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The Treatment of Claustrophobia with Virtual Reality: Changes in Other Phobic Behaviors Not Specifically Treated

C. BOTELLA, Ph.D.,[1] H. VILLA,[1] R. BAÑOS, Ph.D.,[2] C. PERPIÑÁ, Ph.D.,[2]
and A. GARCÍA-PALACIOS, Ph.D.[1]

ABSTRACT

This study was designed to determine the effectiveness of Virtual Reality (VR) exposure in the case of a patient with a diagnosis of two specific phobias (claustrophobia and storms) and panic disorder with agoraphobia. The treatment consisted of eight, individual, VR-graded exposure sessions designed specifically to treat claustrophobia. We obtained data at pretreatment, posttreatment, and 3-month follow-up on several clinical measures. Results point out the effectiveness of the VR procedure for the treatment of claustrophobia. An important change appeared in all measures after treatment completion. We also observed a generalization of improvement from claustrophobic situations to the other specific phobic and agoraphobic situations that were not treated. We can conclude that VR exposure was effective in reducing fear in closed spaces, in increasing self-efficacy in claustrophobic situations, and in improving other problems not specifically treated. Moreover, changes were maintained at 3 months after treatment.

INTRODUCTION

TRADITIONALLY, the treatment of choice for treating specific phobias has been in vivo exposure;[1,2] however, not all patients can benefit from this treatment. Some patients are too afraid of facing the threatening object or context and they reject an exposure program or they drop out.[3] Even for the patients who accept the treatment, this can be difficult. Patients with phobias do not feel safe because there is no certainty for them that something will not go wrong (e.g., elevator stoppage, technical

problems in the airplane, etc.). In the last few years, several studies have been published that describe the utility of virtual reality (VR) techniques for the treatment of phobias: acrophobia,[4-7] arachnophobia,[8] flying phobia,[9] agoraphobia,[4] and claustrophobia.[10]

As Wiederhold[11] points out, numerous publications from at least 15 centers around the world state that the treatment of specific phobias using VR is not only effective, but it also has a number of advantages when compared with traditional treatments. First, VR provides safety to the patient because the virtual environment can be absolutely graded in regards to the suitable degree of difficulty for the patient.[10] Second, VR becomes a useful tool in cases where the feared situation is not easily accessible (e.g., in an airplane).[10] And finally, some patients who follow an exposure pro-

[1]Universitat Jaume I, Department Psicologia Basica, Clinica y Psicobiologia, Castellón, Spain.
[2]Universidad de Valencia, Department de Personalidad, Evaluación y Tratamiento Psicológicos, Valencia, Spain.

gram continue to manifest "residual fears."[3] We think that the control provided by VR environments and the possibility of going beyond what a "real" situation would allow are factors that can promote patients' feelings of self-efficacy and help to eliminate the residual fears.

Although evidence exits on the utility of VR for the treatment of specific phobias, the studies carried out until now have applied VR techniques to patients who were not very impaired by the phobia. There are some exceptions, as in the Carlin et al.[8] study where the patient was severely impaired by her arachnophobia.

The purpose of the present study was to determine the effectiveness of VR exposure designed to treat claustrophobia in a patient who, besides the diagnosis of claustrophobia, also suffered from another specific phobia (natural type: storms) and panic disorder with agoraphobia. We included a 3-month follow-up assessment.

METHOD

Participant

The participant was a patient who asked for help in the Jaume I University Anxiety Disorders Clinic. The patient met DSM-IV criteria for two specific phobias, situational type (claustrophobia), and natural environment type (storms). She also met the criteria of panic disorder with agoraphobia. She had received no prior treatment for psychological problems. She signed a consent form. An independent assessor reviewed the assessment and confirmed the presence or absence of panic disorder (with or without agoraphobia) and other diagnoses.

The patient was a 37-year-old female laundress who was married with two children. She experienced fear of closed spaces (elevators, buses, crowds, planes). The onset of the problem occurred when a crowd surged toward her in a sales mall 12 years prior. As a consequence of that event, she also developed a specific phobia, natural environment type (storms), because what caused the avalanche of people was a big storm. One year after the incident she began to fear crowds, being enclosed in an elevator, reduced spaces, tunnels, traffic jams,

and airplanes. She suffered an unexpected panic attack while on vacation far from home (500 KM). (She went to an emergency room in a hospital.) Since then, she began to develop agoraphobic avoidance, which was evident in her inability to travel to unknown places and shop alone.

