Utilizing VR Technology to Supplement Traditional Phobia Treatment

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***Abstract*—Exposure therapy (ET) has, for a long time, been a solution to help cure patients of phobias. Virtual reality (VR) as a medium opened up many new possibilities, including an alternative to in vivo exposure therapy. The term "in vivo" is Latin for "within the living" and with this treatment the patients are exposed to their fears in real world situations. VR is a technology that uses screens to replicate a simulated world.**

The research is a survey based on qualitative data generated from a literature review, along with an interview from a psychologist to substantiate and give a different perspective to our research. This review will give an overview of the current situation of exposure therapy for phobias, and how to improve its current state. We conclude that a lot of research has been done on the effectiveness of VR treatments, but little is done on how to improve it. Realism and presence is important to the effectiveness of the VR treatments. This research explores the state of VR treatment and ways to improve VRET (Virtual reality exposure therapy).

***Index Terms*—virtual reality, VR, exposure therapy, VRET, phobia**

I. Introduction

A phobia is an irrational or extreme fear of an object or situation. In many cases, this fear can be a considerable hindrance to the daily life of those affected. Different phobias and disorders impact the daily life more than others [1] [2]. The standard treatment method for phobias, and many other anxiety disorders, is called exposure therapy (ET). ET is based on gradually exposing the patient to the feared object or situation to help the patient overcome their fears [3]. ET is viewed as the gold standard in most psychology paradigms [4]. ET is highly effective [5], but only the most severe cases of phobias are eligible for treatment via psychologists. Virtual reality (VR) is a technology that allows for the creation of a digital world or reality. Virtual reality exposure therapy (VRET) is a method that combines VR and ET. VRET treatments have been found to have equal effects and results to traditional, in real situation (in vivo) treatment [6], and is therefore a successful way of doing ET.

The following research questions have been posed:

- **RQ1**: Explore the current state of virtual reality exposure therapy
- **RQ2**: Find suggestions that may improve current virtual reality exposure therapy

Answering these questions will help practitioners, patients, and developers get an overview of the current state of VRET. It will also find areas where VRET can improve, which is the paper's main contribution.

The team will look into the current state of VRET treatments, how VR can be used in different ways to supplement standard treatment, as well as how current VRET treatments may be improved or supplemented.

II. Background

Maples-Keller et al. [7] performed a review on the process and efficiency of extinction training with VR for specific disorders. They found that patients were more immersed when given multiple sensory inputs besides only a VR headset and that VR software allows for a higher level of control compared to in vivo methods. Immersion can be implemented in many methods, the software can simulate realistic situations and environments, or the users can have more ways to interact with the world.

Botella et al.[6] performed a systematic review of the evidence that exists for VRET. Some of their findings include that VRET, compared to traditional ET, shows that there are no significant differences between the two, with only a few exceptions - where VRET scored higher than in vivo. Other findings include how some factors that relate to fear scores. Factors that had a high effect on

the VRET treatment were: global presence, realness, involvement, and fear. There are many possibilities on how VRET can still improve, either by having better software, better VR technologies, or use more accessories.

Most studies done by implementing the use of VR in ET focus on the effectiveness of VRET. Few studies report on how VR was used, and none discuss how to improve VRET. This paper will try to shed light on problems with the current VRET treatments, and possibly how other implementations and use of VR technology may solve the problems.

III. Methods

A. Research strategy

The research strategy we chose was survey. According to Oates[8], sampling data from different sources we can generalize a larger population than the sample. This will provide valuable insight in VRET. A case study would allow us to better understand the use-case of the individual in VRET, but is not applicable to a large population which is necessary in order to answer the RQs. Survey is therefore the best strategy to answer the RQs given the scope and the data we have access to.

B. Data generation

Document collection was our primary data generation method. This method was selected because having unfettered access to patients and psychologists proved difficult in the scope of the research. We were not able to do observations, and the amount of interviews we were able to do was limited. This meant that the interview sample size would be too small to draw generalized conclusions and would therefore complement the document collection.

The document collection is mainly academic journals on the topics of ET, VR and VRET. For the searching phase of the document collection, the search engines pubMed [9] and research gate [10] were used. We also used the IEEE Xplore database.[11] At the inital literature review phase, searches were conducted with different combinations of keywords: vr, exposure, therapy, in, virtuo, vivo, phobia, virtual, reality and ET. This resulted in a substantial amount of documents. These documents gave us a better understanding of the ET process and we added the keyword VRET and primarily focused on documents with this keyword. To select relevant papers and sources, we used several criteria:

- Peer reviewed papers.
- High volume and version numbers, indicating the paper has been revised and updated.
- Written mainly for academic purposes.
- Published by a university
- Editorial board or authors with high standing in the relevant field.

