In virtuo exposure therapy for children diagnosed with social anxiety disorder

Andrei Bercea
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands
i.bercea@student.utwente.nl

ABSTRACT

Virtual reality is a leading edge technology that has been consistently used over the past few years in research studies concerning social interaction between humans. Its popularity has only been increasing in this domain ever since. Among these studies, there are those that target treating social anxiety disorder (SAD) with the help of virtual reality exposure therapy (VRET). However, these studies tend to focus on the adult population, whereas research on VRET treatment of children suffering from this exact same disease is still lacking. This paper aims to find out whether VRET is a plausible means of treating children with social phobia, knowing that this technology has been proven to work on the adult population. Results show that VRET is an effective treatment technique on children, however subject to the same technology-related downsides as in the case of an adult population. Added challenges in treating children with SAD with the help of VRET come largely from the ethical considerations, caused by the synergy between a new technology for which there is no legal ground and the highly regulated medical treatment administered on children. Research showing VRET is feasible on treating social anxiety in the young population will set the ground for further studies involving exposure therapy through VR in treating not only children with SAD, but also other conditions affecting social interaction.

Keywords

Virtual reality, social anxiety disorder, social phobia, traditional exposure, virtual reality exposure therapy, literature review

1. INTRODUCTION

Despite the fact that virtual reality, as a technology, has only become mainstream for just over a decade now, conceptually it has been identified with references, such as Baltrusaitis' [3] of "multiplying artificial worlds", some of them dating back to the 19^{th} century. Ever since, virtual reality, as an entity, was divided into several different fields of activity and with it so were its purposes. Nowadays, virtual reality is used in domains varying from gaming to medicine and even economics [15, 26]. Social sciences is one such field, where, among other uses of VR technology, researchers tried to identify novel ways of providing treatment to VR-preexisting conditions, such as SAD, a mental health disorder which places a person under an excessive amount of stress when confronted with social situations in their everyday life [29]. The technology that resulted from these studies is called Virtual Reality Exposure Therapy (VRET) and it is used in the treatment of several social phobias, social anxiety disorder (SAD) included. VRET was designed as an alternative treatment method to traditional exposure, with the added benefits of cost and time efficiency, but also therapists' control of the inflicted stimuli on their patients.

However, a standing issue is that studies involving VRET have been mainly conducted on the adult population and, while results showed that using exposure therapy in VR is a feasible alternative to traditional exposure [22], studies attesting that these results can be replicated on children have been lacking. This research will comprise a literature review into the core differences between the traditional exposure therapy and the newer VRET method, but also look into how the treatment process is handled when the patients are children, as opposed to adults, since there have been concerns regarding ethical considerations in the treatment of children in traditional environments. The discussion section provides an overview of the results, explains how part of the objects that make the research are a realization of others and takes a stance towards the current state of using VR in the treatment of social anxiety disorder, with a focus on the children population. In the end, limitations of both this paper and the existing scientific body of knowledge are presented and the conclusion argues for the importance of this research and its preemptive assumptions with regards to the impact it will have on future research on the topic.

In order to corroborate the findings of the literature, three members belonging the PHT and HMI departments at the University of Twente have been asked to participate in the research, by giving their expert opinion on: using VR technology in research studies, exposure therapy as a technique to treat patients with SAD, upsides and downsides of this new method. Lastly, the similarities between the two sources of information are assessed, but questions are also raised as for the potential reasons why differences of opinion might occur and how that holds value for the soundness and completeness of the paper.

2. BACKGROUND AND CONTEXT

Social anxiety disorder (SAD) is a mental health condition, defined generally as the fear of embarrassment in a social situation where the person suffering from social phobia is looked at or treated in a negative manner [16, 9]. SAD ranks in top 10 chronic diseases, with an estimated lifetime prevalence rate of 12% [21]. One of the most com-

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mon and researched treatment methods of social phobia is Cognitive Behavioral Therapy (CBT). By stimulating behavioral responses, exposure therapy is one of the most efficient methods of treating SAD [12]. Traditionally, there are two types of exposure therapy: in vivo and in vitro. In vivo exposure refers to the actual interaction of the patient with others, whereas in vitro exposure is the form of treatment through which the patient is put in the position of using their imagination to experience situations which induce the phobia and identify the triggers. Both exposure types have downsides: in vivo exposure is costly and time-consuming, while in vitro exposure only works on patients with rich imagination, able to picture social situations [12]. With the technological advancement and availability on a large scale, a new approach to exposure therapy has been identified: Virtual Reality Exposure Therapy (VRET) or, in short, in virtuo exposure [21].

