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Information and communication technologies (ICT) have changed communications in everything from the personal sphere to professional and scientific realms. The popularity of these new tools is unquestionable and their continuous growth is owed not only to advances in information technology but also to the considerable reduction in costs which has made them increasingly accessible to more professionals. In spite of the issues and the obstacles that still appear, ICTs have brought about a big improvement in the quality of our lives. Their use in the field of healthcare has generated new paths to recovery for many disorders. In psychology, these tools have been applied in many different contexts (experimental, clinical, educational, social, etc.). Here we will focus on clinical psychology and examine the enormous potential that ITCs offer this field. Some of the most utilized technological tools in clinical psychology include personal computers, televisions, mobile phones, PDAs, tablets, virtual reality (VR) and augmented reality (AR). There is already plenty of empirical evidence on the use of virtual worlds or Internet for the psychological treatment of different disorders. For example, “cyber-therapy” involves the use of IT devices as tool to enable or improve the provision of therapeutic services (either on its own or as a supplement to traditional therapies). It also makes use of applications such as virtual reality or augmented reality, both of which have enormous potential in the treatment of a wide range of psychological problems.

This publication, Anuario de psicología clínica y de la salud/Annuary of Clinical and Health Psychology, aims to review and provide updates on the most interesting research trends in clinical psychology. Considering the enormous interest that the use of VR technologies has sparked in the field, this issue of the Annuary includes important contributions by specialists who have been pioneers in the field internationally and are renowned for their scientific production. VR is a new technology in which computers and other devices produce a reality experience that allows the user to actually feel like she is there. With VR, the user can see, hear and feel in a world that is graphically generated in three dimensions and then interact with that world. In the clinical sphere, VR lets the user experience a virtual situation that is clinically significant and relevant to the disorder that is being addressed in a safe environment, under the supervision and accompanied by his therapist. Its principal contributions are immersion (the feeling of being physically present in the virtual world) and interaction (the possibility to interact with the virtual world in real time). As for AR, it is an even more novel virtual reality technique that consists of incorporating virtual elements to the real world. Though still in its initial phases, AR is already being utilized for a range of disorders, including treatment for spider and cockroach phobias. In AR, the participant sees an image of the real world overlaid with virtual elements. These objects can be part of a broader virtual world whose contents can be accessed in different ways, using different communication methods (mobile phones, tablets, PCs, PDAs, Internet, etc.)

In the first article of this issue, S. Quero, C. Botella, V. Guillén, M. Moles, S. Nebot, A. García-Palacios, V. Guillén and R. Baños, researchers from the Spanish universities Jaime I de Castellón and Valencia, present an excellent work entitled Virtual reality for the treatment of emotional disorders: A review. Here they examine the current state of clinical research on the use of presence-inducing technologies, especially VR and its applications in the treatment of different types of emotional disorders: phobias, panic disorder and agoraphobia, and stress related disorders such as post-traumatic stress disorder, adjustment disorder and pathological grief. They analyze the advantages and limitations of these technologies, including the lack of standardization in VR devices and software, the fact that there are no standardized protocols for the community of researchers and the costs required for the set-up trials. In addition, the authors discuss the need for precaution with regard to patient safety and ethical issues. Finally, they present opinions and challenges for the future of VR, whose use will continue to expand beyond the PC reserved for the therapy session.

The second article, Normalization of the eating patterns in a patient with anorexia nervosa, purgative subtype, with the support of a virtual environment. A case study, is by C. Perpiñá, A. Ferrero, C. Carrió and M. Roncero from the University of València and the Agencia Valenciana de Salud (Spain). This interesting preliminary study analyzes the advantages of using a VR component to normalize eating patterns in the general cognitive-behavioral treatment of a patient with purgative AN. The authors show that the VR component was not only perceived as useful by the patient but also helped her reduce her fear and avoidance of food. In addition, it helped her to eat and to establish a more normalized eating pattern with fewer binging and vomiting episodes by increasing her BMI and improving her emotional symptoms. Immersion software was not used in the sessions (that is, a VR helmet that makes a user feel immersed in a 3-D environment was not used). Instead, the participant entered a dimly lit room and sat in front of a relatively large screen in order to facilitate the immersion. The patient’s reactions and subsequent assessments

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1 Juan, M.C., Botella, C., Baños, R., Guerrero, B., Alcañiz, M., Monserrat, C., Rey, B. (in press) Augmented Reality to the treatment to phobia to small animals. First prototype and firsts treatments, IEEE: Computer graphics and applications.
of the virtual environment allow the researchers to conclude that the situation was in fact real enough and similar to her daily experiences.

