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CASE REPORT OPEN ACCESS

# Take a Look at Me Now: The Use of Virtual Reality in the Treatment of Social Anxiety Disorder

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## ABSTRACT

In anxiety and related disorders, Virtual Reality Exposure Therapy (VRET) was one of the first steps toward integrating technology into psychological treatments. In this article, we discuss crucial therapeutical skills and provide a case conceptualisation for the treatment of social anxiety disorder with VRET. The case conceptualisation is based on evidence-based cognitive-behavioural treatment approaches. Social anxiety can be very challenging to treat with exposure in vivo, and virtual reality exposure offers the added benefit of being able to create social situations and real-time interactions within the therapeutic context. The case conceptualisation presented is worked out for a 23-year-old female with social anxiety disorder who is increasingly hindered by her anxiety in her professional and personal life. The treatment rationale of VRET, homework assignments, and progress of therapy are presented. Additionally, this paper discusses what steps to take if the first exposure experiences are not successful and how to progress in such cases. Therapeutic pitfalls are illustrated within this case and potential solutions on how to avoid these pitfalls are addressed.

## 1 | Introduction

Exposure in vivo is the gold standard of cognitive behavioural therapy (CBT) for treatment of phobias, including social anxiety disorder (Abramowitz et al. 2019; Emmelkamp and Ehring 2014). With exposure in vivo, patients are exposed to gradually more anxiety-arousing situations for prolonged periods of time per session until anxiety dissipates and habituation occurs. Exposure in vivo is generally less effective in individuals with social anxiety disorder (SAD) than in individuals with specific phobia or agoraphobia. One of the problems encountered in treating SAD patients with exposure in vivo is that it is difficult to build a hierarchy of gradually more difficult social situations to be practiced during treatment, given the unpredictability of reactions of other people. Virtual Reality Exposure Therapy (VRET) is a modern variant of exposure therapy wherein patients are exposed in virtual reality (VR) to their idiosyncratic fear. VRET has been found equally effective as exposure in vivo in patients with specific phobia (e.g. acrophobia, fear of flying) and in agoraphobia (Meyerbröker and Morina 2021).

### 1.1 | Social Anxiety Disorder

Social anxiety disorder can be a very disabling condition, which is marked by persistent fear of being scrutinised by others (American Psychiatric Association [APA] 2022). Individuals fear in particular social interaction with others in a variety of different situations. These can include walking into a room where others are, eating or drinking in front of others, talking to others, interacting with unfamiliar people or strangers, attending parties or social gatherings, going to work or school, making eye contact, or performing in front of others. Individuals with social anxiety are usually afraid of saying something perceived as stupid that will be evaluated negatively by others, thus making them look idiotic, boring or ridiculous.

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While most anxiety disorders develop during adolescence, that is, before the age of 20 (McGrath et al. 2023), the estimated age of onset for SAD is approximately 10.6 years with a confidence interval ranging from 6 to 14 years, making it the earliest onset among anxiety disorders (De Lijster et al. 2017; McGrath et al. 2023). Social anxiety gradually increases in children and peaks during adolescence (Deardorff et al. 2007). Adolescents with SAD are at a higher risk of school dropout (Vilaplana-Pérez et al. 2021).

Especially due to the variety of social situations that individuals with SAD fear, VRET has become a viable alternative to exposure in vivo situations. In virtual reality, situations can be repeatedly practiced and are much more controllable than real-life interactions (Emmelkamp et al. 2020). Although VRET has been found to be efficacious across anxiety disorders (Emmelkamp and Meyerbröker 2021), in the case of SAD the findings have been more inconclusive (Horigome et al. 2020; Morina et al. 2023). Nevertheless, several studies done with clinical populations suggest that VRET can reduce SAD symptoms (e.g. Anderson et al. 2013; Kampmann et al. 2016; Wallach et al. 2009; Wong et al. 2023).

As recent developments in technology have made real-time interaction with avatars possible, VRET has become a secure and controllable alternative not only for exposure exercises but for social skills training as well. It provides the therapist with the opportunity to guide in-session exposure and vary exposure situations that are difficult for the individual (Jong et al. 2023). Given that social situations in which one can practice in real life are often scarce, VRET has become an important instrument for reproducing social situations, and it has been shown to have the potential to elicit social distress in patients (Emmelkamp et al. 2020).

