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Immersive Therapy: The Impact of Virtual Reality on Cognitive-Behavioural Approaches in Phobia Treatment

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Abstract

Virtual Reality (VR) transforms the human-machine interaction into an active engagement, offering new perspectives, particularly in the field of psychotherapy. Cognitive-behavioural approaches, often challenged by the complexity and costs of scenarios, find a solution in VR by simulating meticulously controlled environments. This innovation allows patients to adjust the characteristics of virtual environments, facilitating their learning to cope with a variety of anxiety disorders, especially specific phobias. This article analyses the implications of VR in psychotherapy for various phobias, exploring the theoretical foundations of cognitive-behavioural therapies underlying these applications. The objective is to critically highlight the advantages and limitations of VR in the therapeutic context, drawing on recent pioneering studies.

Keywords: virtual reality exposure therapy, specific phobias.

* Introduction

Currently, virtual reality (VR) is redefining the dynamics of human-

machine interaction, transforming the user into an active participant rather than a simple observer in front of a screen. This promising development opens new perspectives in the field of psychotherapy, where practitioners are recently exploring the opportunities offered by VR. In particular, cognitive-behavioural approaches, often faced with the need to design complex and costly scenarios, find a solution in virtual technologies by simulating these situations, thus exposing patients to carefully controlled environments. Innovatively, patients can also adjust the characteristics of virtual environments, making it easier for them to learn to cope with the stress associated with these situations.

This introduction is part of an in-depth analysis, where we will examine not only the implications of VR in psychotherapy, but also the theoretical and methodological bases of cognitive-behavioural therapies that underlie these applications. The objective is to critically highlight the advantages and limitations inherent in the use of virtual reality in the therapeutic context, based on recent pioneering studies in the field.

*** Deciphering studies on exposure in VR: Illustrative case of phobias**

Experimentation and evaluation of the use of VR has primarily occurred in the context of treating phobias. A phobia is defined as an irrational fear, an obsessive and distressing apprehension without justification (APA, 2013). Due to their diversity, phobias generally manifest themselves recurrently in specific circumstances for a given individual. They are characterized by an excessive fear of objects, situations or bodily functions which, in reality, present no intrinsic danger and are not the real cause of the anxiety. Phobic behaviours encompass a multitude of objects. As examples, we will explore 5 types of common phobias: acrophobia (phobia of heights), arachnophobia (phobia of spiders), aerophobia (phobia of flying), agoraphobia (fear open spaces) and fear of speaking in public.

*** Acrophobia**

Acrophobia, or phobia of heights, is characterized by intense anxiety related to situations at altitude, often accompanied by a fear of falling. To treat this phobia, an innovative approach was studied by Hajjar (2020) at the University of Quebec en Outaouais. This study explores the use of virtual reality (VR) as a therapeutic tool, with particular emphasis on adding an exposure task not feasible in vivo, such as jumping into the void from a significant height.

The study aims to evaluate the effectiveness of VR exposure with a reality-challenging task compared to exposure alone, while examining whether the effectiveness of the intervention is influenced by the increase in effectiveness personal of the participant.

The study methodology involves the participation of 19 subjects randomly divided into two groups: a group performing a VR jump (n = 10) and a group without this task (n = 9). Participants followed five sessions including psychoeducation, cognitive restructuring, and VR exposure over two sessions of 120 minutes each.

The results of the study show that the group who performed the VR jump showed significantly more improvement in the behavioural avoidance test compared to the group without the jump. Furthermore, regression analysis suggests that perceived self-efficacy is a significant predictor of improvement on the behavioural avoidance test.

In conclusion, Alain Hajjar's study demonstrates that VR exposure, particularly with reality-defying tasks, may be a more effective approach to treating acrophobia. These results open up interesting perspectives for expanding the use of VR in the treatment of phobias linked to specific situations.

*** Arachnophobia**

Spider phobia, known as arachnophobia, is an intense and irrational fear of spiders. A key study conducted by Côté (2006) at the University of Ottawa looked at this phobia using VR as a therapeutic tool. The primary goal of the study was to understand the cognitive changes associated with arachnophobia through VR exposure. Involving 28 diagnosed participants, the study demonstrated significant improvement, positive changes in beliefs and reduction in avoidance, highlighting the innovative therapeutic potential of VR in the treatment of spider phobia.