Measures

Admission interview. Through this interview, demographic and clinical information is obtained. During the interview, the patient is also asked some questions to determine the presence of different anxiety disorders. The patient is also asked about each criteria of DSM-IV–specific phobia, situational type.

Behavioral Avoidance Test (BAT). Avoidance of closed spaces was assessed using a behavioral avoidance test. A closet was built for this test. It measured slightly less than an elevator (75 cm in width × 1 m in length × 2 m in height). The patient was asked to enter the closet and stay there for 5 minutes with the door locked. The patient could terminate the test at any moment and could also refuse to enter the closet if she considered that she was going to experience more anxiety than was bearable. The test ended 5 minutes after its initiation unless the patient had stopped the test before this time. Before the commencement of the test, the patient answered some questions about what she thought was going to happen during the test. The measures used during this test were expected danger, expected fear, expected self-efficacy, and subjective fear. The patient rated these variables using 10-point scales. The therapist also measured the degree of avoidance in the BAT. The range of the scores was from 0 to 13. The score was obtained as follows: 0 = refused to enter, 1 = went in, 2 = closed the door but did not turn the key, 3 = closed the door with key. Afterwards, 0.25 points were added for each period of 30 seconds that the patient stayed inside the closet with the door open, 0.50 points for each period of 30 seconds that the patient stayed inside with the door closed but not locked, and 1 point for each period of 30 seconds that the patient stayed inside with the door locked. The highest score was 13.

Fear record: A Spanish adaptation of the Mars and Mathews[12] scales. The target behavior was assessed according to the degree of fear, from 0 to 10, where 0 was "no fear" and 10 was "extreme fear."

Subjective units of discomfort scale (SUDS).[13] The participant rated his maximum level of anxiety on a 10-point scale before the BAT, while he/she was in the closet and after the BAT. We also used this measure during the exposure sessions.

Problem-related impairment questionnaire.[13] This instrument evaluated the impairment that the disorder caused in several areas of the patient's life. Each area was rated on a 10-point scale with scores ranging from 0 (Not at all) to 10 (Completely). Only global impairment was analyzed in this study.

State-Trait Anxiety Inventory (STAI)[14] adapted by TEA (1988) for the Spanish population. The Anxiety Trait is defined as a relatively stable anxiety apprehension by which those participants differ in their tendency to perceive situations as threatening and to increase, consequently, their state of anxiety.

The Anxiety Sensitivity Index (ASI).[15] This is a measure of anxiety sensitivity, which Reiss et al.[15] have defined as "an individual difference variable consisting in the belief that the experience of anxiety causes illness, embarrassment or additional anxiety." We use a Spanish version of the ASI[16] adapted by Sandin, Chorot, and McNally.[17]

Apparatus

A Silicon Graphics Indigo High Impact computer graphics workstation, a high quality head-mounted display (FS5 from Virtual Research) and an electromagnetic sensor were used to track the head and right hand (Fastrak system from Polhemus). Modeling was done with Autocad version 13 software (Autodesk, Inc). To obtain realistic virtual environments, a special technique of texture-mapping generation was used. The virtual environment was rendered with radiosity techniques using Lightscape version 3.0 software (Lightscape Technologies). Once the visual environment radiosity solutions had been calculated, the Dvise version 3.0 (Division Inc) was used to create the virtual environment from the models. In this model, the texture generated from radiosity solutions was mapped on the geometry models, thus obtaining a highly realistic virtual environment.

Virtual environment

To graduate the levels of difficulty of the "claustrophobic" environment, two different settings were created. The first of them was a house (Figs. 1 and 2) and the second one was an elevator (Fig. 3). In each setting, several different environments existed that allowed for the building of hierarchies with degrees of increasing difficulty. The virtual environments are described in Botella et al.[10]
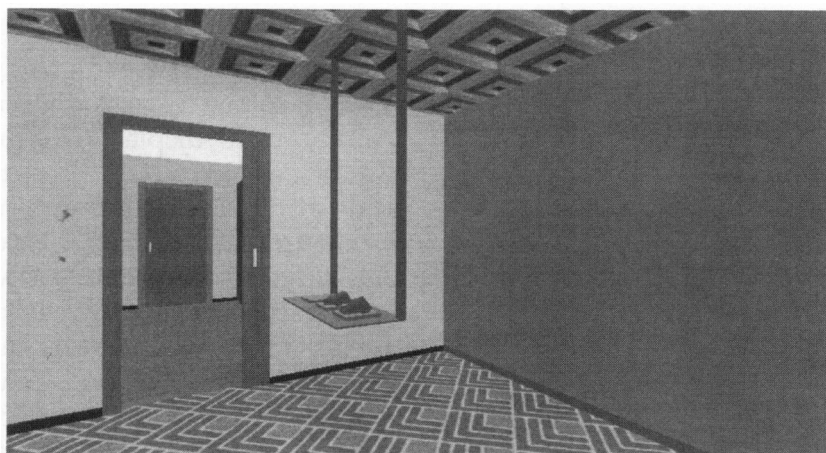

