Chapter 7

Virtual and Augmented Reality: New Frontiers for Clinical Psychology

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Additional information is available at the end of the chapter

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Abstract

In the last decades, the applied approach for the use of virtual reality (VR) and augmented reality (AR) on clinical and health psychology has grown exponentially. These technologies have been used to treat several mental disorders, for example, phobias, stress-related disorders, depression, eating disorders, and chronic pain. The importance of VR/AR for the mental health field comes from three main concepts: (1) VR/AR as an imaginal technology, people can feel "as if they are" in a reality that does not exist in external world; (2) VR/AR as an embodied technology, the experience to feel user's body inside the virtual environment; and (3) VR/AR as connectivity technology, the "end of geography'. In this chapter, we explore the opportunities provided by VR/AR as technologies to improve people's quality of life and to discuss new frontiers for their application in mental health and psychological well-being promotion.

Keywords: virtual reality, augmented reality, cybertherapy, clinical psychology, advantaged technology

1. Introduction

Clinical psychology is generally perceived as a face-to-face interaction between therapist and patient. However, thanks to technology developments, this picture has been changed. The massive innovation of Information and Communication Technologies (ICTs) has brought a revolution to the view of psychology and also the way how psychotherapists work [1]. Especially, the application of virtual reality (VR) and augmented reality (AR) has given an important contribution to mental health.

In the last decades, a growing number of studies have shown important implications of the use of ICTs for treating several disorders and promotion of well-being. Initially, most of these studies have focused on treating anxiety disorders [2], phobias (e.g., specific phobias, social phobia, agoraphobia) [3], posttraumatic stress disorder (PTSD) [4, 5], eating disorder [6], addiction to nicotine or alcohol [7, 8], among others. Furthermore, VR and AR have been used not only for clinical intervention but also for promoting healthy lifestyles or well-being, for example, the reduction in stress [9], treatment of pain in oncology patients [10], or pain management for variety of known painful medical procedures [11]. In all these studies, the use of these ICTs has supported psychotherapists and researchers to reach the best results for patients. Thanks to the technological advances, it is possible to reproduce virtual environment where people can move as they are in the real world [12], or having some mobile applications which can enlarge the world around us and facing specific phobia [13]. But for professionals, it is not always an easy work because the use of ICTs usually implies that psychologists have to open their mind and co-work with engineers and other professionals who have different backgrounds. Psychologists and engineers have to find a way to cooperate and to integrate their knowledge, a cooperation that till now has changed society exponentially.

In this chapter, we review some of the most important advances in this field and how technology can (or could in the future) support clinical psychology. The aim is to explore the opportunities provided by VR and AR as technologies to improve people's quality of life and to discuss new frontiers for their application in mental health and psychological well-being promotion.

2. What is cybertherapy?

Cybertherapy is the branch of psychology that uses ICTs to induce clinical change [1]. It is also defined as the use of advanced technologies, such as virtual or augmented reality, as an adjunct to traditional form of therapy. Cybertherapy is quickly becoming an accepted and validated method for the treatment of many different health care concerns. It occurs because technology supporting "cybertherapy" provides visual and auditory stimulus that may be otherwise difficult to generate, and it can support and motivate performance, as in rehabilitative exercises [14]. Also, other ICTs are becoming increasingly common in clinical psychology. It is generally agreeing that innovative e-therapy approach is an opportunity for earlier and better care for the most common mental health problems. E-therapy approach allows the patient to engage in treatment without having to accommodate the office appointment, often reducing other limitations in face-to-face treatment [15].

These advances come from the role of telemedicine and e-health. Telemedicine has been defined as the use of telecommunication technologies to provide medical information and services. The defining aspect of telemedicine is the use of electronic signals to transfer information from one site to another. It can be useful for situations in which physical barriers prevent the ready transfer of information between patients and health care providers, and the availability of information is the key to proper medical management [16].

Since 1988, Norwegian Telecom Research has initiated and developed several telemedicine applications; the applications were adopted to exchange medical results from clinical chemistry to interactive radiology consultations. All the applications have a common goal to improve efficiency and quality of health care. One of the basic ideas of telemedicine can be expressed by the saying: "Move the information, not the patient" [17]. Indeed, one of the first telemedicine programs was proposed by rural practitioners who required access to certain type of medical services [17].

According to Eysenbach, e-health interventions are defined as treatments, typically behaviorally based, that are operationalized and transformed for delivery via the Internet [18]. A branch of e-health is e-mental health, or Internet-based therapy, in which electronic equipment and therapeutic communication converge. E-mental health can be defined as using ICTs to put patients and mental health professionals in contact; to conduct diagnosis or treatment; to disseminate information; or to conduct research studies or any other activity related to mental health care [19]. The online services include email, discussion lists, chats, or audiovisual conferencing, but also computerized treatments.