VRET has already been consolidated as an efficient treatment option for social anxiety disorder on adults [8]. This research will be focusing on the younger population and aim to find out whether similar results can be achieved with children as well. It will potentially lead to more extensive research being done in this direction and also establish VRET as a widely accepted method of treatment. Deciding whether in virtuo exposure is feasible in treating SAD requires answers with regards to the efficiency of VRET compared to the traditional exposure therapy and differences in the treatment process between the young and mature populations.

While efficiency is based, first and foremost, on the treatment's effectiveness, several other factors can influence whether a treatment method is worth implementing. The relevant ones identified in the literature review are detailed under results, in section 6.1. It is important to take note that the identified factors, in this research, which impact the efficiency of VR are not imperative.

3. RESEARCH QUESTIONS

How does virtual reality exposure therapy compare to traditional exposure in terms of treatment efficiency for children suffering from social anxiety disorder?

Two sub-questions need to be answered:

1. How efficient is VRET in treating adults suffering from SAD, compared to traditional exposure therapy?
2. How does exposure therapy differ between the adult and children populations suffering from SAD?

4. RELATED WORK

SAD treatment using VRET has been experimented with over the past few years. Proof-of-concept studies have been conducted showing that VRET is successful in treating SAD. In Morina et al. [18], 43 psychology students, split in groups of low and high level of social anxiety, took part in a study where in virtuo exposure was used to treat SAD. Results have shown significant reduction in the levels of anxiety of the participants after the study and at the three-month post-assessment. To corroborate these results, Bouchard [6] presents another study conducted on a sample size of 59 adults. This study differs from that of Morina's [18], as it aims not only to prove the efficacy of VRET, but also compare VRET to traditional exposure and no exposure at all. The results show significant improvement for both treatments, traditional and in VRET, as opposed to no treatment at all. However, in virtuo exposure has been deemed by therapists to be exponentially more practical than traditional exposure, while also efficient and cost-effective.

Unfortunately, all of these studies are conducted on groups comprised of adults. Parrish [21] unveils a study conducted on a population of teenagers, aged between 13 and 18. The aim of the study was to show proof-of-concept, so standard measurements for SAD were chosen to portray the results. The study used two different types of environments in order to measure the variables: socially stressing and neutral. As expected, the results showed that participants felt considerably more anxious in a socially stressing environment than in a neutral one, which goes to prove that VRET is feasible for SAD treatment on children. Nonetheless, it is a pilot study and its findings need to be corroborate with theoretical background. In that regard, Gola [13] takes a different approach and focuses on the ethical aspects of exposure therapy in the case of children. The difference between children and adults where therapy is concerned is that adults have already been shaped, whereas children are more volatile and susceptible to being hurt easier than adults. Gola [13] talks about these issues and how, as a result, therapists tend to take children slower than adults through the therapy process, which can affect the treatment outcome.

5. METHODOLOGY AND APPROACH

In answering the research questions, the chosen methodology was literature review. The databases which were searched for eligible papers were: Google Scholar, Science Direct, PubMed and IEEXplore. Representative keyword for the topic were used, such as: virtual reality exposure, social anxiety disorder children, virtual reality anxiety treatment. Priority in the inclusion process had the papers based on clinical studies. As the research is scarce, papers with a focus on other social phobias aside from social anxiety disorder were referenced, excluding however the results on treatment efficacy. The same methodology was applied to both research questions. Based on the information discovered while reviewing the literature, the outcome has been divided into major sections, each presenting a key factor in the differences between either adults and children (in the exposure therapy process) and VRET and traditional exposure.

To corroborate the findings of the literature review, a series of semi-structured interviews were conducted with experts in the field of virtual reality and/or social sciences. These experts are researchers at the University of Twente, under the departments of PHT and HMI, with published papers closely related to the theme of the present research. Due to the current pandemic situation, the interviews were conducted online, on Microsoft Teams, and they were recorded. The interviewees have answered questions regarding the usage of VR as a medium for exposure treatment of social phobias, presented their own take on the considerations that go into subjecting children to VR-based treatment, as well as upsides and downsides of VR compared to traditional treatment, but also challenges faced when the patient population is comprised of children, as opposed to adults. Aside from the standard thematic of the present research, the interviewees expressed their opinions on points of interest to the topic and discoveries they made when conducting their own research. External organizations and professionals were contacted in order to get an opinion from outside the academia circle, but none returned a positive answer to taking part in the research.