FIG. 1.

FIG. 2.

Procedure

The patient attended two assessment sessions in which the Admission Interview, as well as the self-report instruments described earlier, were administered. During the second assessment session, the patient was asked to provide self-efficacy ratings for coping in a closed space created especially for a BAT. She was asked to rate how sure she was that she would be able to stay in a closet for at least 5 minutes, and she scored herself by circling a number from 0 to 10. At the end of the second session, the patient was also provided with the fear record. The patient was instructed to monitor her fear of a claustrophobic target behavior on a 10-point scale during a 15-day baseline

period. She was asked to record this information on a daily basis during the baseline period and throughout the entire process. The fear record was reviewed at the beginning of each subsequent session, and difficulties in monitoring were addressed. She fulfilled the self-report measures at the end of the treatment and at a follow-up session 3 months after treatment.

Treatment

A total of eight sessions of VR-graded exposure sessions were carried out over 30 days. VR was conducted for approximately 35–45 minutes in each session. A video monitor allowed the therapist to observe the virtual environments to which the patient was exposed. The
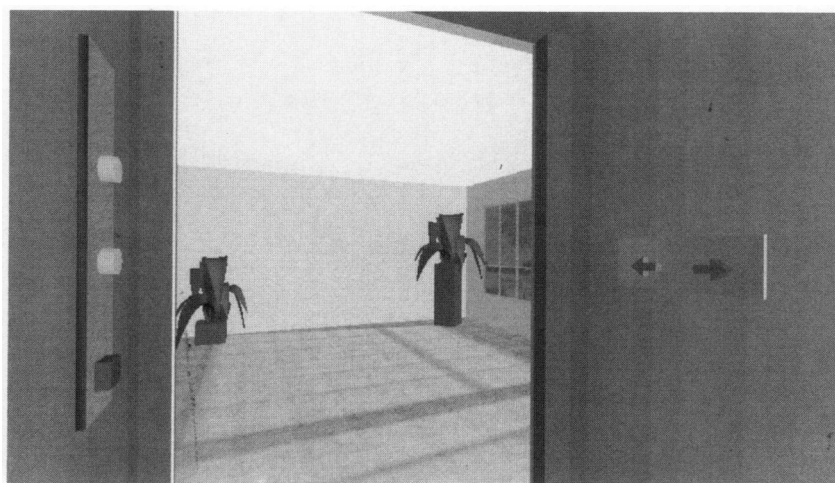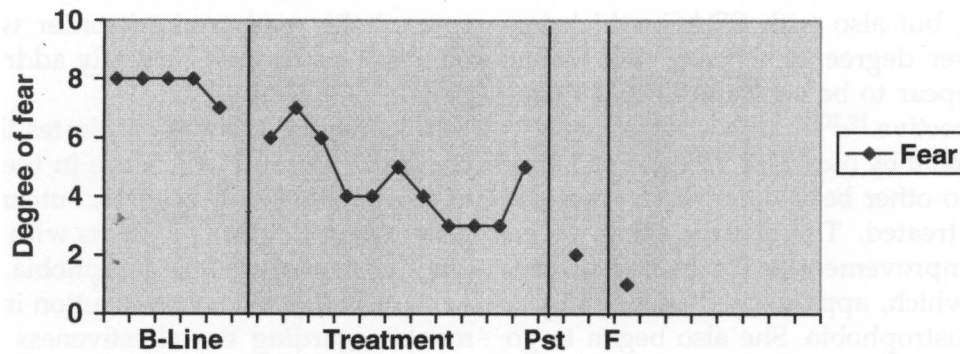

FIG. 3.