A number of studies have investigated VRET in socially anxious patients, including those with speech anxiety. In most studies the effectiveness of VRET was investigated in conjunction with CBT (Andersen et al. 2023), which renders results difficult to evaluate. Accordingly, any potential treatment efficacy might have resulted from treatment elements other than VRET (Morina et al. 2015). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR; APA 2022), the main characteristic of SAD is a fear of negative evaluation resulting in avoidance of social situations or feeling uncomfortable in social situations. The DSM-5-TR distinguishes two types of SAD: the generalised type, characterised by the apprehension of most social situations, and the performance-only type, which is limited to anxiety in a specific performance situation (e.g., speech anxiety). Most effectiveness studies of VRET involving patients with SAD are limited to the specific performance type of SAD, such as talking to an audience.

In a study by Kampmann et al. (2016), however, the effects of pure VRET without any cognitive intervention were investigated with patients with generalised social anxiety. The virtual situations included giving a talk in front of an audience of people who asked questions, buying and returning clothes, talking to a stranger, attending a job interview, dining in a restaurant, being interviewed by a journalist, and having a blind date. Semi-structured dialogues were controlled by the therapist, who was in a separate room. The therapist could vary the avatars' gender and gestures, the number of avatars present, the style of the dialogue and the dialogue topic's degree of personal relevance. Exposure in vivo consisted of exercises that could be implemented in the therapist's office or in neighbouring supermarkets, cafés, shops, or subway stations. Both active treatments were more effective than waiting-list control for social anxiety symptoms. However, the results obtained at the 3-month follow-up showed that in vivo exposure was more effective than VRET in reducing social anxiety.

A recent meta-analysis of VRET in social anxiety disorder (Morina et al. 2023) found a strong treatment efficacy of VRET from pretreatment to posttreatment and follow-up. Compared to wait-list control groups, VRET demonstrated considerably stronger treatment efficacy, and it proved to be equally effective as exposure in vivo. A recent review (Rejbrand et al. 2023), concluded that stand-alone VRET reduces social anxiety symptoms. However, given the limited number of studies involved in this review, the results should be interpreted with caution, as noted by the authors.

SAD is highly co-morbid with avoidant personality disorder: nearly half of SAD patients also meet the criteria for this condition. Avoidant personality disorder is characterised by social avoidance together with hypersensitivity to negative evaluation, fears of rejection, and feelings of inferiority (Emmelkamp and Meyerbröker 2019). Given that SAD and avoidant personality disorder do not differ in general level of symptom severity (Frandsen et al. 2020), VRET may also be effective in individuals with avoidant personality disorder, but this has not yet been evaluated.

There is some evidence that social skills deficits are associated with SAD, but whether this is due to a real skills deficit or to the fact that socially anxious individuals may exhibit negative cognitive biases in evaluating their own social behaviour is still a matter of discussion (e.g., Halldorsson and Creswell 2017). Relatively few studies have investigated the effects of social skills training in adults with SAD. In a study of Beidel et al. (2014), the combination of social skills training and exposure therapy was slightly more effective than exposure therapy alone on measures of social skill and general clinical status. Whether a combination of VRET and social skills training may enhance treatment effectiveness in SAD has not yet been investigated.

## 1.2 | Theoretical Model of (Virtual) Exposure

Providing a treatment rationale is important for successful exposure therapy (Arch et al. 2015). Until a decade ago, the Emotional Processing Theory (EPT; Foa et al. 2006; Foa and Kozak 1986) was the theoretical framework for explaining the effects of exposure therapy. According to EPT, fear is stored in memory as a structure containing information about feared stimuli, responses, and their meanings. EPT holds that fear structures can be modified through emotional processing, which requires two conditions: (1) activation of the fear structure, and (2) integration of new, incompatible information. According to this framework, for a successful exposure, it is important that the fear network of the patient is activated



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(i.e. that the patient feels sufficient anxiety during the exposure); that the anxiety declines over the duration of the situation in the session; and that anxiety declines between sessions. However, research into these working mechanisms has been inconclusive in supporting this theory (e.g. Kircanski et al. 2012).