6. VRET VS. TRADITIONAL EXPOSURE FOR ADULTS

Treatment outcome

First and foremost, the major factor in considering a new treatment method is deciding whether it is an efficient method which provides progress in tackling the symptoms of the disorder. This type of analysis is also the most researched among the factors which contribute to the approval of the method. For this reason, a number of meta-analyses have been conducted, using several different social contexts, which showed that VRET provides similar results to traditional exposure: Powers et al. [22], Robillard et al. [23], Anderson et al. [2], Kampmann et al. [16] and Bouchard et al. [6]. The metrics used to prove the outcome of these experiments will not be discussed, as the focus is not on the actual values, but on the conclusions to be drawn. The overall belief of the aforementioned authors is that VRET is a potent method of treatment, showing similar results compared to traditional exposure at both post-treatment and follow-up assessments. Wait-list participants showed either none or considerably less of signs improvement than participants who participated in traditional exposure or VRET groups. Results, thus, show (1) VRET and traditional exposure provide similar efficacy in treating social anxiety disorder when analyzed by standardized metrics, (2) Wait-list provides significantly worse outcome at post-treatment assessment, (3) VRET provides long-term efficacy in SAD treatment, as compared to result of traditional exposure at follow-up assessment (i.e. three, six or twelve months after the experiment ended).

Financial aspect and time management

Reaching a conclusion with regards to the monetary expenses involved when using VRET as a treatment method was daunting. While it was expected for the focus to be primarily on the patients' progress, the initial belief was that other factors involved in the exposure treatment would not be as underwhelmingly researched as the literature shows. Of all the studies analyzed concerning VRET as a treatment method of SAD (i.e. the meta-analyses from the previous section and the papers focusing on VRET as a standalone treatment method), only Bouchard et al. [6] touched on the financial aspect and other potential benefits of implementing VRET on a large scale. However, the financial aspect was assessed by corroborating findings which involve VR exposure in other contexts, as the therapeutic process is similar. Only Vincelli [28], Emmelkamp [10] and Bush [7] made a point for the cost-effectiveness of VR-based treatment aside from Bouchard [6]. There are, however, different layers to this particular factor, as other researchers find VR equipment costly and high maintenance [11, 25]. After careful consideration of the points of view and their argumentation, it stands that opinions on the financial aspect of using VR in exposure treatment are displayed in a paradoxical manner and contain bias. Nonetheless, all authors of the aforementioned papers agreed on the fact that (1) VR induces lower costs for the treatment sessions compared to in vivo exposure, due to the fact that these sessions can be held in the therapist's treatment room. This is directly linked to the efficiency of in virtuo exposure because, as Vincelli [28] states: "One of the fundamental parameters in assessing the effectiveness of therapies is the ratio existing between the cost of administration of the therapeutic procedure and the resulting benefits". This statement is corroborated by the evaluation performed by Emmelkamp et al. [10], which proved that the effectiveness of low-budget VRET is on par with the more costly traditional exposure.

On the other hand, while agreeing to the previous point, both Garrett [11] and Segal [25] make the point in their papers that (2) VR-based equipment is expensive to procure and maintain. In their study, Garrett et al. [11] interviewed 271 therapists regarding the benefits and downsides of using VR-based treatments. The results showed that the therapists considered the financial costs of VR are the highest barrier in implementing the technology for their purpose, while also agreeing to the fact that monetary expenses can be reduced, due to the necessary settings which can be reproduced in their clinics in order to provide treatment, hence the paradoxical view on the financial aspect previously mentioned. It is necessary to consider the bias in the results obtained, as therapists can be inclined to strive for treatment methods they are already familiar with and those that provide the highest level of comfort and/or reward.

The financial aspect is complementary to the time management factor. This observation has been made by all previously discussed meta-analyses on social anxiety disorder. Exposure therapy is a daunting process to undergo under the traditional premises of in exposure therapy. The therapist often is required to (3) organize group therapy with a large number of people, which is dependent on the demographics and the type of disease, making it a time-consuming task. The therapist is also in charge of (4) replicating social situations in order to perform treatment, which often cannot take place within the premises of their laboratory and may involve a considerable number of outsiders.

The time-effectiveness of VRET is corroborated, as general factor, in exposure treatment, by researchers in the field of social phobias, more so social anxiety. Krijn et al. [17] aimed to consolidate the position of VRET as a treatment method for phobias in general. In his research, he conducted experiments comparing traditional exposure to VRET for: claustrophobia, fear of driving, acrophobia, fear of flying, arachnophobia, fear of public speaking, panic disorder with agoraphobia, and post-traumatic stress disorder (PTSD). While they have not been conclusive for all of the above-mentioned phobias, the results showed that time was the main benefit of VRET over traditional exposure in the case of fear of flying, which leads to the natural conclusion that (5) the more complex the context to replicate, the higher the advantage of VRET over traditional exposure is, which, in the context of SAD, translates into social contexts involving a large number of people (e.g. giving a speech in an auditorium).

