Advances in Virtual Reality and Interventions in Clinical Psychology

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Abstract

The article presents an overview of the advances in the use of Virtual Reality (VR) as a technological tool that has been incorporated into the research and intervention in clinical psychology. The presentation of the information allows to generate a review through different fields of clinical application, to observe the advances in the application of the VR and its use around categories that have been described in pre-existing works. In this way, advances in the use of VR around Anxiety, Eating Disorders, Psychosis and the EMMA System are discussed.

Keywords: *Virtual Reality; Clinical Psychology; Psychological Treatments*

Introduction

Virtual reality (VR) is a technological process that has been gaining strength in recent years, its development and implementation have had diverse niches and has been used mainly in the development of environments to produce simulations of formal aspects of daily life that can be controlled and evaluated. Virtual reality allows to generate three-dimensional environments through a computer and gives a user the possibility of interacting with the different environmental elements of the programmed reality, which allows the formalization of the control of variables and the possibility of recording that in material reality It would be expensive [1-3].

This characteristic, of the generation of environments, was initially exploited by the software development companies for game simulation, now it becomes an important value when thinking about the expansion towards other uses, for example, therapeutic. One of the main characteristics that derives from the use of virtual reality technology in fields such as psychology, is the possibility of putting a subject in a specific environment, with manipulable conditions and that this does not have a sense of danger over its integrity [4-6].

The use of VR technology around clinical procedures in psychology has been widely developed, as indicated by Botella., *et al.* [7] the potential of the tool allows to generate a therapeutic space that helps to control the sources of stimulation and the possibility of control by the therapist on the measure of the exposure. In this sense, the exposure therapy that is the basis of the administration of VR, it is strengthened, while the experience lived by the patient can be active maintaining the security provided by the notion of a controlled virtual environment [8,9].

The study by García-Palacio., *et al.* [10] showed that exposure therapy applied to the treatment of specific phobias through RV has an acceptance of 76.6% as opposed to the usual exposure therapy *in vivo*. The study suggests that therapy through VR achieves a sense of security that helps patient preparation and reduces anxiety rates for the application of stimulation, which is also confirmed in subsequent studies [11]. This demonstrates the implications of VR in the development of therapies that involve its use, while it is shown as a safe option that consultants see as the best option when accepting a therapeutic intervention that involves exposure to aversive stimuli [12].

This paper proposes a revision of the uses of VR in specific fields of application for a decade, with the aim of following up the lines defined in the development process of the first works on the subject, as well as the extension to other applied sectors.

RV, Anxiety and specific phobias

In the review of the literature, Botella., *et al*. [13] reported that the area most explored and that generated one of the work and development spaces on the uses of virtual reality in clinical intervention is the treatment of phobias. The category used by Botella., *et al*. [13] to show the diversity of studies on the subject was "Virtual Reality and Anxiety Disorders". Under this category, they characterized the main phobias in which interventive developments were carried out: social phobia, agoraphobia or panic disorder, acrophobia or fear of heights, claustrophobia, aerophobia, arachnophobia.

In the first instance it is assumed that phobia is a learning that is given by principles of aversive conditioning [14] and implies the association between environmental stimuli, emotional and behavioral responses that are grouped into what clinical psychology has defined as anxiety (Baños et al, 1998). Additionally, it has been shown that emotional and behavioral effects have associated thoughts and meanings that allow naming, relating and explaining the perceptions and feelings that are produced by exposure to aversive environmental stimuli [15].

Currently, from the meta-analysis conducted by Opris., *et al*. [16], the following fields are observed where the emphasis is on the evaluation of therapeutic treatments that include VR as an exposure strategy: Fear of flying, panic disorder/agoraphobia, phobia social, arachnophobia and acrophobia. What Opris., *et al*. [16] found is that in the measurement of the effectiveness of interventions what they call a significantly high level of effectiveness in the treatment of phobias through virtual reality exposure therapy (D = 1.12; VAR D = .34, 95% CI [0.71 - 1.52], P0.05) [16]. However, from the comparison of 15 studies that used exposure with RV, no results different from those obtained with classical methods of exposure for phobias are shown (D = .16, VAR = 5.16, 95% CI [-0.03 - 0.36], P > .05), which shows that there are satisfactory results with exposure through RV that are maintained over time [16].

Morina., *et al.* [17] in an analysis of the effectiveness of exposure treatment through virtual reality on specific phobias, show the effectiveness of the intervention in its subsequent effects in real life. The authors' review included 14 clinical trials on specific phobias, found that patients undergoing VR obtained better results in behavioral evaluations in the aftercare than patients on the waiting list (g = 1.41). Added, it was found that there are no significant differences between exposure by RV and exposure *in vivo* (g = -0.09 and 0.53) [17].