In the past decade, the Inhibitory Learning Model (Craske et al. 2014, 2022) has become the dominant model of explaining the effects of exposure. According to this model, the emphasis is not on habituation to the anxiety-provoking stimulus but rather on disconfirming the relationship between a trigger and the expected catastrophe and learning a new association of the trigger and "no catastrophe" (inhibitory meaning). The pivotal component during the exposure is expectancy violation, which occurs when the patient's expectancy (or belief) about what will happen during the exposure and what in fact happens do not align. The larger the discrepancy between the expected catastrophe and the actual outcome, the more the patient's expectancy is violated. However, clinical studies indicate that it is not in fact the expectancy violation itself but rather the learning rate and the expectancy change that are crucial for successful exposure (Pittig et al. 2022). When a therapist uses VRET, it is important to realise that the working mechanisms of VRET are not yet evident (Scheveneels et al. 2024) and that providing a rationale is an important aspect to enhance treatment engagement (i.e. working mechanisms and rationale are independent but both are important to consider).

### 1.3 | Reluctance to Use Virtual Reality in Treatment

Many clinicians are reluctant to use VR in treating patients out of concern that the use of VR technology will affect the therapeutic relationship because patients wear head-mounted displays, thus preventing eye contact. So far, however, research has found no differences in the quality of the therapeutic relationship between VRET and other evidence-based psychotherapies (Emmelkamp and Meyerbröker 2021). In addition, there is neither evidence that more patients receiving VR therapy drop out because the VR worlds are experienced as unrealistic (Benbow and Anderson 2019) nor that deterioration rates of VR treatment in patients with anxiety disorders are higher than in regular CBT (Fernández-Álvarez et al. 2019).

### 1.4 | Theoretical Model of SAD

In SAD there have been predominantly two theoretical models in cognitive behavioural therapy (Clark and Wells 1995; Rapee and Heimberg 1997). For the case presented here, the cognitive model of SAD proposed by Clark and Wells (Clark and Wells 1995) will be used. This model proposes that individuals with SAD perceive social situations in a negative way and that these negative perceptions foster and maintain their anxiety. In this model, the role of self-focused attention, negative self-beliefs and safety behaviours are highlighted. Individuals with SAD focus excessively on their inner experience and their behaviours in social situations, leading to a heightened self-awareness and scrutiny. This self-focus then intensifies the perception of social threat and in turn leads to negative self-beliefs of rejection or negative evaluation. To handle their anxiety in social situations, individuals engage in safety behaviours such as avoiding eye contact or rehearsing a conversation topic. These safety behaviours reinforce their beliefs that they are unable to cope with the situation without these behaviours (McManus et al. 2008; Piccirillo et al. 2016).

## 2 | Case Illustration

### 2.1 | Presenting Problem and Client Description

Carolin, a 23-year-old woman working in a bookstore, comes to the GP with complaints of anxiety and worries. She has been experiencing more and more challenges with social situations the past years. Carolin explains that her complaints have been present since her adolescence, but that after finishing her studies, she finds herself increasingly confronted with growing anxiety in social interactions with friends and colleagues. She experiences extreme anxiety at the thought of having to talk to strangers, which has become a problem in her work at a bookstore. There she must not only help clients but also introduce authors at book presentations. Her anxiety has become so strong that she called in sick several times when a new book presentation was planned. This has led to a conflict situation at her work, which makes it even more challenging for her to come to the bookstore on normal working days. In her personal life, Carolin has only a few friends with whom she is not very close. Her family lives out of town, which requires her to travel by public transport to get there. Carolin experiences an intense fear of social situations and is especially afraid of the scrutiny of others or that she might behave ridiculously so that others will evaluate her negatively. Therefore, she avoids social situations in her personal life; in her professional life, she endures them with increasing anxiety, leading more and more to avoiding them. In such situations she talks with a low voice, she sweats, her face turns red, her heart races, and she feels nauseous. All these symptoms increasingly impact her daily life since she ruminates about her social activity and the negative evaluation of others. Even though she has completed high school and completed a professional training in languages, she experiences low self-esteem, and she thinks she is worth less than others in social contexts.