Environment-related variables

Segal et al. [25] identified, based on the collective opinion of 271 therapists, that the highest benefit of VR is the (1) exposure of clients to stimuli that would be hard to access in a traditional environment. As this is not a topic that is usually researched, there are only a few papers that corroborate this finding. The literature search resulted in two other papers that confirm the practicality of VR as a medium of exposure: Bouchard [6] and Bush [7].

The findings regarding the environmental benefits (i.e. the advantages a virtual environment has, compared to reality) that VR brings are consistent across the literature. The other major factors that both Segal [25] and Bush[7] identified are (2) the increased control over stimuli of both therapists and patients and (3) the reduced risk of embarrassment that patients face. While the first two benefits

complement each other and are required to co-exist, the risk of embarrassment is a double-edged sword and a side effect of the main drawback of VR-based technology in exposure treatment: (3) lack of presence.
The degree of presence is strictly connected to the degree of immersion [4]. Currently, immersive-VR devices come in the form of a head-mounted display (HMD) and the sense of presence within VR requires the patient to look past the technological presentation [7]. Bush concluded that failure to immerse into the virtual environment causes a decrease in the anxietal response which negatively affects the outcome of the treatment.
Unfortunately, the low sense of presence is not the only downside of HMDs. Another major concern of therapists is (4) motion sickness induced by VR devices, which is one of the most common side effects of VR usage [14, 19]. There are a number of reasons why visually induced motion sickness (VIMS) occurs, but the only one relevant to anxiety treatment is the length of the exposure. This goes to show that prolonged sessions of treatment are discouraged, as they pose a threat to the general well-being of the patient, which inadvertently has an impact on the style of treatment a therapist can opt for [7].

7. ADULTS VS. CHILDREN IN EXPOSURE THERAPY

Discrepancies in Virtual Reality

So far, the research consolidated VRET as an efficient method of treating phobias, with social anxiety as its cornerstone. The studies presented showed that VRET can be as much of an effective means of decreasing anxiety levels in adults as traditional exposure, together with side benefits, such as time, costs and even the environment itself acting as a catalyst in the favoring of VR over traditional exposure in the therapeutical process. However, the lack of experiments conducted on children leads to the omission of key factors which go into the treatment of anxiety and, generally, all social phobias.
A first challenge when it comes to the treatment of children in VR is related to health and safety. As shown by previous studies, adult participants exhibited neck pain, eye strain and motion sickness. However, all of these side effects of using VR equipment pose a bigger threat in the treatment of children, as their legal guardian/parent is required to provide consent on their behalf in order for them to take part in clinical trials, which is unlikely to happen when children can be exposed to harm. Not only that, HMD providers also advise the use of VR equipment to be restricted to children of age 13 or above [30]. While these issues occur in both populations, adults and children, parents tend to have the predisposition of keeping their children away from any source of harm, thus not allowing them to take part in clinical trials, leading to the lack of scientific knowledge that is being faced by the research community [5].
Nonetheless, these are side effects of VR usage that adults are also exposed to, which goes to show that parents tend to protect their children from negative experiences that they, as adults, may feel inclined to endure. The reasoning behind this may be that children are yet to fully develop and these side effects can prove to be more impactful on them than on the adult population. On a positive note, the lack of maturity provides children with a sense of engagement [30]. As the research is scarce, it is yet to be determined whether children's excitement in the face of adversity (i.e. technological advancement such as VR, in the current context) is a factor for an increased sense of presence, but it is not far-fetched to assume so, given that metrics are being developed in this regard, according to Bouchard [5].

Ethical considerations

Exposure therapy in and by itself raises ethical concerns due to the nature of the treatment, which is often hard to mediate by the therapist, even more so of an issue in the case of children, a vulnerable population to whom extra consideration needs to be granted, mainly because of two major reasons: not understanding the therapeutical process and self-reliance on others, most often family. Gola et al. [13] provides a thorough analysis of the challenges in exposure therapy with children based on the current ethical standards in place.
First and foremost, children may not understand what the treatment entails, the rationale behind it or why it is beneficial for them. Almost always it is the case that they do not seek treatment by themselves, but their parents are the ones to pursue it. As a result of not understanding the positive outcome that the process brings, children are often reluctant to engage in exposure therapy, since they do no wish to subject themselves to feared stimuli and feelings of embarrassment, self-consciousness, uncertainty, alienation, being misunderstood, or trapped, and others.
Beside consent, a second ethical standard that plays a major role in exposure therapy with children identified by Gola et al. [13] is competence. Generally, therapists fear causing more harm than good to their patients with exposure therapy [24], no matter whether the patient is a child or an adult, as their control over the stimuli in a social situation is limited. On top of that, another challenge is the capability of a therapist to emphatize with their patient, a challenge exponentially harder to overcome in an adult-child relation [13]. The therapist needs to be overly cautious of the level of exposure they subject their young patient to, which correlates with the level of understanding they have of the child. By not being able to show emotional tolerance, there is a high risk that the level of exposure conducted by the therapist will be intolerable for the child, triggering attrition in the treatment of social anxiety.
The next ethical standard discussed by Gola et al. [13] is beneficence. This standard holds the highest impact on the patient's treatment as it is the one deciding factor that has a tool on the performance of the patient and their overall progress in dealing with anxiety. Both parties, therapist and client, must work together in trying to identify exposures that are beneficial to the patient. This a trial and error method which has the purpose of assessing the specifics of the exposure tailored to the needs of the patient [20]. Often, exposure may not go as planned, which can be harmful to the patient. Extra care is required from the side of the therapist when the patients are children, in order to provide tolerant exposure and avoid risks. In administering treatment, the therapist must display both competence and beneficence for the patient to show a positive outcome as a result of exposure therapy.
Last but not least, Gola et al. [13] touches on confidentiality and boundaries. When working with children, it is often the case that lines are blurry. Once getting accustomed to their therapist, children feel the need to bridge the gap between themselves and the person they feel safe with (i.e. holding hands, hugging) [1], especially when they are subjected to exposure that causes them to feel anxiety. Thomas [27] discusses the need to differentiate boundary crossings between the two populations, as children behaving unlike adults is a natural response to coping

