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Mini Review

Is Almost being There Enough? The Application of Virtual Reality in Cognitive-Behavioral Therapy

Mitchell G Jomsky[1,2] and Nicholas A Kerna[3]*

[1]*University of Health and Humanities, Tortola, BVI*

[2]*University of Science, Arts and Technology, Montserrat, BWI*

[3]*SMC Medical Research, Thailand*

***Corresponding Author**: Nicholas A Kerna, POB47 Phatphong, Suriwongse Road, Bangkok, Thailand 10500. Contact: medpublab+drkerna@gmail.com.

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Preface

Howard ("Howie") Mandel is a popular Canadian actor, comedian, and television personality, most notably known as a judge on the hit television show, *America's Got Talent*. In addition to being a well-known actor, he is also a self-proclaimed "germaphobe" (fear of germs). He has a lesser-divulged fear of heights (acrophobia). To address this acrophobia, Mandel experienced his first treatment session with cognitive-behavior therapy (CBT) augmented with virtual reality (VR) during the June 25, 2019 airing of *America's Got Talent*. Two Italian psychologists employed a "green screen" and had Mandel wear VR goggles as he virtually walked a tight rope suspending high over a canyon to save a person virtually hanging from the tight rope seemingly in peril of falling to a dramatic death. During his virtual rescue mission, Mandel appeared "definitely freaked out". Nevertheless, later admitting, he was impressed with the technology [1].

Keywords: *Acrophobia; Cognitive-Behavioral Therapy; Computerized CBT; Exposure Therapy; Phobia; Virtual Reality*

Abbreviations

CBT: Cognitive-Behavioral Therapy; CCBT: Computerized CBT; ET: Exposure Therapy; VR: Virtual Reality; VRET: Virtual Reality Exposure Therapy

Background

Having a patient or subject "face" or confront a fear or anxiety is a hallmark of cognitive-behavioral therapy (CBT). Exposure therapy (ET) or desensitization has been used to help patients by taking small steps towards overcoming their specific phobias or anxieties. Exposure therapy works by gradually increasing the level of exposure to a fear, which allows the patient to gain control over their phobia progressively. As the treatment progresses, the patient typically feels less anxious about their phobia [2].

Discussion

Traditional CBT

In a case of acrophobia or fear of flying (aviophobia), a CBT practitioner may set the stage by having the patient read about airplane safety, watch videos of airplanes, and take a trip to an airport to observe airplanes taking off and landing. Later, the therapist may have the patient board a plane for a flight. However, this process can be lengthy and costly [3].

Computerized CBT (CCBT)

Computer technology can be used to lessen the cost and duration of therapy in this computer-enhanced exposure therapy. In 2016, a web-based commercial program, called FearFighter™, was used successfully for specific phobias by some UK therapists. FearFighter™ (available on the App Store) is an online computerized cognitive-behavioral therapy (CCBT) program designed to treat panic attacks, agoraphobia, and other phobias using psychoeducation, cognitive restructuring, interoceptive and *in vivo* exposure exercises, applied relaxation, restructuring of maladaptive schemas, and relapse prevention. FearFighter™ utilizes interactive exercises and multimedia content, as well as text on screen [4].

FearFighter™ is demonstrating some treatment success but has specific constraints and limitations in its application. However, with newer advances in technology forthcoming that will make better use of VR, there will likely be enhanced efficacy and broader applications. Currently, VR's primary limitation is in the technology of the glasses or goggles.

Primitive virtual reality

Horror film fans of old are most likely familiar with anaglyph glasses—the cardboard specs with one blue lens and one red lens (Figure 1). These anaglyph glasses worked by filtering out the cyan and magenta, respectively, thus "fooling" the brain to see a projected image as if it were in three dimensions or 3-D, rather than the typical two-dimension perception without them. Horror moviegoers of the 1950s and 1960s would shriek in terror and duck out of the way as objects appeared to be coming at them from out of the screen. The following depictions show some variations of the anaglyph glasses, that visually tricked viewers in prior years.