### 2.2 | The Therapist

Carolin's GP referred her to a therapist who is a licensed mental health psychologist and cognitive behavioural therapist with several years of experience in treating anxiety and related disorders. The therapist's focus is mainly on behavioural interventions such as exposure as this is an empirically supported treatment intervention (Parker et al. 2018). The therapist has worked not only with social anxiety disorder but also with anxiety-related disorders such as posttraumatic stress disorder, where a social-anxiety component often plays a role as well. The clinical setting where the therapist works has a virtual reality set available with different virtual social environments.



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A high-end VR gaming laptop is available for the patient view (Hardware: i7 cpu, 16GB, GTX 1080, 250GB and a Surface Pro 2017), and for the therapist interface, a tablet is used (ultramobile PC, Surface tablet). The head-mounted display is an Oculus Rift 2 with touch controllers and a MorphVOX Pro Screamingbee, which transforms the voice of the therapist. The system has six degrees of freedom, and the patient can move freely within the virtual environment. The therapist can manipulate the number of avatars in the environments, and the friendliness of their appearance. Interactions are in real-time and directed by the therapist. A voiceover is used to mask the therapist's voice in interactions with the patient. Different relevant environments are available: a supermarket, a bus ride, a café visit, a park and a party at a private home (© CleVR. net; Social environments).

### 2.3 | Case Formulation

According to the DSM-5-TR (APA 2022), Carolin fulfills the criteria of social anxiety disorder. The severity at the beginning of therapy is measured with the Liebowitz Social Anxiety Scale (LSAS; Liebowitz 1987), which measures fear and avoidance in a number of social situations. This questionnaire highlights the high degree of Carolin's pattern of avoidant behaviour (total score: 63; anxiety score: 34; avoidance score: 29). In addition to her fear of social situations, being under scrutiny, and being rejected by others, her avoidance behaviour has increasingly become a problem. In her personal and professional life, Carolin has become more and more isolated. Given the high avoidance score on the LSAS, the therapists suggests that Carolin take the first steps in VR, as taking these steps in the VR environment seems less frightening to Caroline than having to do so in real life. Carolin's individual case conceptualisation is based on the model of Clark and Wells (1995).

Carolin perceives social situations in a very negative way (e.g. she believes that her colleagues and boss are negatively evaluating her). She experiences feedback from others or the observation of others doing things differently than she does as a threat indicating that she does not do it right. Her negative perception that she is not doing things right fosters her belief that she does things stupidly, leading to increasingly negative self-beliefs (e.g. 'I am not able to do the work at the same level as my colleague'; 'I am stupid'; 'They see that I am not able to do my work at the level I am expected to', etc.). Carolin increasingly uses safety behaviours in work situations (e.g. pretending to look at the catalogue so that customers will address a colleague first; taking notes during meetings so she does not have to say anything, etc.). However, when she is directly addressed by a customer, she does not hear details of the question but instead feels the blood pumping in her ears and her skin turning red as more and more red blotches appear on her neck, which eventually leads to stronger scrutiny by both herself and others, thus intensifying her perception of the social threat. Afterwards, Carolin relives the social situation again and again looking for confirmation that the customer thinks that she is stupid and will look for help from another colleague, making it even harder for her to return to work the next day. To handle her anxiety during normal working days, Carolin engages in safety behaviours such as avoiding eye contact or rehearsing a conversation (e.g. 'A book is not available; it will take a few days before the book will be delivered', etc.). If a customer turns to her unexpectedly, she may fall silent as she cannot think of what to say. This has already led to awkward situations wherein eventually a colleague took over helping the customer.

### 2.4 | Treatment Goals

During one of the first treatment sessions, the therapist discusses with Carolin what her goals for the treatment are. Carolin wants to be able to do her work without being anxious all the time. Together with the therapist, she reformulates this into different subgoals: 1) working a limited number of hours in the store with no customer contact, then eventually building up her hours and, at a later moment, adding customer contact; 2) making eye contact with customers; 3) asking a customer to repeat the question when she has not fully understood the question; 4) discussing with her boss that she needs some extra time to present a writer at a book presentation; and 5) talking to her boss about her challenges and how he can support her during this process. When these subgoals are achieved, Carolin expects that she will be better able to handle her anxiety, and she hopes that that will decrease her fears as well so that she will automatically be more at ease.