with the treatment process.
As exposure therapy takes place out-of-office on many occasions, confidentiality is a hard ethical standard to oblige, as the therapist is no longer the only person that the patients interact with, but everybody that they get into contact with. Out-of-office exposure comes with the risk of clients being identified as patients undergoing therapy without their explicit consent. Moreover, as the patients will most likely engage in interaction with other children, there is also the risk of being put in an uncomfortable position and pried on, as children may not feel the same restrain as adults in asking questions and making assumptions. To tackle this issue, Olatunji et al. [20] recommends that the therapists "deidentify" themselves, to increase the chances of maintaining confidentiality while out of office. This is a practice which can be implemented when treating both adults and children but is more so beneficial when conducting out-of-office exposure with children, due to the higher risks if breaching confidentiality with the younger population.
While there are still precautions that the therapists can take, most of the time, abiding by the ethical standards of confidentiality and boundaries is out of the therapist's control. For this matter, it is mandatory to: discuss these issues with both the young patient and the family, address them in the informed consent and obtain approval by the family to perform out-of-office exposure on the child [13].

8. SUMMARY OF INTERVIEWS

For the sake of anonymity, in this section, the interviewees will be refereed to as A, B and C. Given that the interviews have been conducted in a semi-structured manner, they will not be broken down based on specific questions, but rather a collective opinion will be presented depending on the appropriate topic, as well as the discrepancies between the interviewees' beliefs. The discussions have been conducted broadly, due to the differences between the current topic and the specific areas of expertise of the interviewees.

The initial matter that has been touched on was VR as a medium for exposure treatment. In this regard, all interviewees acknowledged VR as an exceptional "tool". As a psychologist, A embraces the idea of bringing the outside world within the treatment room. In comparison, she highlights the limitations of traditional treatment, which only provides her with the possibility of accessing the patients' experiences through their stories. This translates into the therapist not being able to analyze the patients in their day-to-day lives and how they interact, whereas, with VR, she can oversee a realistic experience which the patient cannot evade through a cognitive filter. Lastly, A considers that patients being in her proximity, when undergoing exposure, enables her to intervene in a given situation, as opposed to traditional treatment, where these patients would only have the opportunity to follow her advice in their own environments, without the therapist being present. Similar to A, B holds in high regard the option of controlling stimuli in VR, which is not available to therapists in a traditional environment (i.e. treatment room is inferred by traditional environment; out-of-office therapy is excluded). B also identified that VR tackles the issue of avoiding escapism: "*Patients usually tend to escape from situations that elicit anxiety*". C contrasts VRET with out-of-office exposure, in which VR benefits both therapist and patient, from a safety and controllability standpoint, thus avoiding the potential risks correlated with traditional exposure. However, C came to the conclusion that, based on observations from his own research, "*controls are a problem in therapy with VR*", due to the novelty of the VR technology, which therapists are not accustomed to.