The main advance of online therapy is that it can reach people who might not otherwise seek therapy, such as disabled people or those who live in remote areas; it also reduces the contact time between therapist and patient [20]. Today, it is possible to make counseling through Internet, avoiding the face-to-face communication. It does not mean that human interaction disappears, and on the contrary, it faces relevant obstacles such as geographical distance, timetable, and emotive aspects that prevent patients to seek for a psychological therapy [17].

Mohr and colleagues [21] brought the e-health to a forward step. Mohr underlines the "behavioral intervention technologies" where technologies, such as telephone, videoconferencing, and web-based interventions, are integrated with other advanced technologies such as sensors for monitoring, social media, VR, and gaming, promoting e-mental-health interventions. From this perspective, e-mental-health not only provides new delivery media for mental health treatments, but opens the possibility for entirely new interventions. For example, mobile technologies can harness sensors and ubiquitous computing to provide continuous monitoring and/or intervention in the patient's environment. VR creates simulated environments that afford a high degree of control in engineering the provision of therapeutic experiences. Gaming may provide teaching methods that are more engaging. These opportunities may also challenge and expand the limits of the knowledge regarding human behavior processes [18].

After this overview, we can consider cybertherapy as a ramification of e-mental health. It includes all those kinds of treatment done through interactive and immersive technologies such as virtual and augmented reality where people get involved in the "digital" environments. As mentioned, cybertherapy has been used to treat psychological conditions such as anxiety disorders and phobias, eating disorders, autism, substance abuse and addiction, to reduce pain and discomfort perceived during unpleasant medical treatments, to manage stress, to administer exercises for cognitive rehabilitation (e.g., memory and attention disorder), and so on [22]. Evidence has shown that cybertherapy outcomes are comparable with those obtained through therapy protocols that are not supported by technologies [23], with some additional advantages that may make cybertherapy a preferable option. The most obvious

advance is that the mediated environment allows patients to experience situations, to display stimuli, or to provide feedback of the patient's action that in vivo would be not controllable (e.g., crowd behavior), not feasible (e.g., scenario variation to improve transfer of skills), or unavailable (e.g., an iced world mitigating pain during medical treatment from severe burning) [22]. In addition, the use of mediated environment minimizes implementation failures because a mediated environment embeds the administration manual: standard task instruction and explanations, organizations of stimuli into subsequence treatment steps, and setting options for personalized treatment. As Botella and colleagues have pointed out [22], the use of ICTs in delivering a psychological therapy allows treatment to reach people in critical conditions, to improve persistency, ubiquity, anonymity, and multimodality of an intervention, as well as the ease with which data can be stored, accessed, and manipulated.

Cybertherapy can adopt different formats: from totally self-guided to more blended, including the presence of the therapist in different graduations, and the protocol can also include other treatments in addition to the virtual one [24].

In technical terms, hardware and software are combined into cybertherapy to achieve the final therapeutic goals. The software content embeds and makes concrete abstract scenarios, imagined situations, feared objects, subjective symbols, and meaning. The hardware shapes the way in which those contests are experienced, whether in isolation from the surrounding or merged with them and whether involving the body in a natural interaction with the environment or mediating the interaction with input devices [25].

As we said before, cybertherapy includes different types of technologies. Now, we focus on two of them: VR and AR.

2.1. Virtual reality in cybertherapy

VR is a collection of technologies that allow people to interact efficiently with 3D computerized database in real time using their natural sense and skills [26]. In terms of behavioral science, VR has been described as an advanced form of human-computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion [26]. VR has emerged as a potentially effective way to provide general and specialty health care services and appears poised to enter mainstream psychotherapy delivery.

Where does the use of VR in cyberpsychology come from? The pioneering work by Watson demonstrated, contrary to the dominant Freudian theories of psychology, that it was possible to stimulate phobias in a laboratory environment. The little Albert experiment provided empirical evidence of classical conditioning in human. Few years later a study was conducted with the patient named Peter [27]. The therapist treated his rabbit phobia with classical condition model: a pleasant stimulus (food) was presented simultaneously with the rabbit. This case illustrated how fear may be eliminated under laboratory conditions. The study was a pioneer which introduced evidence-based psychological procedures to the field of psychological treatment through the application of "exposure therapy" [22].