Evidence has been observed that shows the effectiveness of exposure procedures through virtual reality in different anxiety disorders that include specific phobias, it has shown the importance of the intervention based on the results obtained and the possibility of adherence to treatment, as well as the opportunity for patients to feel safe for exposure. Additionally, it is observed that the clinical intervention does not have significant differences with respect to the exposure in vivo, which supposes the effectiveness of the resource with a greater possibility of safety for the patient as well as the remarkable advantage for the adherence to the treatment and the sustainability in the post-treatment time.

RV and eating disorders

Following the analytical categories of Gutiérrez [6] and Botello., *et al*. [13] for the application of virtual reality in clinical interventions from psychology, a review of the interventions on eating disorders is carried out. Gutiérrez-Maldonado., *et al*. [18] developed 4 environments of virtual reality for the evaluation of eating disorders and their relationship with the perception of distortion of body image as well as dissatisfaction with the body. Using an experimental sample of 85 people with eating disorder, divided into 3 groups of people diagnosed with Anorexia Nervosa, Bulimia and unspecified eating disorders and a control group of 108 people, we proceeded to evaluate the responses on the perception of body image and dissatisfaction at the moment of interacting through virtual reality environments with different situations.

The development of virtual environments propitiates specific interaction conditions that allow evaluating the reactions of the participants, allowing the staging of concrete situations that provoke ways of experiencing daily experiences in a controlled manner. Gutiérrez-Maldonado., *et al.* [18] managed to generate four environments where different situations of daily life are presented: in the first the participants are in a kitchen and can sit at a table with light foods in calories, in the second environment the Participants sit in a kitchen with foods with a high caloric content. In the first two environments the participants are alone on stage. The third scenario takes place in a restaurant environment, the participant sits at a table and finds light calorie food. In the fourth room the participant finds himself in a restaurant, sits at a table and finds food with high caloric content. In restaurant environments people are accompanied by virtual characters sitting at the same table.

The previous study shows the possibilities that are open for the exploration of the phenomena associated with eating disorders, in this case, the participants are exposed to situations of daily life in a virtual environment that allows measurements on their behavioral responses and on the appreciations about oneself when interacting with foods in contexts that may or may not include the presence of other people [18]. The study allowed us to observe an important relationship between participants who have been previously diagnosed with an eating disorder and their distorted perception of the image with the conditions in which it is found in contextual terms, when food has more calories, greater distortion is perceived, however, there is no significant relationship that indicates the increase in the distortion of body image in the presence of other people in the context [18].

This type of studies allows us to observe the development of the use of the RV technology, which is not only applied for the intervention, but as a research tool that allows observing particular conditions of the phenomena to be studied and is offered as a research tool that allows to relate variables to establish explanation processes.

However, the use of VR has been systematically tested for clinical intervention in people with eating disorders that involve a distortion and dissatisfaction of body image. Marco., et al. [19] used 5 virtual reality environments to apply a protocol of cognitive behavioral therapy that includes five areas of work, in each of these areas the environment allows the participant to make an evaluation of their body image, observing scales of their corporal conception that They should be compared with the actual scales of your body, which allows a reflection on the image and the possibility of observing the distortion that you have and the reasons for it.

An additional possibility for the use of VR is described by Gorini., *et al.* [20] who developed a work on the emotionality produced by the interaction with different foods in people diagnosed with eating disorders. The work used three conditions of RV where the participant could interact with food in a virtual space, the main characteristic of the food is that they suppose a great caloric load and in each condition the time of exposure of the food changed. The measurements show a significant increase in the anxiety levels of people with eating disorders in the presence of high-calorie foods.

It is observed through the studies presented that the RV is offered as a possibility that is not limited to the possibilities of clinical intervention, but is used in different ways to delve into specific aspects of the phenomena that integrate emotionality, belief and the behavior around eating disorders. Likewise, it is offered as a useful tool to bring complex contexts closer to controlled scenarios where the variables can be of greater use to test various configurations that are at the base of the explanation of the phenomena and their possible intervention.

RV and Psychosis

Daniel Freeman [21] refers to the RV as a tool that allows to open the field of work on fields of psychopathology and clinical intervention, affirms that the possibility that RV brings in terms of the identification and control of variables associated with various psychopathological phenomena It allows the clinical psychologist a unique investigative possibility in environments prepared according to specific conditions that replicate the daily contexts with the goodness of controlling factors to generate correlational or causal explanations.

One of the possible uses that this tool allows is the possibility of using social environments created to explore the way in which subjects experience the symptoms of certain mental pathologies such as social anxiety or adaptive disorders [22-24]. These recreated social environments can be transferred to other clinical experiences that allow identify variables associated with the presence of symptoms in people diagnosed with psychotic disorders [22,25-27].