Further, the interviewees were asked to delve deeper into the specifics of the upsides and downsides of VR, as compared to traditional environments, some of which they already identified in defining VR as a medium for exposure in the previous segment. What A considered to be critical was the inexistence of standards and the lack of instruments for conducting therapy in VR, while also making a point for the technological barrier and VR's inaccessibility. She acknowledges the potential that VR has in terms of treatment effectiveness, but deliberates that the differences in outcome between VRET and traditional exposure are dependent on how the therapy is conducted in a traditional environment (i.e. going to the patient's day-to-day environment can be more effective than conducting therapy in the clinic, so how does one then compare VRET with out-of-office exposure?). However, as VRET places more control into the hands of the therapist than traditional exposure does, A believes that VRET has better standing than traditional exposure in patients with high levels of avoidance, as she can manipulate the situation accordingly, which is corroborated by B's stance on avoiding escapism. On the other hand, a major difference between virtual and traditional environments is the presence of the therapist. A states that patients with high level of anxiety benefit more from the presence of the therapist, a perk which is unavailable in virtual environments, causing VRET to be detrimental in these cases. B comes with a different stance on the issues that arise with exposure therapy in VR: boredom. She noticed in her research that after a certain number of sessions, patients get tired of experiencing the same virtual scenarios, which can be a daunting problem to tackle, as it involves the creation of a variety of different environments that are to be changed with each treatment session. As B's research is focused on older patients (i.e. 40 and above), she noticed that the older population has a harder time dealing with the side effects of using VR than then younger one (e.g. motion sickness). On a good note, B acknowledges that VR is better suited than traditional environments for treating certain types of phobias (e.g. fear of flying), as it proves more efficient, from the perspective of time and cost management, to simulate an environment for undergoing exposure, for both therapist and patient.

Lastly, having established their positions on VRET and its changes from the traditional environment, the interviewees were asked to consider the involvement of children in this type of treatment and discuss its possible advantages, but also drawbacks, such as ethical considerations. A main factor that C noted is conducting therapy, comparable in terms of effectiveness with out-of-office in vivo exposure, from the premises of the clinic. This translates into safety and control for the therapy process, which is especially relevant when referring to the treatment of children, where out-of-office exposure has an increased risk of confidentiality breaches. Not only that, but VRET also allows for conducting treatment as a "*gamified way of learning*", by adapting the relevancy of the environment to what children can refer to, boosting, thus, their self-determination: "Coaching them (children) into new behaviours within a pleasurable and interesting environment is one of the major benefits of VR". On the other hand, B is more reserved towards drawing conclusions with regards to the usage of VR in the treatment of children, affirming that, in its present state, VRET should be used

as a complementary tool to the already existing methods: "*In the USA, VRET is the primary treatment method for patients with PTSD. In order to get clearer conclusions, we need to reach the same level of research in other mental health disorders as in PTSD*". What all interviewees agreed on was the importance of proactive communication in pursuing informed consent from the parents/legal guardians. As psychologists, they are aware of the difficulties that asking a parent for informed consent to conduct experimental treatment on their children can pose. More vocal on the subject was C, who firmly stated that applying for ethical approval is a setback for the largest part of the academia circle: "*Most studies are conducted by PhD students, who are limited by time. In general, obtaining ethical approval for using children in medical research requires a lot of effort, making it, thus, unavailable to the majority*". B corroborates this standing, reasoning that in order to reach solid conclusions, several research projects are required and, only then, can practitioners make use of the 'scientifically validated' environments.

9. DISCUSSION

When trying to assess the efficiency of VRET as compared to traditional evidence-based exposure therapy, the first and most important aspect that has been analyzed was treatment efficiency. The literature review revealed that treatment effectiveness was similar for the two treatment methods, with slight fluctuations among trials. These fluctuations, however, cannot be objectively categorized as a direct effect of the treatment method itself, but rather on the specifics of the experiment that was conducted: affinity to VR, social context presented, demographics and others. While it cannot be said that treatment effectiveness had no influence over the results, it was also, from an objective standpoint, not a defining reason for a treatment method to be more effective than the other. This applies for both the studies with groups treated solely in VR and for the meta-analyses that followed simultaneously groups in VR and a traditional environment.

As expected, VRET received recognition regarding the new features that the leading edge technology brings to the process of medical treatment of SAD. Exposure therapy is a high-risk treatment method, which means that both therapists and parents are highly reluctant with allowing children to undergo exposure therapy. VR solves this issue by allowing therapists to control the stimuli the patient is exposed to, which is the highest benefit of using VRET in the eyes of the therapists.

Virtual environments solve many of the issues with the existent methodology. The literature unveiled that patients feel safer when confronted with anxiety in a virtual environment than they do in traditional exposure, primarily due to the increased control over the stimuli patients themselves have in VRET, but also because they no longer feel the fear of being embarrassed in public. Aside from the increased control, the shift towards a virtual environment offers therapists the opportunity to expose patients to stimuli that are hard to access. While it is not always the case that certain social situations are difficult to emulate through out-of-office exposure, it is particularly beneficial for a variety of other phobias that might be harder to confront patients with.