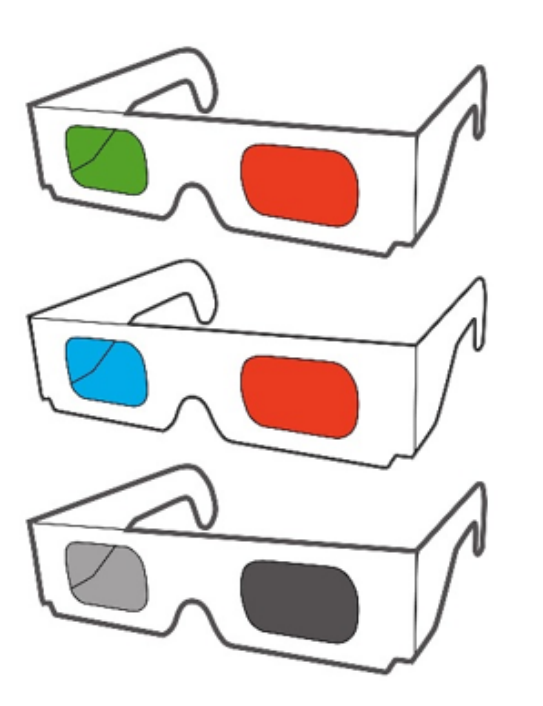

Figure 1: *Three variations of anaglyph glasses used to create an illusion of 3-D viewing. Note. Courtesy of needpix.com.*

Present-day virtual reality

Today, this rudimentary virtual reality is virtually extinct due to advancements in optics and movie production techniques. In today's digital world, these optical advancements have broken new barriers. VR glasses can manipulate, deceive, and alter the brain's optical activity more effectively.

As advanced technology is invented and designed for a specific purpose, the application of that novel technology expands into other fields. Such is the case with virtual reality with its application in the military, entertainment, and other areas. Now, it is being applied in psychiatry as shown by Geraets, *et al.* (2019):

- Patients with generalized social anxiety disorder (SAD) avoid various social situations and can be reluctant to engage in *in vivo* exposure therapy. Highly personalized practicing can be required before patients are ready to perform *in vivo* exposure. Virtual reality-based therapy could be beneficial for this group.

- This uncontrolled pilot study demonstrates the feasibility and treatment potential of VR-CBT in a difficult-to-treat group of patients with generalized SAD. Results suggest that VR-CBT may be effective in reducing anxiety as well as depression and can increase quality of life [5].

The feasibility of this novel application was corroborated by Lindner, *et al.* (2019):

- Virtual reality exposure therapy (VRET) is an efficacious treatment for fear and anxiety and has the potential to solve both logistic issues for therapists and be used for scalable self-help interventions. However, VRET has yet to see large-scale implementation in clinical settings or as a consumer product, and past research suggests that while therapists may acknowledge the many advantages of VRET, they view the technology as technically inaccessible and expensive. We reasoned that after the 2016 release of several consumer virtual reality (VR) platforms and associated public acquaintance with VR, therapists' concerns about VRET may have evolved [6].

According to Donker, *et al.* (2019): "A low-cost fully self-guided app-based virtual reality cognitive behavioral therapy with rudimentary virtual reality goggles can produce large acrophobia symptom reductions. To our knowledge, this study is the first to show that virtual reality acrophobia treatment can be done at home without the intervention of a therapist" [7].

Side effects of virtual reality

Some adverse of a patient using VR can be the inability to focus, dry eyes, nausea (motion sickness), vertigo, and seizures, as well as eye muscle weakness in accommodation. However, most of the side effects of VR will correct immediately after the person disengages from the device.

According to Gent (2019), "modern VR headsets achieve the illusion of depth by presenting each eye with a slightly different image on a flat-screen. This means that, no matter how far away an object appears, the eyes remain focused on a fixed point, but they converge on something in the virtual distance" [8] (Figure 2).