Freeman [22] exposes at least 7 advantages that the use of the VR brings: 1. Evaluation of symptoms, in this case the putting in situation of the subjects allows to observe the unfavorable reactions and to keep record of the behaviors, which allows to complement the results of evaluation inventories and interview processes in cases where it is assumed that persecutory illusions and paranoia occur. 2. Establish correlations between symptoms and physiological responses and behaviors, in this case the possibility of a virtual environment allows real-time measurements of the physiological conditions of activation associated with the production of specific behaviors which allows linking causal aspects between the appearance of symptoms, environmental stimuli, physiological and behavioral responses. 3. Identification of predictor variables, allows the identification of individual variables on specific aspects of the symptoms of concern, persecutory illusion, paranoia, etc. 4. Identification of Differential Predictors, VR allows generating correlational studies that link variables associated with different clinical disorders that may be present in different disorders such as social anxiety and adaptive disorders, however, specific differences can be made between the answers in one and another case linked situations as background stimuli on which predictions of specific responses can be generated in each differentiated case. In the case of psychosis, situations of anxiety can be linked that lead to specific responses that allow prediction markers to be generated about the expected behaviors. 5. Identify environmental Predictors, following what is described in the previous section, not only prediction markers can be established on differential responses between different disorders, but also relationships can be established between specific stimuli of the environment and the reactions and behaviors they produce in the subjects. 6. Establishment of Factors of Causality, according to the path we have been doing, experimental tests can be established that allow generating causal explanations between environmental stimuli, the appearance or presence of symptoms, physiological responses and behaviors in cases of psychosis. 7. Development of treatments, finally the development of the VR allows not only the possibility of establishing explanations about the variables associated with the phenomenon, but also allows the use of virtual scenarios for the production of intervention protocols that allow reducing the effects of the symptom.

Virtual Reality EMMA System

One of the main advances in VR technology in the context of clinical uses is the opening of research teams that, from an interdisciplinary perspective, have broadened the vision of design to produce systems that involve expanded contexts to simulate different situations of the everydayness in complex environments that include diverse activities, interactions and environmental possibilities [13]. The MindLab Laboratory team of the Jaume I University, which is part of the MindLab consortium which brings together 7 universities in the United States and Europe, has worked over the last 10 years developing an adaptive system that allows the production of a complex virtual reality context that the researchers call a "world" in which people can put themselves in different situations within the same virtual reality [4,13].

The novelty of the system is precisely in the possibility of generating different contexts within the same RV scenario, so the participants can move in a world that allows them to enter different environments with different stimulatory forms. This step towards the production of a world with greater complexities allows the treatment of diverse conditions, but its idea of creation is due to the clinical intervention of post-traumatic stress disorder -TEPT- [4,28,29]. The characteristics of Emma's world provide environments for handling different emotions: desert for anger, island for relaxation, forest for anxiety, snowy landscape for sadness and a meadow for joy. The use of these scenarios is determined by the therapeutic objectives and by the way the therapist manages them for the patient's needs [4].

The world of EMMA has been used for the intervention of post-traumatic stress anxiety disorders [30-32]. The tool that enables the treatment through Emma is associated with emotional control, that is, the possibility offered by the tool for the controlled expression of the emotions associated with the trauma through the presentation of environments with specific stimuli that evoke particular characteristics of the even traumatic. The environments that the Emma system has predefined serve to evoke emotions according to the controlled presentation of stimuli that the therapist can control so that the individual can be managing the expression and feeling [30-32].

The world of EMMA has also been used to treat anxiety caused by child abuse [33,34]. López-Soler., et al. [33] modified the environmental scenarios of the RV so that the children felt comfortable according to their interests, for this they included stimuli that include photos of children's faces expressing different emotions, characters related to the preferences of the children, the environments were modified so that the graphics had an animated tendency and the book of life was modified so that it had a contemporary technological graphic presentation. The results of the intervention show a significant improvement in the control of anxiety due to abuse and the possibility of an adequate management of emotional responses, which allows us to say that the world of EMMA-Childhood becomes a tool that allows not only the clinical intervention in adults, but has been extended to other types of populations according to their age [33,34].

On the other hand, the world of EMMA has also been used in the intervention in adaptive disorders in view of its possibility to adapt environmental resources to the possibility of generating emotional processes that are deployed through the stimulation used by the therapist [35]. It is also used for the resignification of emotional content in the elaboration of duels and becomes an effective tool for this purpose the daily life [36].

Discussion

As seen in the previous sections, VR has claimed a wide space within the clinical intervention. The most important characteristics for its positioning are those that have to do with the configuration of virtual environments where reality can be emulated, the concretion of a controlled context of environments that reproduce the reality of individuals. Added, is the possibility of control over the degrees of stimulating exposure that directly affect the responses of the subject to intervene, this same characteristic results in control forms that help the study and the interventive application on specific clinical problems [22].