The rationale behind VR use to help exposure technique is simple: in VR, the patient can be intentionally confronted with the feared stimuli while allowing the anxiety to attenuate. What distinguishes VR from other media or communication systems is the sense of presence. What is "presence"? Generally, the sense of presence has been defined as a mental state in which a user feels that he/she is being there, in the computer-mediated environment [28]. These characteristics of VR offer a number of advantages, as we explain below, over in vivo or imaginal exposure [26].

Since the early 1990s, when Hodges and colleagues [26] reported that the use of virtual environment can provide to acrophobic patients the feeling of heights in a safe situation, VR exposure therapy has been proposed as a new medium for exposure therapy [29]. In the past decade, numerous studies have tested the efficacy of VR. Review and meta-analysis [30] studies show how VR therapy works more effectively than imaginal therapy (visualization) and as effectively as in vivo exposure therapy [31].

To give a clearer idea about the intervention trough VR, we explain below the intervention for people with flying phobia made by Botella and colleagues [32]. The program includes three virtual scenarios: (1) living room: here, the participant can perform some activities usually associated with the days or hours before the flight: pack, listen the TV news about the weather, and take his/her ticket for the check-in; (2) airport: the time before flight is simulated. The participant can listen and see on the monitor for the announcement of boarding pass, knowing that his flight is near, and listen to other people talking about the flights. It is also possible to see and hear planes landing and take-off. At the end, participant can enter into the virtual airplane scenario; (3) airplane: the participant is sitting on the plane and can experience take-off, flight, and landing in different conditions (turbulences, storm, etc.) Through the previous virtual environment description, it is possible to figure out how much VR reflects the reality.

VR offers several advantages as new options to patients who are unable to utilize imaginal therapy due to difficulties engaging with a situation, or who are resistant to in vivo treatment due to extreme anxiety. It is recognized that there is a large percentage of population (over 80%) that cannot visualize effectively. In addition, many of those suffering from anxiety do not feel that they can approach their feared situation in real life [22].

In addition, VR has an advantage to create safe virtual world where the patient can explore and experience "new realities"; this feeling of safety is essential in therapy, so that the patient can act without feeling threatened. Moreover, in VR, information can be presented gradually, in such a way that the patient can progress from easier tasks to more difficult one. This work in the virtual world helps patients master the strategies need to overcome their fears and limitations in the real world. Furthermore, as VR goes beyond space and time, researchers do not have to wait for specific events to occur. Rather, they can simulate them whenever appropriate for the patient and the therapy process [26].

In summary, VR protocols can offer to clinicians and researchers a practical tool to support the clinical tasks (assessment and treatment) in ecologically valid, safe, and controllable environments [33].

2.2. Augmented reality in cybertherapy

AR is a modification of VR which includes a combination of both real and virtual elements. The most significance aspect of AR is that the virtual elements add relevant and helpful input to physical information available in the real world. User can see images that blend both "real-world elements" and "virtual elements" that have been introduced by the system [13].

As is explained in **Table 1**, there are differences between AR and VR. The first difference is the immersion of the user inside the system. VR achieves an involved environment for the user and perceptive channels such as vision and sound are controlled by the system. Contrarily, the AR system complements the real world being necessary that the user maintains his/her sense of presence in that world. AR has a mechanism that combines the real and the virtual scenes that is not present in VR settings. In the AR system, the virtual objects generated by computer must be completely fused to the real world, in all of the dimensions.

In few words, while VR immerses fully the user in the entire virtual environment, AR permits the user to see the real world, with the important difference that virtual object merges with actual ones in a composite image [34]. According to Milgram and Kishino [35], AR is a form of mixed reality, that is, a particular subclass of VR-related technologies that, via a single display, expose the user to electronically merged virtual and nonvirtual elements.

AR has been used in various fields such as education and teaching [36], medicine and surgery [37]. However, AR applications for psychological treatment are still scarce and address mailing phobias [33]. Preliminary data show the utility of the system for the treatment of insect phobia [13]. Below is described a study for cockroach phobia to underline how AR system works in therapy (**Figure 1**) [13].

AR-cockroaches system was developed using a proper engineer software. It uses computer vision techniques in order to obtain the position and orientation of the camera with respect to

Area	Virtual reality	Augmented reality
Immersion	User is completely immersed into the virtual environment	User can see their own body in context
Point of view	Egocentric and allocentric	Allocentric
Sense of presence	Feel inside the virtual world	Keep feeling inside the "real" world
Environment	Substitutes the existing environment with the virtual one	Uses virtual elements to build upon the existing environment
User experience	Generates new experience	Enhancing the experience
Time study	Since the beginning of twentieth century	Since the last few years
Cost	Higher	Lower

Table 1. Principal difference between VR and AR in clinical psychology.