## 3 | Course of Treatment

### 3.1 | Treatment Rationale and First Exposure

According to international treatment guidelines (e.g. National Institute for Health and Clinical Excellence, NICE guidelines 2013), CBT is the first choice for treatment. CBT is a very structured and goal-oriented treatment approach focusing on the present, which makes it a practical, easily accessible and effective treatment method. For Carolin, this approach provokes ambivalent feelings. On one hand she is happy with the provided structure, but on the other hand, it is very confronting for her as she notices immediately that she is asked to come out of her comfort zone step by step.

Carolin's treatment starts with a first session of explaining the treatment rationale and getting to know Carolin. During this first contact, the therapist observes that Carolin avoids eye contact with her and that Carolin finds it difficult to give more insight into her own emotions and anxieties. She often replies, 'I don't know' and that 'it maybe could be the case'. For the therapist, this is a challenging situation as she does not want to put too much pressure on Carolin but nevertheless wants to get to know her. Every time Carolin succeeds in making her emotions and thoughts more explicit, the therapist reinforces this by complimenting her and thus building a stable therapeutic relationship. The therapist starts working with her on the relationship between her thoughts, feelings, and behaviour and how these are interrelated. Carolin describes a recent situation at her work wherein she was approached by a customer while she was pretending to search for something in the catalogue. She explains that when the customer started talking to her and



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asking her for assistance, she became so nervous that she began concentrating on all the bodily symptoms she was experiencing to the extent that she could not understand what the customer was asking for. When realising that she did not know what the customer had asked and he looked at her with an uncomfortable look, she saw this as a confirmation that the customer thought that she was stupid and unable to do this work. As a result, her bodily symptoms increased, she stumbled and was unable to respond. The therapist explores with her the relationship between her thoughts ('the customer thinks I am stupid') and her behaviour (looking down and focusing on her bodily symptoms) and their combined effect on her anxiety. Carolin admits that when she focused on her bodily symptoms, she indeed started feeling worse. Building upon on these insights, the therapist asks Carolin how she thinks she could interrupt this vicious circle. Carolin responds that perhaps changing something in her behaviour would be a good starting point as she insists that her thoughts come 'automatically'. Together they discuss what she could practice doing differently. Given that the therapist already noticed that Carolin is avoiding eye contact in the session, she suggests that Carolin practice making eye contact as a first exposure. Carolin recognises that this is difficult for her, and together they decide what a first exposure could look like. In the end they decide that Carolin will start by looking at the therapist's eyes for 10 s, then pause, then look again for 10 s, pause, and look again to check if she can succeed a third time for 10 s.

Here it is important for the therapist to explain the rationale of exposure and on which theoretical model it is based (see Theoretical model of exposure). According to the 'habituation' model, the rationale is explained in terms of habituation, that is, that fear will decline when a patient does not avoid anything in the exposure situation. For example, in this case, when individuals are afraid of looking into people's eyes, the goal is to practice looking into the eyes of others. By practicing making eye contact with different persons instead of avoiding it, one can become accustomed to the situation and gradually find it less distressing. Therefore it is important to make the duration of exposure long enough and challenging enough such that anxiety increases in the beginning of exposure and decreases over the duration of the exposure.

When doing exposure according to the inhibitory learning model, it is important to make the expectancy explicit ('What is your greatest worry about what will happen during exposure?') and then start the exposure as an experiment to test whether this expectation becomes true or is violated. It is argued that the larger the discrepancy between the expected and the actual outcome, the more a patient will benefit from the exposure.

In Carolin's case, the therapist explains exposure as a first opportunity for Carolin to attempt to do things differently in stressful situations and to investigate whether she can do so. While doing the exposure, the therapist guides her carefully and compliments her after she has looked for 10 s in the eyes of her therapist. Additionally, she labels what she sees happening to Carolin in terms of making anxiety symptoms explicit (see Dialogue below).

After the exposure Carolin feels tired and excited at the same time: tired because it cost her a lot of energy to take these steps and excited because she did it successfully. They agree that Carolin will keep a journal until the next session and will start registering on a daily basis situations in which she feels anxious, what she thinks at that moment, what she does, and what the outcome of the situation is. Additionally, she agrees with the therapist that she will practice with making eye contact with somebody every day. For this exposure exercise, she will write down how high she expects her anxiety to go up and how much anxiety she ultimately experienced when doing the exposure.