The third article, *Virtual Reality Applications in Attention Deficit Disorder with Hyperactivity: An Approximation*, is written by G. Delgado from the Clinical Psychology Research Group and Quality of Life of Patients and Relatives and I. Moreno from the University of Sevilla (Spain). The authors analyze the spheres of application of VR technology in attention deficit disorder with hyperactivity (ADHD). The authors review research that spans across two decades (1990-2012), noting that VR has been utilized in the assessment and diagnosis of this disorder as well as intervention and treatment procedures (when VR is used alone or as part of multimodal programs, combined with cognitive-behavioral techniques or with neurofeedback). The authors’ results show that VR is a useful and sensible tool for the detection/assessment of ADHD and in terms of treatment, the studies which made use of VR and were reviewed by the authors showed promising results.

Finally, G. Herrera, X. Casas, J. Sevilla, R. Jordan, L. Rosa, C. Pardo, J. Plaza and S. Le Groux from the Universities of Valencia (Spain), Birmingham (United Kingdom) and Pompeu Fabra (Barcelona, Spain). They presented "Pictogram Room: Natural Interaction Technologies to Aid in the Development of Children with Autism", a project designed to work on the key areas of development of children with autism. The project consists of a set of educational video games designed to make progress in areas such as self-recognition, joint attention, communication and relationships with others. The current version of the project on the website http://www.pictogramas.org incorporates a total of forty educational games focused on two dimensions of developments: body awareness and postures. According to the authors, subsequent versions will continue with this pedagogical proposal, incorporating other educational games related to joint attention, imitation and communication. In the article, the authors provide the example of 'The Body’ series, which offers several sets of activities that have been designed to favor the development of body awareness.

These four contributions represent a major advance in our knowledge of these technologies in the sphere of mental health, from the outstanding general review by Soledad Queero, Cristina Botella, Verónica Guillén and the rest of his team from the Spanish universities Jaime I de Castellón and Valencia to the specific applications in eating disorders, autism and ADHD. It will be an indispensable text for those who already make use of these technologies as well as those who are considering them.

As noted by Quero et al. in their article, multidisciplinary teams made up of engineers, computer programmers and therapists must work together in order to take full advantage of this potential. It is also important to reflect on the ethical issues and the implications and consequences that the application of these new technologies could have for the users.

The adjustment to ethical and legal criteria associated with the use of these technologies must be determined as they have in traditional interventions. However, the special nature of these tools make it necessary to develop new strategies that take into account all of the relevant aspects. These aspects include competence in dealing with these technologies and the analysis of which situations can be dealt with efficiently and effectively with these tools. However, it also covers more specific aspects such as informed consent (in the case of minors, the disabled and adults), avoiding harm and maintaining confidentiality.
At this moment a great expansion of Information and Communications Technologies such as Virtual Reality and Augmented Reality is taking place in several fields, including the psychological treatments field. These technologies help the patient both to confront his/her problems in a meaningful yet controlled and safe setting. Further, they open the possibility of experiencing his/her life in another, more satisfactory, way. There are already data on the effectiveness of these procedures for the treatment of different psychological disorders. In the present work a review of the different studies made in this field for emotional disorders is presented. Besides, the advantages and disadvantages of VR, and the future lines of work concerning these technologies are also analysed.

Keywords: Virtual Reality, Emotional Disorders, Psychological Treatments, Clinical Psychology

INTRODUCTION

The psychology treatments field has advanced notably in the last years. Since the beginning of the movement of psychology based on evidence we have already a high number of treatments protocol that have proved to be effective and efficient. In this sense, it should be highlighted the role played by the Information and Communication Technologies (ICTs). It is generally assumed that technology assists individuals in improving their quality of life; but, to ensure appropriate development and use of these technologies, clinicians must have a clear understanding of the opportunities and challenges they will provide to professional practice. Our team has developed and validated several applications based on different ICTs, such as: Virtual Reality (VR), Augmented Reality (AR), the Internet or mobile devices. In this work some advantages and limitations of ICTs for this field are discussed; also some of these applications using VR for the treatment of emotional disorders are presented, and finally, some future perspectives are analysed.