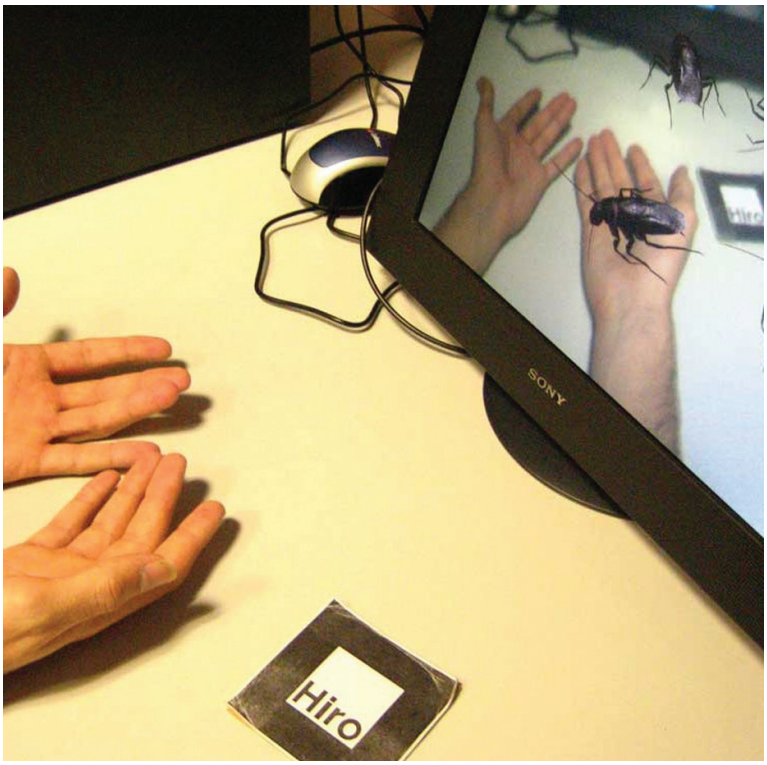

Figure 1. Cockroach AR system. *Labpsitec, Universidad Jaume I, Spain.*

markers. When the camera found a marker in the real world, the program recognized it and activated the feared virtual environment (cockroach). The virtual insect that virtually appears in the hands of participants (cockroach in this case) looks real thanks to a peculiar AR technology. The therapist can watch the virtual stimuli presented to participants during the exposure session in the monitor and can control the application using computer keys (number of cockroaches, movement, size, etc.). All of these combined cockroach's options enable the therapists to apply the treatment progressively [13]. This aspect put focus on the main advantages of AR as it was figured out also in VR: the feeling of safety [22]. In AR, it is possible to modify the virtual elements through the participant consent which reduces their rejection for therapy.

AR offers additional advantages: it can provoke great feeling of presence because the environments and the tools with which the participants interact are real. In AR, the users can see their own body in the environment and interact with the fearing stimuli; in addition, the system allows patients to use real elements and their own hands and body to interact with stimuli.

These pioneer studies show that AR can be a very important alternative treatment for phobia and might be useful for other psychological disorders.

3. The key concepts of virtual and augmented reality for clinical psychology

The artificial environment generates from virtual and augmented reality is closer to daily life people. That is why virtual environment can be considered as an "ecological laboratory" where behaviors, feelings, and human experience can be studied in a controlled and rigorous way [38].

Virtual and augmented reality can improve some aspects of available treatments [33]. As mentioned, the ecological validity of the assessment could be even better than "in vivo" therapy. First, with AR and VR, the therapist has total control over the virtual situations and elements in the computer program, such as the generation of stimuli, including their order of appearance and their quantity. Second, they can make patients feel more secure during therapy because outcomes that they fear will happen in the real world cannot happen in AR and VR (without consent and planning). For example, the therapist can expose a patient to a virtual elevator and assure him/her that it will not break down, or can expose a patient to a flight with no turbulence. As the patient progresses, the therapist can plan more difficult exposure tasks. Third, AR and VR enable easier access to threatening stimuli. This efficacy is significance because it is not always easy to obtain real elements such as cockroaches or spiders as needed for therapy [22]. In other works, it could be assumed that VR and AR can have numerous applications in the field of psychological treatments. According to Riva [26], these advantages position VR as an "intermediate step between the therapist's office and the real world."

We focus the future perspective of VR and AR on three main aspects which contribute to increase their efficacy and affectivity in clinical psychology. As we described below, VR and AR could be considered as imaginal technology, embodied technology, and connectedness technology.