The team decided to compliment the literature review with an interview of Stian Solem, a professor in psychology at NTNU. This was in order to get the perspective of a professional in the psychology field. This was considered more viable than questionnaires as we could get a dynamic approach to better understand the source material when access to large groups of patients and psychologists was unavailable. The interview was semi-structured and conducted face to face sitting in an angle allowing the interviewee to have eye contact with the researchers. This was done following the suggestions of [8].

C. Analysis

Document collection and literature review was an efficient method of establishing the effect of VR therapy, as we could use sources who had access to patients, psychologists and documented the effects of VRET. As VR technology is constantly developed, some papers are outdated and does not reflect the current state of VR technology. Overall it gave insight into how VR could be utilized in ET and its effectiveness, directly relating to RQ2 and some degree to RQ1. The interview was stored through field notes and recorded. Permission to use the interview was given orally and recorded. The recording of the interview was stored on a secured device, for later transcription. From the literature review and the interview, the data generated was qualitative. In the analysis of the textual data, different sections deemed relevant to our research questions was highlighted and reviewed by other team members in order to minimize the risk of misinterpreting.

IV. Findings

The findings in this paper are based on a literature review of 6 papers, 2 books, and an in-depth interview with professor Solem.

All of the papers in the literature review, which performs some kind of VRET, states that VRET has a positive effect on the subjects. The positive effects are reported through case studies and surveys [12] [13] [1] [2], reviews and meta-analysis [14] [6] [7] [4]. VRET always having a positive effect on the subject's fears means that it is better than not getting any form of therapy. In the more recent papers (2017) [6] [7], the positive effects have been reported as equal to traditional ET or better than traditional ET.

None of the papers reported the quality of the VRET software that was used. Major complaints from Solem was that he previously had experienced software that lacked realism. Garcia-Palacios et al. found that 90% of the subjects who opted for VRET, chose it due to the fear of real-life situations, while 57% of those who opted for in vivo said "It is necessary to confront real spiders to overcome the fear", and 23% said that VRET would not be real enough. Solem added to this by saying that in ET, it is enough to only instill fear. Maples-Keller et al. found that software that displayed hyper-realism was not necessary to make VRET sessions successful. The therapist's VRET interfacing software is something that the papers have not reported on. Solem mentioned that using the software and hardware has often been cumbersome, while adding that few therapists, in his experience, are comfortable with advanced technologies, and is therefore vexed with many VRET interfaces.

According to Solem, multiple subjects are sometimes included in the same session, "... it can have positive effects if you can control the situation". The positive effect Solem mentions, which is not achieved in normal, singular patient ET sessions, is the courage and compassion from seeing others struggle with the same fear, and overcoming it. No papers were found that used multiplayer VRET for phobias, except for social phobias.

Only a single paper reviewed used multiple sensory inputs [7]. Including the standard VR headset, they used simple audio inputs and occasionally a joystick or a controller. They saw that the other sensory inputs had positive effects on subjects. Solem says that a reason for many not using VRET in Norway, today, is that it has often been clunky. It needed a big desktop, a large room, and several wires.

V. Discussion

A. RQ1

Since VRET's inception, it has become an increasingly exceptional technology. This can be seen in the more recent papers and reviews. VRET has become more effective at helping subjects with phobias, and other mental issues. If used properly, it is equal to normal ET, and in some cases more effective. In Norway there are very few that use VRET, according to Solem. Solem believes more therapists will use VRET when it gets more accessible and uncomplicated to use.

B. RQ2

Realism and immersion is essential in VRET. As a pair, they are used to instill fear in a subject, but also to relieve subjects to doubts of VR. If given the chance to take VRET, several subjects disregard it, with the belief that there is a lack of realism. At the time of writing, there exist many types of sensory inputs and accessories that help interact with the world within VR. A few are: platforms to walk on [15] instead of having to push buttons, and vests or other straps for physical feedback [16]. Using such accessories for an increased sense of presence would be beneficial for immersion, although a negative effect might occur by making it more cumbersome and expensive.

As Solem stated, the systems being cumbersome makes both patients and therapists wary VRET. None of the papers mentioned these aspects, which shows that it has been disregarded. If VRET is to advance, these aspects of VRET needs to be improved. It is important to focus on the accessibility and ease of use for both patients and practitioners. Wireless headsets with simple interfaces, and start-time are necessary. Implementing this will lower the bar for practitioners to implement VR into their services, and lower the threshold for patients by continuing to exercise their phobias at home, post-ET sessions.