ADVANTAGES OF VIRTUAL REALITY FOR THE PSYCHOLOGICAL TREATMENTS FIELD

Research over the past three decades has shown that the “in vivo exposure” technique is quite effective in treating several psychological problems, especially anxiety disorders. For these disorders, avoidance of feared situations is an element that contributes to maintenance of the problem. The clearest form of avoidance is not facing the situation; for instance, not using elevators, not staying in places where the windows are closed, etc. This kind of behaviour provides relief in the short term, but causes important problems in the long term. Consequently, one of the main aims of treatment consists of coping with feared situations. This is achieved by “exposure”, a treatment technique that is used precisely to activate pathological fear structures in order to disconfirm sufferers’ beliefs and teach them to cope with phobic situations. In fact, most studies stress that the most effective treatment for many psychological disorders is in vivo exposure to the feared situations (Harris, Robinson & Menzies, 1999; Marks, 1987; Öst, 1987).

In short, exposure procedures involve presenting a person with anxiety-provoking material (situation, objects, etc.) for a long enough time to decrease the intensity of their emotional reaction. Usually, in vivo exposure is presented in a graded or graduated way; that is, the patient is exposed to the feared situation in a gradual manner. However, in vivo exposure has a number of limitations and VR has been considered a viable alternative to this technique. Generally, the works devoted to analyzing the contribution of VR to the field of psychological treatments highlight the following advantages that VR has over traditional exposure therapies (Botella, Baños, Perpiñá, & Ballester, 1998a; Botella, Baños, Perpiñá, Alcañiz, Villa, & Rey, 1998b; Botella, Quero, Baños, Perpiñá, García-Palacios, & Riva, 2004; Riva, 1997; Riva, Botella, Legéron, Optale, 2004; Wiederhold, & Wiederhold, 1998; Zimand, Rothbaum, Tannenbaum, Ferrer, & Hodges, 2003):

Firstly, in vivo exposure is costly, as it usually requires the therapist to go to the feared place. Exposure interventions “without a therapist” are still not very frequent and patients are often reluctant to participate in this type of treatment. In addition, the feared place is not always easily accessible, and imaginative exposure (that is, exposure to imagined situations) in these cases is less effective. The additional difficulty of individual differences in imaginative ability must also be taken into account. VR technology can help overcome these difficulties by generating different settings that would not otherwise be readily available without leaving the office.
VR exposure allows almost total control of everything occurring in the situation experienced by the person in the virtual world. If a patient fears being trapped in an elevator, or turbulence and bad weather during a flight, we can assure him/her that these threats are not going to occur until he/she feels prepared to cope with them and, in fact, he/she accepts them to happen in the virtual world. The same can be said for numerous elements that are present in the situation which can make it more or less threatening. For instance, number of feared persons, animals or objects, size and degree of closing/opening of virtual spaces, the height of the spaces, the presence of protecting elements, duration of a determined situation, etc. This makes a personalized construction of the exposure hierarchy possible by enabling the user to cope with the feared situation or context at his/her own pace. VR system can generate as many audiences and social situations as the person requires, and such situations can be at his/her disposal when needed and as many times as the person desires. The only mission of the avatars and the whole virtual world is to be there in order to help. Therefore, VR provides valuable opportunities regarding training and self-training. A person with fear of driving following a motor vehicle accident can practice different feared elements (overtaking a track, driving with rain, entering a tunnel, or passing over a bridge) as many times as needed in the virtual world. This possibility of continuous practice in many diverse contexts may help to generalize the therapeutic achievements to the real world.

VR helps the person feel present and judge a situation as real. In fact, a central element of VR is that it provides the person a place where he/she can be placed and live the experience (Baños, Botella, Guerrero, Liaño, Alcañiz, & Rey, 2005). VR contributes an important benefit to treatment because it affords a feeling of presence that can rarely be achieved with imaginal exposure. This aspect is fundamental, since exposure therapy is intended to facilitate emotional processing of fear memories. Furthermore, the therapist is able to know what is always happening in the situation, what elements are being faced by the patient and by what is disturbing him/her. Obviously, this also contributes to the control of the situation and the protection of the patient.