*** Aerophobia**

Flying phobia, also called aerophobia, was the subject of two case studies aimed at evaluating the effectiveness of VR in psychotherapy. The first of these studies was carried out with a 32-year-old woman (North and North, 1994). The virtual scene used to treat his phobia represented an aerial view of a city. The therapy took place over eight sessions of thirty minutes each. The patient reported a high level of anxiety at the beginning of each session, followed by a gradual decrease. To assess the real-world benefits of VR, the patient was

presented with a real-life situation, flying over the beach on the Gulf of Mexico for ten minutes in the company of her therapist. Just like during the virtual reality sessions, the patient experienced strong anxiety at the start of the flight, followed by a rapid decrease to an acceptable level. Outpatient follow-up over several months conducted by a clinical psychologist confirmed the maintenance of symptomatic improvement in this patient (North et al., 1996a; North et al., 1996b; North et al., 1997).

The second case study was carried out with a 42-year-old man whose fear of flying significantly hampered his professional life due to his frequent travels. Accompanied by his therapist, he was placed in the cockpit of a flight simulator. The therapy took place over five sessions during which the patient was able to expose himself to anxiety-producing situations and experience various physical and emotional sensations. The introduction of VR in the first phase of psychotherapeutic treatment led to a significant reduction in anxiety, thus allowing the patient to cope with the phobogenic situation in the real world (North et al., 1996a; North et al., 1996b; North et al., 1997).

*** Agoraphobia**

The following experiment can be considered a pioneering study in evaluating the effectiveness of VR in the treatment of psychological disorders, particularly agoraphobia, defined as the fear of finding oneself in places or situations that are difficult to leave. (APA, 2013). Sixty participants were selected for this study, with thirty assigned to the experimental group and thirty to the control group. Only the experimental group was exposed to anxiety-inducing scenes in VR. The results demonstrated an improvement in symptoms among participants in the experimental group compared to the control group, including a reduction in avoidance behaviours in phobic situations. This study has been the subject of in-depth development in various publications (North and North, 1994; North et al., 1995a; North et al., 1995b; North et al., 1996c).

Along the same lines, research by Malbos, Mestre and Gellato (2008) aims to demonstrate the effectiveness of a therapy for claustrophobia using virtual reality (VR). Six participants suffering from claustrophobia were exposed to virtual environments simulating enclosed spaces.

The sample was selected from individuals diagnosed with claustrophobia according to DSM-IV

criteria. Six participants volunteered, diagnosed using the structured Mini-International Neuropsychiatric Interview. The therapeutic program consisted of eight sessions, the first including various components such as psychological education, relaxation and cognitive restructuring. Sessions 4 through 8 involved exposures to virtual environments.

Results indicated a significant improvement in claustrophobia and quality of life among participants after treatment. Questionnaires and behavioural tests revealed a notable reduction in anxiety related to confined spaces, an improvement in quality of life and a reduction in avoidance behaviours. These improvements were maintained at follow-up six months after the end of treatment. The results of the subjective evaluations highlighted that the participants felt real immersion in the virtual environment.

*** Fear of speaking in public**

Fear of public speaking is a major aspect of social phobia, characterized by persistent and intense apprehension when a person is in the presence of unfamiliar individuals who may stare or speak to them. The subject fears adopting embarrassing or humiliating behaviour (APA, 2013). We will examine here the first controlled study carried out on this pathology (North et al., 1998). Participants were recruited from Clark Atlanta University, and after an initial selection, six subjects meeting the criteria for social phobia were chosen and included in an experimental group matched to a control group composed of unaffected subjects. of social phobia. Members of the experimental group were unable to speak publicly, whether in class, in meetings, or during lectures.

For this study, a virtual auditorium was specially developed, including three rows of chairs that can accommodate more than a hundred people, as well as a wooden podium overlooking the audience. For a more realistic immersion, a speaker was activated during the sessions, allowing participants to hear the echo of their own voice. This approach now demonstrates that the use of elements, even fanciful, meticulously selected and cleverly orchestrated, promotes sufficient immersion to provoke reactions close to the behaviours observed in corresponding real situations.

As part of this innovative research, participants were equipped with headphones for a total "immersion" experience in the auditorium. Standing behind the virtual

podium, facing the audience, they had the opportunity, throughout the sessions, to experience different physical and emotional sensations, similar to those felt during in vivo exposures, such as tachycardia, pain chest, sweating, tremors, etc.

The results of this study focused on fear of public speaking report a significant reduction in anxiety and phobic symptoms among participants in the experimental group, compared to individuals in the control group.

There is also the study by Harris, Kemmerling and North (2002) which aims to evaluate the effectiveness of brief VR therapy in reducing anxiety related to public speaking in university students. Eight students received individual treatment with VR, while six students in the control group received no treatment. The sample was selected from beginning elocution students at a large university. The results, evaluated before and after treatment, showed a significant reduction in anxiety in the group that received VR therapy, confirming the effectiveness of this approach as a psychological treatment. The study also highlights the need for future research, particularly in younger populations, to assess the effectiveness of VR as an early intervention for speaking anxiety disorders.