The findings from the interview provided novel insights towards the possibilities of using VRET in sessions with multiple subjects. This has not been used in VRET, except for social fear treatment. As Solem said, ET with several patients at once can have several benefits. Multiplayer is a new aspect of VRET that should be explored.

VI. Conclusion

We gained a lot of useful information from the interview with Solem, and want to thank him for sharing his knowledge with us.

A limitation on our main focus, RQ2, was the lack of in-depth interviews. When we interviewed Solem, we believed he had a lot of knowledge of VRET. He had some experience with VRET, but it only gave us a shallow insight into it. Therefore we should have performed several interviews to get a broader view from several therapists. Some interviews were canceled, but we could have put in more work to schedule these interviews.

This paper shines a light on several areas of VRET that are lacking, and some new features that should be explored more. An obvious shortcoming is the difficulty many face when trying to use VRET for the first time. There should be a higher focus on developing realistic VR scenarios, as realism is a big concern for the users.

There should also be a focus on developing or integrating existing accessories for VR, to increase immersion.

A new feature that should be researched more, is the aspect of multiplayer VRET. In multi-patient ET, Solem introduced benefits that do not exist in single-patient ET, that still has all the benefits of single-patient ET.

In conclusion, this paper discovers several areas where VRET can, and should improve, as well as a new aspect that has not been explored. VRET is not common in Norway, even though it is reported as very effective, and the improvements mentioned would help it become more widespread in Norway and other countries.

REFERENCES

[1] M. F. I. A. Depla, M. L. ten Have, A. J. L. M. van Balkom, and R. de Graaf, "Specific fears and phobias in the general population: Results from the netherlands mental health survey and incidence study (nemesis)," 2008.

[2] T. L. Barrera and P. J. Norton, "Quality of life impairment in generalized anxiety disorder, social phobia, and panic disorder," 2009.

[3] A. P. Association. (2020). What is exposure therapy? [Online]. Available: https://www.apa.org/ptsd-guideline/patients-and-families/exposure-therapy. (accessed: 16.03.2020.

[4] S. A. M. Rauch, A. Eftekhari, and J. I. Ruzek, "Review of exposure therapy: A gold standard for ptsd treatment.," 2012.

[5] K. B. Wolitzky-Taylor, J. D. Horowitz, M. B. Powers, and M. J. Telch, *Psychological approaches in the treatment of specific phobias: a meta-analysis*. Clin Psychol Revs, 2008, pp. 1021–1037.

[6] C. Botella, J. Fernández-Álvarez, V. Guillén, A. García-Palacios, and R. Baños, "Recent progress in virtual reality exposure therapy for phobias: A systematic review," 2017.

[7] J. L. Maples-Keller, C. Yasinski, N. Manjin, and B. O. Rothbaum, "Virtual reality-enhanced extinction of phobias and post-traumatic stress," 2017.

[8] B. J. Oates, *Researching Information Systems and Computing*. SAGE Publications, 2006.

[9] pubMed. (2020). Pubmed, [Online]. Available: https://www.ncbi.nlm.nih.gov/. (accessed: 26.03.2020).

[10] Research-gate. (2020). Research gate, [Online]. Available: https://www.researchgate.net. (accessed: 26.03.2020).

[11] IEEEXplore. (2020). Ieeexplore, [Online]. Available: https://ieeexplore.ieee.org/Xplore/home.jsp. (accessed: 25.03.2020).

[12] A. S.Carlin, H. G. Hoffman, and S. Weghorst, "Virtual reality and tactile augmentation in the treatment of spider phobia: A case report," (accessed: 21.04.2020).

[13] P. A. GARCIA-PALACIOS, P. C. BOTELLA, P. H. HOFFMAN, and B. S. FABREGAT, "Comparing acceptance and refusal rates of virtual reality exposure vs. in vivo exposure by patients with specific phobias," 2007.

[14] R. K. Chesham, J. M. Malouff, and N. S. Schutte, "Meta-analysis of the efficacy of virtual reality exposure therapy for social anxiety," (accessed: 21.04.2020).

[15] Virtuix. (2020). Virtuix, [Online]. Available: https://www.virtuix.com/. (accessed: 26.03.2020).

[16] HaptX. (2020). Haptx, [Online]. Available: https://haptx.com/. (accessed: 26.03.2020).