Given that difficult stimuli are now easily accessible, one might assume that it will also reflect in reduced costs and improved time management. While the literature shows that it is indeed practical for therapists to be able to conduct therapy from the comfort of their own clinic, it was unexpected to discover that the financial aspect is, on many occasions, a pitfall for many therapists. In the case of SAD, conducting out-of-office exposure therapy is not expensive to begin with, due to the simplicity of the general social situations patients generally need to be exposed to. Therapists consider that integrating VR technology into their treatment process is still too expensive, due to the initial and high-maintenance costs inquired. The general belief, however, is that prices will decrease with time and VRET will become more affordable in the future. On top of that, therapists fear that their lack of technical expertise will prove to be an inconvenience in administering treatment. Interviewees had disjointed opinions on this matter, which is why it is safe to assume that technical fit and costs incurred are subjective topics in making a decision for the efficiency of VRET.

The change from traditional to virtual environments does not accompany only benefits. VR devices are well-known to cause physical strain, especially after long sessions of wearing a head-mounted display. These side-effects of VR usage range from motion sickness to neck pain and even eye strain. It stands to reason that this plays an important role on why age restriction is placed on the HMDs, even if the literature does not explicitly state so. As a result, parents often opt out of this type of therapy, as they do not wish to expose their children to any type of harm. The immediate result is that researchers have a hard time conducting studies aimed at the younger population, leading to a lack of scientific body of knowledge. Many other factors are believed to cause differences in the treatment process of social anxiety between traditional exposure and VRET, but no study firmly confirms any. Nonetheless, it is a certainty that children show a predilection for an increased sense of engagement, which is a result of the means the information is presented to them. One of the interviewees corroborated this finding, stating that children are prone to engage in the process when the social context they are confronted with is visually appealing. As such, it can be assumed that the social situations children are put through in a virtual environment need to differ from those aimed at the adults, who do not require a stimulant to keep them engaged. Emphasis needs to be put on the possibility for children's engagement acting as a catalyst to surpass the technological barrier and acquiring an increased sense of presence. This is currently being researched and a definite conclusion is yet to be reached.

Lastly, the largest discrepancies between the treatment of adults and that of children come from the side of ethical considerations. A summary of the five ethical standards, together with potential challenges and recommendations, as identified by Gola et al. [13], can be found in Table 1. Exposure therapy classifies as a high-risk treatment method, no matter the environment in which it is conducted: traditional or virtual. The literature revealed that part of the therapists who treat social anxiety waver with regards to the usage of this technique, which comes from the possibility of treatment backfiring when it is applied wrongly. This can often occur when exposure is not calibrated to tailor-fit a particular patient's needs, causing what Emmelkamp et al. [10] defined as the process of "attrition and deterioration" (i.e. patients discontinuing treatment before it is completed and/or patients' condition worsening as a result of wrongfully applied exposure).

The ethical standards that researchers and therapists together ought to comply with are the first tile for the foundation of a domino effect. Receiving ethical approval for medical research, in general (i.e. including phobia treat-

ment, thus social anxiety disorder), is a tedious task that requires considerable workload, one of the expert interviewees states. This fact is often left out of the research publications and overlooked as a result. Adding into the equation that the targeted population is comprised of children and that treatment is conducted with VR as an intermediary, it gets exponentially more difficult to obtain ethical approval. This translates, from the very beginning, into a shortage of research publications, followed by a lowered percentage of soundness and completeness of the cumulative research on the topic. Past the point of research, therapists require an established methodology that they can follow in the treatment process, which is in direct contradiction with the already questionable soundness and completeness of the existing research, leading therapists to opt out of an under-researched application of a technique deemed as high risk. Moreover, clear legal guidelines are still to be drafted for the use, in medical treatment, of VR, a leading edge technology, ever-developing, that define the norms and means in which VR can and should be utilized. Without the guidance and support of the law to shelter therapists who engage in VR-based treatment, it is increasingly difficult to motivate more therapists into shifting towards exposure therapy in a virtual environment.

All in all, it would be premature to take a stance towards the overall efficiency of VRET, as compared to traditional exposure. What is certain is that the VR technology brings novel features which have the potential of greatly easing the process of providing treatment, either by not having to relocate to a different location to expose patients or by therapists accessing stimuli which they could not before. Moreover, VRET was established as an effective treatment method by the studies conducted, thus opening the door for more extensive research to be done in this direction to better define the upsides and downsides of exposure therapy in virtual environments. Until solid conclusions are drawn, VRET will continue to comprise a minor percentage of the means of administering exposure treatment, often being used as a complementary tool in the therapy process. In order to determine the efficiency on the children population, extensive research needs to be done on VRET, in general, to increase its popularity and attract more researchers towards studying the method. So far, VR was proven to solve some of the issues with the existing treatment in children, overcoming boundary crossings (i.e. therapist no longer participating in exposure along with the patient) and confidentiality breaches (i.e. patient no longer under the risk of being identified in out-of-office exposure).