3.1. Imaginal technology

Mental imagery refers to perceptual experience in the absence of sensory input, commonly described as seeing with the "mind's eyes" or "hearing with the mind's ear" [39]. It is different from perception which occurs when information is directly registered from the senses. Mental imagery is described also as the simulation or recreation of perceptual experience across sensory modalities [40]. Pearson [40] has marked two different routes by which mental imagery can be created within consciousness. First of all, an image can be created directly from immediate perceptual information. For example, someone can look at a picture of a horse, create a mental image of the picture in their mind, and then maintain this mental image as they look away or close their eyes. Second, an image can be created from previously stored information hand in long-term memory. For example, someone can hear the "horse" and then create mental imagery based on their previous experience of what a horse look like.

Imagery has been used frequently in psychotherapy, since the interpretation of dreams by Freud [41]. Today imagination plays a particular role in influencing the key characteristics of mental disorders [41]. This aspect is present especially in patients with PTSD which suffer of

intrusive imagines, flashback, or sensory memories about their traumatic events [42]. In PTSD, the term flashback is used to describe an intense period of dissociation where patient feels that is reliving a traumatic event [42]. Flashback-type mental images have also been identified in other psychological disorders such as social phobia [43], agoraphobia [44], bipolar disorder [45], and also in depression, which is associated with verbal- and imaginative-based process, such as negative rumination. Actually, 90% of depressed patient report distress intrusive memories of past experiences [46].

Holmes underlines that mental imagery acts as an amplifier of emotional effects [46]. In fact, imagery has the power to hijack attention (most obviously by flashbacks) further away from the external world, making the internal cognitions more believable and associated emotion more powerful. Amplified anxiety states consequently affect behavior by the avoidance of anxiety-related triggers, for example, the avoidance of crowded places in agoraphobic anxiety [44]. Other important aspects are that mental imageries are capable to induce learning and to promote behaviors. Thanks to mental exposure and its future desensitization, people can face fear situations and learn positive behaviors [44]. All these characteristics including learning, emotional responses, changing behavior, and physiological responses could be translated to VR field. VR can develop simulative environments which are acceptable from the view point of sensory evidence. In fact, VR can be considered as an advanced imaginal system and an experiential form of imagery that is as effective as reality in inducing cognitive, emotional, and behavioral responses [44]. For that reason, VR exposure therapy has been used in contemporary clinical practice with a strong evidence base for treating psychological disorders, such as described previously in this chapter.

There is an increasing evidence that VR exposure is more efficacious than treatment using mental imagery simulations. First of all, the imagination usually decays rapidly. The mental image remains in our mind for approximately 250 ms. [46]. In VR, this risk is not present because the patient is involved into the environment without the need to evoke any imagination. Moreover, imagination of previous events needs a good memory and sometimes is not trustful [22]. For example, during an assessment with PTSD, therapist asks patients to think about a traumatic event. Sometimes patients fall in this task because memories are not clear. In VR, patients are already involved into traumatic event, which gives them the possibility to relive the traumatic experience and to face it.

Another important role of VR is to induce positive emotions through positive virtual environments [47]. It is common that relaxing imagination is useful to eliminate stress or negative thoughts from our mind. Thanks to virtual environment, it is possible to involve people into a specific environment to reduce their level of stress (e.g., virtual island [9]).

To summarize, VR gives an experience that is able to reduce the gap between imagination and reality and to go over memory limits increasing the efficacy and effectiveness of psychotherapy.

3.2. Embodied technology

As we have seen, most VR applications have been used to simulate external reality [48]. In fact, in VR it is possible not only to experience synthetic environment as if it is "our surrounding

world," but also to experience synthetic avatars as if they are "our own body." VR can be defined also as an "embodied technology" for "its ability of modifying the feeling of presence" [49]. People's representations in the virtual world are usually named avatars, and for the first time in human history, they could allow us to watch ourselves being others and doing something they have never done [49].

Following the point, VR as an "embodied technology" can be useful to alter the body's bounds and to study the relationship among body (posture, movements, actions) and cognition and emotions. Moreover, virtual avatars can help to amplify the "modeling" learning, and therefore to promote the learning of adaptive behaviors.