As has been shown, VR therapy allows the consolidation of a treatment adherence process based on the forms of exposure that are perceived by the individual as controlled contexts, where the exposure is totally monitored by the clinician and, the idea that it is through a programmed technological system allows maintaining a sense of security that is not found in live exhibitions [10,11,29].

The latter is significant and becomes a very important option for the work of clinical psychologists, while the scenarios can respond to the demands of individuals who require specific stimulation contexts. Examples of this possibility are the systems that integrate diverse resources such as EMMA, these applications that have great capacities for the use of stimuli or simulated situations, allows the clinician to quickly adapt intervention forms that suit the interests of the consultant [4,13,33].

Now, not only does VR allow accommodation according to the specific clinical demands of the patients, but it can also be adapted to the social and historical problems in which the subjects live. De la Rosa Gómez and Cárdenas-López [37] present a virtual reality design that allows clinical intervention in victims of criminal violence, which responds to the contextual conditions experienced by Mexican communities, due to the violence associated with the drug traffic.

De la Rosa Gómez and Cárdenas-López [37] also refer to the clinical functionality on VR exposure, which shows better results in the control of symptoms in opposition to therapy by imagination, in addition they detailed that the participants found less aversive the VR scenarios. Kramer., *et al.* [38] confirm that the VR scenarios help put them in situation and allow a significant contextual immersion in specific environments, for example, in ex-combatant populations. In their study Kramer., *et al.* [38] investigated the perception of military veterans towards VR as a tool for evaluation and treatment of post-traumatic stress disorder, through semi-structured interviews they could characterize that veterans felt that the tool allows a good immersion in combat environments, since There is a subjective perception of physiological reactivity, thoughts and behaviors similar to those experienced that triggered memories.

On the other hand, Kramer., *et al.* [38] comment on a reoccupation associated with the experience of immersion in VR environments. Veterans report that the way in which recreated contexts evoke strong traumatic memories and negatively impact emotionality is worrisome. This concern is recurrent in the arguments about the exposure therapies, specifically those that refer treatments on post-cumulative stress consolidated in processes of criminal violence or product of social conflicts. The repeated mention of revictimization is a problem that exposure therapy has to deal with and, evidently, the RV has been the target of arguments against the use of information technologies to reproduce scenarios of violence.

According to the above, the development of VR should contemplate studies that identify, if and to what extent revictimization processes and, if this condition is necessary for the development of trauma. According to the classic explanatory forms of exposure therapy, recurrence on stimulation scenarios is necessary to produce the counter-conditioning and to achieve control of the anxious effects [39]. Soto., *et al.* [40] show the usefulness of configuring VR scenarios that allow individuals to be placed in specific combat situations, using contexts with general stimuli of situations such as environmental factors, sounds of fauna and flora and shooting, etc. which allows generating the reaction of the anxious symptoms without evoking the specific aspects of the consolidation of the trauma [41-45].

Conclusions

The development of information technologies has led to various possibilities to enhance social interactions and generate novel possibilities in communication processes. In this field of technological diversity and the possibilities of information, virtual reality emerges as a source of novel experiences for individuals. In this context, there was an important relationship between computer technology and clinical psychology. From this binding relationship, a niche of work is created for what to do of clinical psychology, whose fundamental premise is to generate a space for intervention through the creation of controlled reality environments where a subject can be put to generate specific interventions on their discomfort.

Several work groups have been given the task of expanding the expectations of technological use and the relationship of virtual reality and interventional processes in clinical psychology. From the classic works of Cristina Botella and her team (2007), a series of practical processes have been generated that have resulted in a quantity of literature that confirms the relevance of the tool and the quality of the procedures when intervening clinically on people who have problems in their daily lives. It has been shown that these classical studies began with the relationship between stress and anxiety conditions produced by specific learning, which involves the creation of scenarios that emulate the learning situation to generate controlled responses that may be susceptible to being conditioned, fed back to the recognition and control of physiological and resignified responses around specific aspects such as belief.

Cases have been reported where the experience of VR has been questioned based on its implications on revictimization and the negative effects on emotionality, specifically in the use for the treatment of post-traumatic stress. However, the literature reports that these controlled exposures are necessary to produce the effect of counter conditioning and the control of anxious symptoms.

Clinical psychology has expanded the uses of VR for different disorders such as food and psychotic. This opening has managed to consolidate studies that explore the very foundations of the production of associated psychological phenomena in order to broaden their understanding of them. It was shown how the developed RV environments allow to extend the expectations of use, even reaching the production of VR environment systems such as EMMA that provide different contexts for the diagnosis and intervention of different problems in the same package.

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