FIG. 4.

therapist's instructions in the VR sessions were similar to those used in conventional in vivo exposure. The therapist encouraged the patient to interact with the environment long enough for her anxiety to decrease. Their anxiety level (SUDS[18]) was assessed every 5 minutes.

RESULTS

Results of the fear record are shown in Figure 4. The treatment brought about an important decrease in the fear toward closed spaces and in the interference of the claustrophobia in the patient's life. These outcomes not only were maintained but also improved 3 months later.

The results from the other measures are shown in Table 1. The BAT scores showed an important change in the avoidance toward closed spaces, because the patient changed from not being able to complete the BAT (before the treatment) to completely achieving the goals of the test after completion of treatment. A clear improvement in all the measures of the BAT was obtained. The expected danger and

the expected fear decreased, and the self-efficacy in the feared situation increased. The degree of fear reported also decreased. The results regarding the self-report measures showed also a decrease in global impairment and anxiety sensitivity (ASI) upon completion of treatment. In these measures, changes were maintained at 3-months follow-up. Finally, general trait anxiety (STAI-T) also decreased, although this decrement did not occur until 3-months follow-up.

DISCUSSION

Our findings support the clinical effectiveness of VR exposure for treating claustrophobia. The treatment was effective in decreasing the fear and avoidance to claustrophobic situations and the interference of the problem, and the achievements were maintained at 3-months follow-up. This data support the results of our previous case study.[10] Moreover, VR was used alone as the sole technique, and it was applied to a patient with not only a diagnosis of spe-

TABLE 1. BEHAVIOR AVOIDANCE TEST (BAT) AND SELF-REPORT MEASURES

Measures	Pretreatment	Posttreatment	Follow-up
BAT			
Expected danger	10	3	1
Expected fear	10	3	1
Expected self-efficacy	0	7	8
Subjective fear	9	0	0
Behavioral avoidance	4	13	13
ASI	34	25	18
STAI-T	33	30	23
Interference	8	7	5

cific phobia, but also with PDAG, which implies a higher degree of severity. VR would therefore appear to be very useful in a therapeutic perspective.[19,20]

The treatment by means of VR achieved generalization to other behaviors which were not specifically treated. The patient achieved an important improvement in her fear of storms, a problem which, apparently, had nothing to do with claustrophobia. She also began to go alone to places which she had previously avoided because of her agoraphobia (going to pick up the children from school, going shopping alone, taking the bus to work). Finally, her fear of getting trapped in a traffic jam decreased significantly.

Regarding self-efficacy measures, our data also support our premise that VR may be an excellent source of information in the field of performance outcomes[10,19–21] because the patient showed an important change in the self-efficacy with closed spaces. This issue could be one of the reasons why the improvement generalized to other problems not specifically treated. The patient reported that the treatment helped her to feel more capable to face feared situations in general, not only claustrophobic situations.

Another issue related with generalization are the results from the ASI. The score of the participant before the treatment was very high. According to data from Spanish samples,[17] the patient was situated in the range of scores of people with a diagnosis of panic disorder. These data indirectly support the current approach on the construct of anxiety sensitivity (i.e., this construct is more strongly associated to panic disorder than to other anxiety disorders).[22,23] On the other hand, there was an important decrease in the score of the patient after completion of the treatment. We think that this finding is encouraging because the condition of the patient could be considered as severe, and the only treatment that she received was VR exposure to claustrophobic scenarios. The fact of generalization of improvement to other aspects not specifically treated and the change observed in many agoraphobic behaviors that the patient presented, brings us to believe that the extension and enlargement of the scenarios created by VR can be very helpful in the treatment of such an important problem as

agoraphobia and panic disorder with agoraphobia. Our team is currently addressing this issue.

In summary, our data indicates that VR exposure is a useful procedure in the treatment of claustrophobia. Moreover, outcomes can be generalized to other problems with higher degrees of severity than agoraphobia. However, we would like to exercise caution in our statements regarding the effectiveness of VR because most of the work in this field is still to be done. It will be necessary to study and analyze VR's usefulness in the treatment of other psychological disorders, and include larger samples given the fact that most studies in this field are case studies.

ACKNOWLEDGMENTS

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Address reprint requests to:
Cristina Botella, Ph.D.
Universitat Jaume I
Department Psicologia Basica
Clinica y Psicobiologia
Campus Borriol. Ctra. Borriol s/n
12080 Castellón, Spain
E-mail: botella@psb.uji.es

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