For instance, literature points out that [50] the sense of embodiment is principally based on three main aspects: sense of self-location, sense of agency, and sense of body ownership [50]. *Self-location* is a determinate volume in space where one feels to be located. Normally self-location and body-space coincide in the sense that one feels self-located inside physical body. This collocation can break down when people have an out-of-body experience in which they perceive themselves outside of their physical body. The *sense of agency* refers to the sense of having a global motor control, including the subjective experience of action, control, intention, motor selection, and the conscious experience of will. The development of agency depends on the synchronicity of visual motor correlations, for example, the imagination of a tool that touches my hand and the real touch of the hand. The *sense of body ownership* refers to one's self-attribution of the body. It has been proposed to emerge from a combination of bottom-up and top-down influences. Bottom-up information refers to the afferent sensory information that arrives to put brain from our sensory organs; top-down information consists of the cognitive process that may modulate the processing of sensory stimuli, for example, how much the avatar in VR is similar to real person (this aspect depends most of the time on the graphic computer quality). In fact, the illusion of ownership diminishes when the external object does not resemble or is in a different spatial configuration to the real body [51].

Experimental manipulation of the embodied experience is problematic. However, the use of VR has unique advantages to control the factors associated with the embodied experience. For example, VR makes possible in a relatively easy manner the manipulation of the body representation in terms of structure, morphology, and size, dissociating the egocentric visual perspective from the body, and exploiting the role of multimodal information in spatiotemporal term for body perception [52].

For instance, Slater's study embodied participants alternately in two virtual bodies such that they could have an extended conversation with themselves. In the study, one body represented themselves and the other represented Dr. Sigmund Freud with whom they would discuss a personal problem. While embodying their own body (lookalike) representation, they described the problem. They then transfer to the counselor body and, from that perspective, saw and heard their lookalike body describing the problem, and then gave some insight into how the problem might be solved. They would then transfer back to their own lookalike body and look at and listen to the counselor body giving them the advice, and then respond to it. If they chose to, they could then once again see and hear this response from the perspective of the counselor body and again respond to it. This process of switching between the lookalike and counselor

body continued until the participant decided to stop. Results showed high level of sense of embodiment [52].

Other recent studies have also proved how changing the perspective, and living experiences from other bodies, can help us to promote empathy, and even compassion and self-compassion. For instance, Salter's group has analyzed how the use of virtual bodies can promote compassion and self-compassion. They have analyzed the effects of self-identification with virtual bodies within immersive VR to increase self-compassion in persons with high self-criticism and depression [53]. The same author and his colleagues investigated also how embodied, in VR, a black avatar decreases the racial prejudice [54]. Moreover, Bailenson's group has studied how embodied an avatar in VR can make us better people. For example, participants embodied a Superman avatar and the results show that, after the experiment, they felt more helpful [55]. In other Bailenson study, participants embodied a sea coral and, after the experiment, they felt more sensible to ocean pollution [51].

Other interesting approaches are based on the development of new immersive technology named: machine to be another. It is an advantage technology to interchange bodies (the real body with the avatar) which offers to the users an immersive experience of seeing themselves in the body of another person. MTBA is a low budget body swapping system, and using a head-mounted display, participant sees the perspective of another person (performer) that mimics his/her movements (**Figure 2**).

The performer's first-person perspective is captured by a camera controlled by user's head movements, revealing torso, legs and arms of the performer's body. While interacting with the physical space, participants also perceive realistic tactile stimuli. An audio system plays a

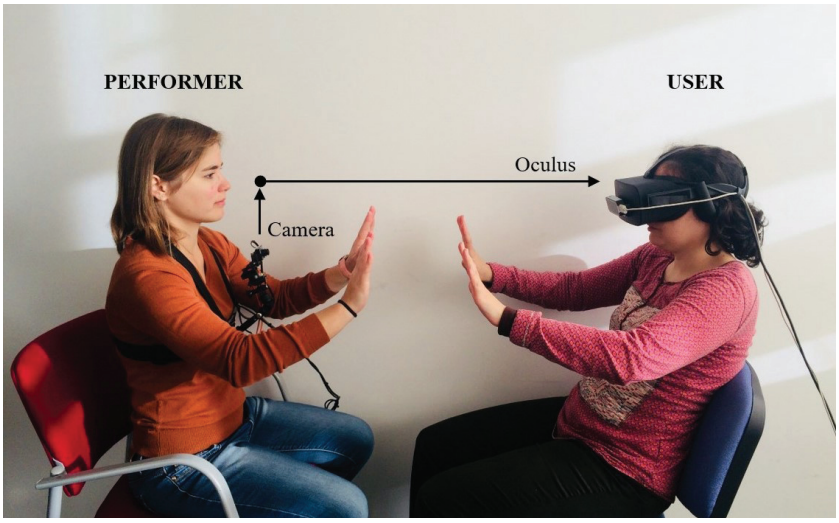

Figure 2. The machine to be another system. *Labpsitec, Universidad de Valencia, Spain.*

personal narrative recorded by the performer. The goal of the MTBA is to induce empathy and compassion to participants as the study of Falconer [53].