*** CBT and VR exposure**

The integration of virtual reality (VR) into psychotherapeutic approaches finds a solid basis in the theoretical and methodological postulates of behavioural and cognitive therapies (CBT). These therapeutic methods are distinguished by their structured, brief, present-centered approach, focused on results expectations, and by their constant commitment to the evaluation of their practices, thus differentiating their approach from other intervention modalities.

The fundamental principles and techniques of behavioural therapies are mainly based on the conditioning model. In essence, they assume that the difficulties exhibited by patients are often learned and that it is therefore possible to unlearn them. According to the behaviourist perspective, many symptoms associated with psychiatric disorders can be attributed to or maintained through three broad categories of conditioning.

*** Classic Packaging**

Post-traumatic stress disorder provides a poignant illustration of this complex phenomenon. Let's imagine a patient who was the victim of an attack by a man. Eight days later, she experienced an anxiety attack on the subway, triggered by the presence of a

man next to her using the same aftershave lotion as her attacker. In the context of post-traumatic stress, the intensity of the shock is so profound that this type of reaction is frequently observed: all the stimuli present during the attack become associated with the anxious state felt at that moment. It is established that conditioning depends on the intensity of the triggering stimulus. Low-intensity stimuli require repetition to induce conditioning, while a single high-intensity stimulus, such as aggression, may be sufficient. Thus, post-traumatic neuroses can emerge following a single traumatic experience.

*** Operative Conditioning**

This mechanism finds significant application in understanding avoidance behaviours in phobic individuals. Let's take the example of a patient phobic of pigeons, who tends to flee when he encounters one. Avoidance of the anxiety-provoking object allows a reduction in anxiety (Wittchen, 1994). Escape behaviour is thus reinforced by the positive effects it generates, notably the reduction of anxiety (Mowrer, 1960). This behavioural pattern leads the patient into a vicious circle in which he becomes captive, because the more he avoids the distressing situation, the less he is able to confront it, and the more his anxiety regarding this situation increases (Mowrer, 1960). Phobics thus find themselves prisoners of their own behaviour, resulting in a refusal to go out or self-isolation, for example.

*** Social Conditioning**

Based on the principle that it is possible to learn a behaviour without having experienced it oneself, social conditioning is based on observing a person exhibiting this behaviour (Bandura, 1977). During the sessions, the therapist explains to the patient the behaviour he wants to see him adopt, taking advantage of the power of imitation and learning by observation. This approach offers an innovative way to reshape patient behaviours by providing them with positive models to imitate.

*** Exposure strategies**

Exposure strategies constitute an essential element at the heart of behavioural therapies, historically being among the first to be deployed and remaining of paramount importance to therapists due to their high effectiveness with patients. The fundamental principle of exposure is relatively simple and has particular application in the treatment of anxiety disorders: avoiding what arouses fear only increases and maintains that fear, whereas confronting the source of the

fear can, under certain conditions, reduce its intensity. There are strict rules guiding this confrontation. Exposure must be progressive, prolonged and exhaustive, following a carefully orchestrated graduation to gradually empower the patient. It is important to emphasize that poorly conducted exposure can worsen the anxiety response. Various types of exposures are offered to patients (Cottraux, 1994):

Systemic desensitization: the relaxed subject follows a hierarchical presentation of increasingly intense imaginary stimuli. He is invited to face in reality, desensitize situations (having lost their anxiety-provoking character).

In vivo desensitization: the relaxed subject confronts in stages the situation he fears in reality.

In vivo graduated exposure: the subject who is not relaxed, faces step by step, the situation he fears in reality.

Participation modelling: The therapist precedes the subject in the real situation, he serves as a model, then guides him and strengthens him in his confrontation of the situation.

Implosion (flooding): the subject is confronted in imagination with the anxiety-provoking situation at the maximum level of intensity until his anxiety disappears, lasting at least three quarters of an hour.

In vivo immersion: the subject is immersed in reality in the anxiety-provoking situation at the maximum level of intensity until his anxiety disappears, lasting at least three quarters of an hour.

*** The cognitive approach**

The cognitive approach has considerably enriched behavioural therapies by broadening their field of investigation from behaviours to "cognitions" (the contents of thought). This perspective, now widely integrated into studies exploiting virtual reality (VR) (Emmelkamp et al., 2001; Vincelli et al., 2003), is based on the concept of information processing. Indeed, when an individual receives information, he does not receive it passively, but rather interprets it, evaluates it and distorts it. Thus, in a given situation, an individual's behaviour depends as much on how he or she interprets the situation as on the situation itself. All the techniques aimed at modifying the patient's beliefs are grouped under the name of cognitive restructuring.