10. LIMITATIONS

Unfortunately, the existing literature leaves much to be desired. Factors like monetary costs and technology barriers are still to be discussed thoroughly. Both literature and experts have had contradictory points of view in this regard, none of which can be corroborated due to the lack of research. Based on the meta-analyses which have been analyzed, all studies focus, first and foremost, on the effectiveness of the treatment, with little or no attention being given to other factors which influence treatment efficiency. While the interviewees provided insightful points of view on observations made in their research that affect the treatment efficiency of both adults and children (e.g. gamification, self-determination), these are yet to be investigated extensively and theorized. The biggest limitation of the existing literature is that VRET on children is under-researched, which raises questions with regards to the completeness of the present paper. Overall, it would be untimely to assume that VRET is a viable option to replace the already established traditional methods at this point in time. According to the interviewees, research in this field is still in its initial phase. While experiments on adults have been more frequent, before accrediting VRET for children, several other research studies need to be conducted from which conclusions can be drawn and standards implemented.

11. CONCLUSION

This paper identified factors that play a role in determining the efficiency of VRET, based on the current literature, considering both the differences between the traditional and virtual environments, as well as methodology divergences between the adult and child populations. To complement the literature findings, a series of interviews was conducted with researchers from the University of Twente, active in the fields of VR and/or psychological treatment. Given the present state of the scientific body of knowledge, more research in the direction of administering treatment for social phobias in children through virtual reality exposure therapy is required and encouraged, in order to draw solid conclusions on the efficiency of VRET in treatment of social anxiety in children. Specifically, future work should encompass meta-analyses focused on target groups comprised of children, which are to assess the standing between VRET and traditional exposure in terms of not only effectiveness, but overall efficiency. To be noted that this paper does not cover all aspects of treatment efficiency of VRET on children with SAD, but a collection of observations in the existing literature reviewed, which makes it susceptible to having overlooked factors which can influence the standing with regards to the thematic of treatment efficiency.

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Table 1. Ethical Challenges and Recommendations in Exposure Therapy With Children [13]

Ethical standards	Potential challenges	Recommendations
Informed Consent and Assent	Exposure therapy may be viewed as harmful, unsafe, or ineffective	Provide comprehensive information about treatment research, benefits and "side effects," and rationale, describe parents' role.
	Children may not fully understand treatment and rationale	Describe specific steps in treatment and rational in age-appropriate terms. Use child-friendly and personable analogies.
	Children may be unwilling to engage in exposure therapy	Empathize with difficulty of exposures. Frame the exposures as hypotheses or suggest a "trial run." Emphasize treatment is at the client's pace. Use motivational interviewing strategies, values work, or work with parents in reducing accommodations.
Competence	Not challenging the client enough	Examine own beliefs about exposure and what it means for a client to be anxious. Discuss in supervision.
	Not thinking through the logistics or potential pitfalls	Think through the potential obstacles and pitfalls before conducting an exposure and discuss with client or family
	Conducting too challenging of an exposure too early on	Create anchors for SUDS. Take a calm and accepting approach when an exposure was not successful. Take ownership when not successful.
	A therapist may not be able to be emotionally tolerant to the client's anxiety or may share the same fear of the client	Determine whether you possess the emotional tolerance to do this work. Keep in mind value of exposure and rationale. Use supervision to discuss discomfort. Conduct exposures to fear.
Beneficence and Nonmaleficence	Minimize risk of exposure therapy and maximize the benefit	Collaboratively create exposures, chose the next exposure, and agree on specifics of exposure. Think through potential obstacles. Help client understand that there are no guarantees. Anticipate that exposures may not go as planned, emphasize goal of being able to tolerate anxiety. First exposure should be challenging but feasible. Modify exposures that were unsuccessful. Create "above and beyond" top of the hierarchy exposures that fully target core fear but are not truly harmful or unsafe. Consult with colleagues, poll others, consult with other professionals, discuss with family to determine appropriateness of exposure.
Confidentiality	Out-of-office exposures increase risk of confidentiality breaches	Discuss concerns with client and family before engaging in exposure. Remind clients that they have a right to refuse out-of-office exposures. Takes steps to de-indentify self, such as removing badges, coats, and ties, avoid visibly recording SUDS. Develop a cover story. Conducting the exposure in another neighborhood or a time when there is less likely to be people around.
Boundaries	Boundaries may be more easily blurred when conducting exposure therapy	Remember that casual conversations and settings outside of the office may be necessary or appropriate in an exposure. Address this issue during consent. Gain approval from parents for all steps in exposure. Consider a cost-benefit analysis when a boundary is informed crossed. Take a neutral stance when asked personal questions by children.