Gent explored the safety of VR goggles and summarized how the normal vision process is altered in virtual reality. In the normal state (non-VR), when looking at an object, both eyes first point at the object, which is termed vergence. For closer objects, there is more convergence of both eyes. Depending on the distance of the object, both lenses focus by a process called accommodation. When an

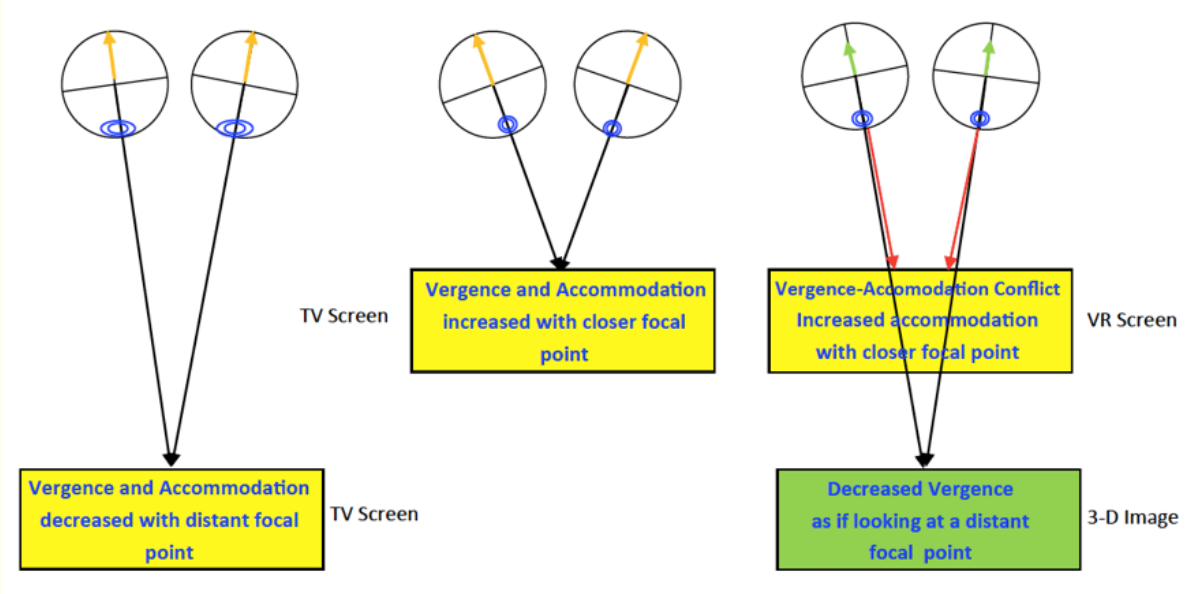

Figure 2: *Diagram depicting the vergence-accommodation conflict. Note. Image by Mitchell G Jomsky (2020).*

object is closer, accommodation increases. Vergence and accommodation work in concert assisting the brain in processing an image and determining the depth of field. More convergence and accommodation signals the brain that an object is closer; conversely, less convergence and accommodation signals the brain that an object is farther [8]. Gent also indicated the following:

- Another issue with VR is the so-called vergence-accommodation conflict. Modern VR headsets achieve the illusion of depth by presenting each eye with a slightly different image on a flat screen. This means that, no matter how far away an object appears, the eyes remain focused on a fixed point, but they converge on something in the virtual distance. [8]

This mismatch of increased accommodation and decreased convergence that can occur in virtual reality may be the cause of nausea and eye strain that some wearers suffer after the prolonged use of VR goggles or headsets.

Conclusion

The Howie Mandel experimental therapy demonstrated to the television public that cognitive-behavioral therapy could be augmented with virtual reality. Some studies have suggested that VR-augmented CBT, CCBT, or VRET may be more effective than CBT alone, and may prove less costly to the patient in the long term. As technology advances, virtual reality may become a vital tool in the treatment of specific psychiatric disorders (e.g., phobias) in the clinical setting as well as prescribed for home use, while being mindful of any non-reversible side effects that may occur in its long-term application. In the case of virtual reality-augmented cognitive-behavioral therapy, "almost being there" (in virtual reality) seems better than not being there at all.

Conflict of Interest Statement

The authors declare that this paper was written in the absence of any commercial or financial relationship that could be construed as a potential conflict of interest.

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