*Dialogue:*

THERAPIST: Okay, Carolin, are you ready to begin with the exposure exercise? You understand what the idea is?

CAROLIN: Yes, I think so. I'm a bit nervous, but I'll try my best.

THERAPIST: That's completely normal. Remember, the goal here is to handle your anxiety and observe what happens. We'll start with the exercise: making eye contact for 10 s, alright? I will keep track of the time so that you do not have to worry about that.

CAROLIN: Okay, I think I can do that.

THERAPIST: Alright, here we go. [Starts timer.] Just look into my eyes. What do you see? [After 10 s] How was that?

CAROLIN: It wasn't too bad. I felt anxious at first, but I was able to do so.

THERAPIST: Excellent. Now let's try making eye contact with me for again 10 s. Remember, it's okay to feel nervous. Ready?

CAROLIN: Yes, I am ready.

THERAPIST: Excellent, I'm starting the timer now. [Counts silently to 10.] There we go. How did that feel? Did you avoid anything or do anything to make it easier for yourself?

CAROLIN: A bit harder to do it again, but I think I'm getting used to it. I noticed that you did not ask me what I saw; that made it more intense, but I did not do anything to make it easier.

THERAPIST: Excellent! This is how we will practice again and again!

### 3.2 | Exposure Exercises in Virtual Reality

During the next exposure sessions, it becomes more and more evident that Carolin tends to provide socially desirable answers aligned with what she thinks the therapist expects her to say. When the therapist points this out, Carolin admits that this could be the case. The therapist takes a moment to look together with Carolin at her goals and asks her how she thinks she can reach these. Although Carolin knows which steps are necessary, she is reluctant to take ownership of her own progress and take these steps. While she fully understands that she needs to do things differently, she experiences so much anxiety



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that she remains avoidant and reluctant in doing the exposure exercises. To be able to reinforce successful exposure exercises, the therapist and Carolin discuss starting the exposure exercises with a virtual reality exposure set. After becoming familiar with the head-mounted display (HMD), Carolin enters a virtual environment without any anxiety-provoking stimuli in it (a garden with flowers, green lawns and trees) to become familiar with how she can navigate in the virtual environment and to see how she reacts to the environments. After that, she starts the first exposure exercise guided by her therapist. Together they decide to progress with the making-eye-contact exercise Carolin already practiced with the therapist. First, she enters a virtual supermarket where she is supposed to walk around and finally buy a single item and make eye contact with the cashier (see figure 1 for examples of interactive VR environments). The therapist guides the exposure in the supermarket, making sure that the exposure is properly done. While guiding her through the supermarket, she lets Carolin describe regularly what she sees to ensure that she is not using avoidance behaviours and gives Carolin tasks such as finding the washing powder, thus ensuring that she will not close her eyes. When Carolin approaches the cashier, the therapist notices that her anxiety does not noticeably increase, which appears strange to her as she anticipated that making eye contact with the cashier would be more anxiety-provoking than walking through the supermarket. After having done the first round of this exposure, the therapist looks back with Carolin on what she has learned and what was difficult for her. When the therapist asks Carolin if she had been avoiding anything, Carolin is reluctant and says, 'Actually, no.' However, when the therapist asks her if she did anything during the exposure to make it easier for her, she admits that when walking up to the cashier, she had been telling herself that the situation wasn't real. The therapist asks her if she thinks that she can do exactly the same exercise without telling herself that it isn't real when walking up to the cashier. Carolin is reluctant, but when her therapist challenges a bit by asking what the worst is that could happen to her, Carolin admits that she should be okay and that she will try. Before doing the exposure again, the therapist asks Carolin to do everything she can to make the experience as real as possible for her, as if she were really in a supermarket. In the following exposure exercise, the therapist guides her again through the supermarket and asks her again to find certain objects to ensure that Carolin is not using avoidance behaviours. When walking up to the cashier, the therapist monitors Carolin's anxiety closely and, given that the anxiety is consistently increasing as she approaches the cashier, the therapist assumes that Carolin is not using any safety behaviour (e.g. telling herself that the experience is not real). When Carolin is paying at the register, the therapist asks Carolin for the colour of the cashier's eyes and to describe the cashier's face. Although Carolin feels increased anxiety while looking at the cashier, she is able to look at her and answer the therapist's questions. Carolin is surprised to realise that the cashier looks at her in a friendly manner and that the cashier is wearing nice eye makeup; nevertheless, the cashier does not look into the Carolin's eyes, which surprises her (see Zhang et al. 2020 for an overview of the uncanny valley effect). After the exposure exercise, she elaborates that although she knew that it was not real, she really felt it as if she were in fact in that situation. She discusses with the therapist that she was surprised by what actually happened. While looking at the cashier, she noticed that the cashier's gaze was in fact friendly and did not express a negative evaluation.