A schematic representation of cognitive restructuring is often presented to patients, particularly those suffering from depression. A concrete example is offered to them: the patient

meets someone he knows in the street; this person does not greet him or say hello. How does he react? What does he feel? What's he saying? In particular, a depressed patient often explains that this situation impacts his morale, reinforces the idea that he is not loved, and is convinced that the other has deliberately chosen not to greet him, perhaps expressing a lack to want to greet him, etc. The patient is then encouraged to think about the factors triggering his distress in such a situation: is it the situation itself or the interpretation he has made of it? Would he have reacted the same way if he had known that the other had not seen him or if he is very nearsighted, for example? These examples, taken from the patient's world, aim to demonstrate the importance of the subjective aspect in their experience.

*** Interest and limits of the use of VR in psychotherapy**

The use of VR in psychotherapy is of significant interest, particularly in the context of behavioural and cognitive therapies which offer a variety of exposure techniques. Some patients have difficulty imagining anxiety-provoking scenes, particularly when they have to face them in reality (in vivo exposure). Avoidance often becomes a preferred strategy, helping to reduce anxiety and cope more easily with embarrassing situations, such as public speaking for social phobic patients, for example.

The employment of VR in psychotherapy is emerging as a promising tool to overcome the challenges associated with traditional treatment approaches. VR offers original support to patients who have difficulty imagining certain scenes or who are too phobic to experience these situations in reality. Under the immersion of VR, patients often feel safer compared to in vivo exposure, even if the virtual scenes seem more realistic to them than those offered during systematic desensitization.

Although VR is increasingly popular in psychotherapy, it is crucial not to neglect its complexity and the potential risks associated with its use. Stanney (1995) points out that VR is contraindicated for patients suffering from panic attacks, with serious medical problems such as epilepsy, or in those under the influence of toxic substances, therefore North et al (1998) made specific recommendations for therapists using VR, including:-

1- The patient should begin the VR exposure sitting in a chair rather than standing.

2- The use of an immersion helmet is essential, allowing the patient to see their body, even partially.

3- Exposure therapy sessions should be fragmented, with breaks between each 20-minute segment. We pause for a period of time, then resume exposure for 15-20 minutes before taking another break, as exceeding this duration could result in physical symptoms of malaise and dizziness in the patient.

These suggestions aim to strengthen patients' feeling of physical and psychological safety during virtual reality exposure sessions.

Cognitive-behavioural therapies benefit from the many possibilities offered by VR. Guided by the therapist, the exploration of virtual scenes promotes the induction of a state of relaxation in the patient, thus demonstrating positive results. Immersion in virtual reality allows the patient to live an experience in a more realistic way than if he or she simply imagined it (Vincelli and Molinari, 1998). With this in mind, VR becomes a flexible tool, allowing precise control of the intensity and frequency of the stimuli to which the patient is exposed. The use of virtual reality offers the possibility of fine-tuning situations, instantly interrupting stress exposure, discussing modalities and resuming the course of therapy, all from the therapist's office. This prevents the patient from putting themselves in a public situation while preserving the necessary confidentiality.

However, although VR is a fascinating advance, it has in no way altered the theoretical (behaviourist and cognitivist) and methodological foundations on which therapy using virtual reality is based. Nor has it eliminated the essential role of the therapist in the treatment process. On the contrary, it seems to have strengthened the therapeutic alliance between the patient and the therapist, favouring an even closer collaboration (Vincelli, 1999).

It is important to emphasize that making virtual reality a psychotherapy in its own right would neglect the special relationship that develops between the therapist and the patient. Virtual reality must be integrated, at a specific moment, into the overall process of psychotherapy.

*** Conclusion**

In conclusion, the rapid development of VR has opened up new and exciting perspectives in the field of psychotherapy, especially for the treatment of anxiety disorders. The reviewed studies, focused on specific phobias, attest to the effectiveness of VR as a therapeutic tool, offering promising results in the systematic desensitization and management of anxiety disorders.

However, although VR has undeniable advantages, its integration into psychotherapeutic practice must be carefully considered. The practical and ethical implications must be carefully evaluated, and the use of this technology must be subtly adjusted to meet the individual needs of each patient. It is essential to emphasize that, despite technological advances, VR can never replace the fundamental therapeutic relationship between the mental health professional and the patient.

VR should not be seen as a stand-alone solution, but rather as an enriching complement to the existing psychotherapeutic process. Its judicious integration, carried out collaboratively between therapist and patient, can provide added value by enabling controlled virtual experiences for the treatment of phobias. Thus, VR broadens the range of therapeutic tools, but its use must remain anchored in the theoretical and methodological principles of behavioural and cognitive approaches. In the pursuit of innovation, it is crucial to maintain the balance between the technological advantages offered by VR and the continued need for authentic and empathetic human interaction.

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