To summarize, the potentialities of VR as an "embodied technology" open its use wider than the only reproduction of real worlds. Thanks to this advanced technology, it is possible to study behavioral, cognitive, and emotional aspects that were hard to realize so far. And by designing meaningful embodied activities, VR can enhance therapy and promote significant changes.

3.3. Connectedness technology

Recently, software developers and ICT industries have emphasized that next interesting and compelling work for VR and AR focuses on helping people to connect with others through shared experiences. The new developments of VR are changing not only the way people interact with computers, but also the way individuals interact each other. One of the evident signs of this change has been the creation of totally new interactive communication environments like computer-mediated communication (CMC). CMC created a new social space, called cyberspace [56]. Interaction and connection are the key features of cyberspace, from which a sense of self can be built. VR, more than other technologies, carries the detachment of interaction from physical interlocutor co-presence to its logical extreme and challenges the very concept of interlocutor identity. The concept of cyberspace clearly shows that VR is, in fact, a parallel universe created and maintained by the networks in which people interact.

The CMC brought new challenges to clinical psychology. There are objective barriers that stop people the seeking for a therapy program (e.g., geographical distance and lack of local skilled clinicians). To go over all these barriers, new technologies have found some solutions. For instance, videoconferencing means simulating face-to-face psychotherapy using a clinician at a site distant from the client [57]. Some clinicians are not agreeing to use videoconference technology for therapy because they argue that the therapeutic alliance will be impaired [57]. However, other studies have shown that therapeutic alliance is established equally well in videoconferencing and face-to-face therapy and, in some case, participants prefer the online therapy (e.g., younger participants, people living in rural and remote areas). Cybertherapy can go even further over this problem, thanks to its power to cut geographical limit and to reach people anywhere and anytime [57]. The growing of new technology gives also the opportunities to interact with people inside the virtual environment. Thanks to this forward step, it is now possible not just to call a psychotherapist by Skype, but also to interact with the artificial therapist.

Since several years, virtual environment was populated by avatar, a graphical image that represents a person, and it can interact with real people, thanks to its artificial intelligence (AI). This innovative tool addressed numerous issues in clinical research, assessment, and intervention. The first AI tool was "Eliza" that was designed to imitate a Rogerian therapist. The system allowed a computer user to interact with a virtual therapist by typing simple sentence responses to the computerized therapist's questions. "Eliza" disappeared soon due its inability to handle complexity questions from the users [58]. A new version of AI therapist was created by the Institute of Creative Technology, Los Angeles (USA). The program

SimCoach was created to face the urgent need of reducing the stigma of seeking mental health treatment for veteran population who have a strong PTSD and cutting geographical barriers. SimCoach allows users to initiate and engage in a dialog about their health care concerns with an interactive AI therapist. Generally, these intelligent graphical characters were designed to use speech, gestures, and emotions to introduce the capabilities of the system, solicit basic anonymous background information about the user's history and clinical-psychosocial concerns, provide advice and support, direct the user to relevant online content, and facilitate the process of seeking appropriate care with a live clinical provider. The SimCoach project is not conceived to deliver a diagnosis or treatment or serve as a replacement for human provides and experts, but to support users who are determined to be in need, to make the decision to take the first step toward initiating psychological or medical care with a real psychotherapist, who is the best [58].

The connectedness potential of technology seems to be limitless. Thanks to its feature, it was possible to reach people who were in need and without physical or social resource for seeking a therapy assessment.

As we discussed, the three features of VR and AR, imagery, embodiment, and connectedness are fundamental for the efficacy and effectiveness of cybertherapy. Clinical psychology reached an excellent level in the society, and it contributes to the well-being of community. These goals were reached easily, thanks to the supply of new technologies, and in few years, we assist to their potential growth.

4. The future of cybertherapy

The future of VR and AR therapy includes treatment of a wide variety of disorders. Internet dissemination allows therapists easy access to new virtual environments and provides them with a broader selection of options for use in therapy. The possibility of offering VR services to patients, under therapist supervision, at home has already become a reality, but this practice has yet to become widespread.