In the following sessions, they build up together different exercises that Carolin has to practice in virtual reality. When Carolin succeeds and manages the exposure exercise, they discuss how they can make it a bit more challenging. Every time that Carolin still experiences difficulty, they repeat the exposure exercise until she manages it. In the sessions, VR exposure is used to practice taking a bus and making small talk with fellow passengers on the bus or with the driver. Later they practice entering a virtual shop to buy clothes or a restaurant or bar, and in all exposure exercises, Carolin practices looking into the eyes of the relevant avatars. When at times she does not know how to respond in a particular conversation, the therapist helps her via modelling to learn how she could potentially react and encourages her to practice different behaviours to see what the effect of her behaviour is. In addition to advancing through the different situations under the guidance of the therapist in virtual reality, Carolin also starts doing small exposure exercises in her daily life.

### 3.3 | Outcome and Prognosis

At the end of her course of treatment, Carolin is able to do her daily tasks at work without experiencing too much distress. As a result, she starts to enjoy her work again as she feels more confident in doing her work. This confidence in herself increases her willingness to engage more in exposure exercises. When measuring her social anxiety at the end of the treatment,

**FIGURE 1** | Examples of interactive virtual environments developed by CleVR ©.



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Carolin scores only 17 points on the LSAS (Liebowitz 1987), which is - compared to her starting score of 63 - an enormous improvement. In her last sessions, Carolin and the therapist discussed what aspects of treatment helped her, and Carolin explained that it was really useful for her to have practiced the situation in VR even though she knew that it was not real. She says that the VR experience helped her to realise that she could navigate the situation even though she was anxious. In real life, this made it easier for her to relax in real social situations. Having practiced different situations in virtual reality encouraged Carolin to take the next step and translate the exposure from virtual reality to real life.

Carolin admits that her avoidant 'nature' is something she needs to be aware of in the future. Together with the therapist, she writes down the personal cues indicating that she is engaging in avoidance behaviour as well as what she can do to break through that behaviour. Carolin says that it always helped her to be reminded of how compassionate she is toward others but how she is not able to show that compassion to herself. So in writing up her pitfalls and potential solutions, she writes down that she has to be compassionate with herself and break the exposure into smaller pieces when she notices that she is avoiding the exposure.

### 3.4 | Clinical Practices and Summary

As illustrated in Carolin's case, VRET can be an important tool for taking first steps in exposure exercises. As Carolin explains to her therapist in one of their last sessions, practicing different situations in virtual reality with varying difficulty considerably helped her to face the exposure in real-life situations. This is significant as it highlights the importance of the confidence an individual experiences through successful execution of a certain behaviour in a challenging situation, often referred to as self-efficacy (Bandura 1977). VRET has the potential to provide the patient with the unique experience needed to be able to also practice these challenging situations in real life. As VRET has the ability to elicit emotional and physiological responses similar to real-life experiences, it can be assumed that the same brain regions are active as in actual perception (Álvarez-Pérez et al. 2021), explaining why individuals respond to virtual stimuli as if they are real. Therefore the experience in VRET may be as useful as real-life experiences for patients.

Especially in social anxiety disorder, this can be an advantage as different social situations can be practiced repeatedly with different levels of complexity and challenge for the individual patient. An additional value in using VRET to treat social anxiety disorder is that social skills can be practiced within different social contexts. In Carolin's case, it was useful to start with easier exercises from her daily life (e.g. buying groceries, making eye contact) and then build up the difficulty to the more challenging situations from her work, including her greatest fear: presenting someone or something (such as the author of a new book) to an audience.

