome of CBT in GAD. *J. Cogn. Psychother.* **2008**, *22*, 68–79. [CrossRef]
22. Miloff, A.; Lindner, P.; Dafgård, P.; Deak, S.; Garke, M.; Hamilton, W.; Heinsoo, J.; Kristoffersson, G.; Rafi, J.; Sindemark, K.; et al. Automated virtual reality exposure therapy for spider phobia vs. in-vivo one-session treatment: A randomized non-inferiority trial. *Behav. Res. Ther.* **2019**, *118*, 130–140. [CrossRef] [PubMed]
23. Botella, C.; Pérez-Ara, M.Á.; Bretón-López, J.; Quero, S.; García-Palacios, A.; Baños, R.M. In Vivo versus Augmented Reality Exposure in the Treatment of Small Animal Phobia: A Randomized Controlled Trial. *PLoS ONE* **2016**, *11*, e0148237. [CrossRef]
24. Bentz, D.; Wang, N.; Ibach, M.K.; Schicktanz, N.S.; Zimmer, A.; Papassotiropoulos, A.; de Quervain, D.J.F. Effectiveness of a stand-alone, smartphone-based virtual reality exposure app to reduce fear of heights in real-life: A randomized trial. *Npj Digit. Med.* **2021**, *4*, 1–9. [CrossRef] [PubMed]
25. Boeldt, D.; McMahon, E.; Mcfaul, M.; Greenleaf, W. Using Virtual Reality Exposure Therapy to Enhance Treatment of Anxiety Disorders: Identifying Areas of Clinical Adoption and Potential Obstacles. *Front. Psychiatry* **2019**, *10*, 773. [CrossRef]
26. Hubona, G.S.; Shirah, G.W. Spatial Cues in 3D Visualization. In *Ambient Intelligence for Scientific Discovery: Foundations, Theories, and Systems*; Cai, Y., Ed.; Springer Berlin Heidelberg: Berlin, Heidelberg, 2005; pp. 104–128.
27. Streicher, A.; Hoffmann, J.; Roller, W. VIEW: A Concept for an Immersive Virtual Reality Image Interpretation Workbench. In Proceedings of the International Conference on Theory and Practice in Modern Computing, MCCSIS 2019, Porto, Portugal, 16–18 July 2019.
28. Tang, Y.M.; Ng, G.W.Y.; Chia, N.H.; So, E.H.K.; Wu, C.H.; Ip, W.H. Application of virtual reality (VR) technology for medical practitioners in type and screen (T&S) training. *J. Comput. Assist. Learn.* **2021**, *37*, 359–369. [CrossRef]
29. Fleming, I. Chapter 3—Defining software quality characteristics to facilitate software quality control and software process improvement. In *Software Quality Assurance*; Mistrik, I., Soley, R., Ali, N., Grundy, J., Tekinerdogan, B., Eds.; Morgan Kaufmann: Boston, MA, USA, 2016; pp. 47–61.
30. Riva, G. Virtual Reality in Clinical Psychology. *Ref. Modul. Neurosci. Biobehav. Psychol.* **2020**, 978. [CrossRef]