Adding to the previous methods, exciting new methods are allowing for the introduction of real digitized images into the virtual world [22]. This technique was published at the last Facebook congress by Mark Zuckerberg. He introduced, in the social virtual world, the possibility to show some personal pictures or the own smartphone pictures to increase the sense of presence [59]. These techniques have the potential to help disorders as attention, social phobia, public speaking, anxiety disorder, PTSD, and so on. For instance, including photograph of child's actual classroom, the therapist can work with them to improve concentration skills during tests and assignments. In addition, working with the photographs of classmates, co-workers, or family members can help people to improve their social skills in a safety virtual world and then can actualize their abilities in the real one [22]. For example, after practicing with the therapist in a closed system, the client can visit a virtual world populated by other avatar, initiate conversation, and obtain feedback from other avatars in real time audio.

Another future perspective for the cybertherapy is the use of the "data glove." It allows for tactile interaction in the virtual environment, giving to the users the ability to grasp and manipulate virtual objects. This technology can be used to increase the sense of presence in the virtual environment, or to help desensitize patients to disturbing tactile stimuli, or to distract them for a painful surgery [22].

As technology advances and more disorders are being treated through it, research continues into ways in which the boundaries of cybertherapy can be expanded. Technology is growing more and more, and its contribution to clinical psychology will be a crucial issue. Furthermore, in developing new virtual and augmented reality tools, it is important to keep several concepts in mind as therapeutic concept and ethic, the practice and the costs of equipment, and the multidisciplinary teams of experts in particular psychologists and engineers.

5. Conclusion

A technological revolution in mental health care is approaching. As Freeman and colleagues have stated, at the forefront may be virtual and augmented reality, the powerful tools for individuals to make new learning for the benefit of their psychological well-being [60]. Cybertherapy is quickly becoming an accepted and validated method for the treatment of many different mental disorders. In this chapter, we have described the potential of VR and AR to improve the role of clinic psychology. In **Table 2**, the advantages and limits of VR and AR in clinical psychology are summarized.

VR and AR have some differences: in VR people are immersed in virtual environments and interact with it. The perception to interact with the environment is possible, thanks to the sense of presence (the feeling to be inside the environment); AR is an extension of the real world, mixing real and artificial reality where people keeping the opportunity to see their own body, which is not possible with VR, and to interact with the artificial objects. In the last decades, many studies have shown that VR and AR are successful tools for therapy with a high level of efficacy, satisfaction from participants, and decrease in participant's symptoms.

Imagery, embodiment, and connectedness play the keys roles for understanding VR and AR and their potentialities in clinical psychology. In virtual environments, people can feel "as if they are" in a reality that does not exist in external world (imagery technology). VR/AR also

Advantages	Limits
More naturalistic or "real-life" environments	Cost required
Control of stimulus presentation and response measurement	Lack of interoperability of VR applications
Safe virtual situations	Different therapist-patient dynamic
Source of information on patient's performance achievements	Basic technological capabilities for therapist and patients
Ecological validity	Deficits in sense of presence can influence therapy success
Increased standardization of rehabilitation protocols	Cybersickness

Table 2. Advantages and limits of VR and AR in clinical psychology.

promotes the experience of feeling user's body inside the virtual environment (embodied technology). And now, VR/AR could help users to connect with others and to share experiences (connectivity technology). These characteristics have enormous potential for clinical psychology and to improve psychological treatments. However, several barriers still remain. The first obstacle refers to the expense, especially of designing and creating virtual environments [26]. However, the development of technologies has reduced the cost dramatically. Now is easy to find economic equipment and there are several free online programs to develop virtual environments. Second, VR software and clinical protocols still lack standardization, and most VR systems available are not interoperable. These issues force most researchers to spend a lot of time and money designing and developing "one-off" VR creations. Third, from therapists' side, the operation of PC-based VR programs requires basic computer skills. In addition, there is a different therapist-patient dynamic in VR therapy that also must be taken into account. Fourth refers to the patient side. The insufficient sense of presence level felt by patients in the virtual environment could negatively affect the therapy. Other barrier from patients is cybersickness, and symptoms can include motion sickness, oculomotor problems, and migraines. One more barrier regards cultural adaptation. VR applications, as other psychological tools, need to be culturally adapted in order to make it compatible with the patients' experience and with the general therapeutic goal [12].

Overall, the future of VR and AR seems to be limitless. Technology progress is growing exponentially, and it can generate great and significant changes for clinical psychology. Till now, cybertherapy made huge steps which contributed to the spread of well-being in the society, but it is just on the starting point. Clinical researchers are working hard to keep the relationship between clinical psychology and ICTs in privileged position.

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Conflict of interest

There is no financial or personal interest to report.

Abbreviations

VR	virtual reality
AR	augmented reality
ICT	information and communication technology

PTSD posttraumatic stress disorder

MTBA machine to be another

CMC computer-mediated communication

AI artificial intelligence

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