In general, when working with virtual reality, it is important that the person in the virtual environment actually feels as if what is experienced is real. The subjective feeling that a user experiences in VR as "being there" is called 'presence' (Emmelkamp and Meyerbröker 2021). Results about the role of presence in the treatment of VRET have been inconclusive (Ling et al. 2014). In recent studies, presence is considered a necessary requisite to experience anxiety in a virtual environment, but the relationship goes both ways when repeated exposure exercises are done (Diemer et al. 2023).

However, presence has often been defined as a quite technical construct, and clinical-practice observations suggest that it is in fact the relevance of the virtual environment and its anxiety cues as well as the engagement a patient shows during exposure that are important prognosticators of successful exposure.

Avoidance behaviour can be a major challenge in the treatment of anxiety disorders (Abramowitz 2013). In VRET the advantage is that the therapist can guide the exposure exercise and ensure that the patient is not avoiding anxiety-provoking aspects. Avoidance behaviour in virtual reality can be quite subtle, such as not looking at the anxiety-provoking stimuli or—even worse—completely closing the eyes. Here a directive approach on the part of the therapist is necessary. To prevent active avoidance behaviour, the therapist can ask the patient what she actually sees. In Carolin's case, the therapist did so by giving her tasks such as searching for objects in the virtual environment. In that way, the patient is forced to describe what she sees, which enhances the feeling of being in the environment and thus increasing engagement in the VR exposure.

More subtle avoidance, such as the patient looking at all details and doing the requested tasks in virtual reality but telling herself that the situation is not real, demands that the therapist is particularly alert. When the anxiety of the patient does not increase in an anxiety-provoking situation, this can indicate a more subtle avoidance behaviour. In that case, it is important to discuss with the patient directly if they are doing something in particular to decrease anxiety in that situation. It is essential to check the patient's understanding of the rationale. If the patient understands the rationale, it may help to do an imaginal exposure exercise that activates the sensory system to support the virtual exposure. It is not so much the realness of the environment that is important for successful exposure but that sufficient anxiety-provoking stimuli are present in the environment.

Another important pitfall of which therapists should be aware is that a patient may choose socially-desirable responses instead of honest or accurate ones. In that case, it is important to emphasise that the patient's own feelings are important, not the therapist's expectations. An advantage of using virtual reality exposure is that the therapist can monitor all exposure sessions and can redirect if the exposure is not done properly.

On the other hand avoidance behaviour in therapists, particularly when providing exposure therapy, can significantly impact the efficacy of the treatment (Deacon et al. 2013). Exposure therapy requires the therapist to guide the patient through confronting feared stimuli (Abramowitz et al. 2019). However, when the therapist experiences discomfort or anxiety about distressing the patient, leading to avoidance behaviours such as reducing the intensity of exposures or skipping challenging steps altogether, this can undermine the therapeutic process



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and limit the patient's progress (Deacon et al. 2013). Avoidance behaviour in therapists with respect to VR-exposure usage can manifest in two ways: on one hand, a therapist may choose VRET as a means of avoiding having to practice with the client in real life, while on the other hand, a therapist may elect not to use VRET out of fear that it is too complex to use a VR system (thus, avoiding social exposure situations due to fear of technical challenges). In both cases, the efficacy of the patient's exposure treatment will be negatively influenced.

Implementing a virtual reality exposure system can be quite a challenge for therapists and clinics as different systems are available (Ma et al. 2021). The more advanced and elaborate the interactive system of the virtual environment is, the higher the costs will be. Generally, it can be concluded that the more elaborate virtual reality systems are more effective in the treatment of anxiety disorders than e.g. films, which are not interactive. With film, patients tend to describe the experience as 'watching a movie' instead of engaging in an exposure exercise. As there are yet no cost-effectiveness studies into the different systems of VRET, it depends on the financing system of each country whether and how VRET can easily be implemented.

Considering the potential of VRET with real-time interaction with the therapist via different avatars, it is a very powerful tool to use for first exposure steps in treating social anxiety and provides the therapist with the opportunity to monitor how patients do the exposure, to practice different levels of challenge, and—perhaps most importantly—to enhance the individual's confidence in managing exposure exercises.

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