VR makes going beyond reality possible. In therapy, (and also in the real world) one can witness the importance of certain situations considered extreme in order to definitively overcome a problem. There are different thresholds of difficulty/threat; once a very high threshold is overcome, it is much easier to cope with the remaining ones. Virtual worlds allow creating situations or elements so “difficult or threatening” that they would not be expected to happen in the real world. For instance, in our claustrophobia application one of the walls can be displaced (producing a loud noise) reducing the room to a very small space. The first patient who was treated with this application indicated precisely this: “If I am able to cope with that wall I can confront everything” (Botella, et al 1998b). The same can be created in other virtual worlds; a person with phobia of spiders unexpectedly has to cope with thousands of spiders, or spiders whose size increase so much that they turn into monsters.

VR is an important source of personal efficacy (Botella, et al. 1998a; 2004). According to Bandura (1977), from all possible sources of personal efficacy, performance achievements are especially useful. VR is an excellent source of information on personal efficacy. VR allows the construction of “virtual adventures” in which the person experiences him/herself as competent and efficacious. VR is flexible enough to permit the design of different scenarios in which the patient can develop personal efficacy expectations of the highest magnitude (including from easy performances to very difficult ones) generalization (referred to very different domains) and strength (difficult to extinguish, and to achieve the patient perseveres regardless of difficulties). The goal is for the person to discover that the obstacles and feared situations can be overcome through confrontation and effort.

A problem posed by in vivo exposure treatment is that patients are sometimes so afraid of facing what they fear that they either refuse this type of program or drop out after beginning (Marks & O’Sullivan, 1992). This treatment can also be very aversive for patients who do accept them and can make them feel very insecure, as there is no assurance that something will not go wrong (e.g., the elevator stopping, technical problems on the plane, etc.). Safety is an important advantage of VR. Patients can control the context and the computer-generated setting with the therapist as they wish and with no risk involved. Indeed, the “virtuality” of the setting is precisely what makes patients feel safe (they can act, experiment and explore the feared setting “as if” it were real). This provides the important intermediate step between the therapist’s office (where patients feel safe and sheltered) and the real world (which may seem so threatening that patients decide they cannot cope with it). Furthermore, VR allows the feared object to be graded very precisely according to individual differences. This means that treatments can be “custom-made” for each patient and each problem. Moreover, patients usually accept the use of VR very well. A study conducted by Garcia-Palacios and colleagues compared the acceptance of one-session and multisession in vivo exposure vs. multisession VR exposure therapy (Garcia-Palacios et al., 2001). More than 80% of the sample preferred VR to in vivo exposure.

VR offers privacy and confidentiality. The possibility offered by VR of confronting many fears inside the consulting room, without the necessity of in-vivo exposure, represents a significant advantage.

Besides these advantages of VR over the traditional exposure technique VR offers other advantages from a more general treatment perspective. On one hand, VR becomes a new sense that is incorporated in our “perceiving appa-
us”, using Popper’s (1962) and Lorenz’s (1973) terminology. The virtual worlds allow us to access more information about both ourselves and the world. By watching him/herself confronting different feared agoraphobic situations, an agoraphobic changes the perception he/she has of him/herself (perhaps I am not so weak) and about the world (perhaps it is no so dangerous). The magic of virtual worlds and its importance regarding treatment lies precisely there. They are “safe” contexts, the “safe base” that therapy offers to the patient (Bowlby, 1973). In these protected contexts, people can freely explore, experience, feel, live, revive feelings and/or thoughts whether they are current or past. Nothing prevents them from knowing the world and their selves. Assuming this new perspective provides an enormous sensation of freedom. It is possible to be aware of the world and the self, which were considered absolutely given and finished; in fact, they are just an interpretation, a simulation, which (at least to a certain extent) can be changed. The patient can construct a new reality about him/herself and the world (“I have been an agoraphobic until today, but starting now there is no need to keep doing it”). Therefore, the goal of VR is not necessarily to “recreate” reality, but rather to achieve virtual environments that are relevant and significant to the person (Hoorn, Konijn, & Van der Veer, 2003).

The first study using VR for the treatment of a psychological disorder was focused on acrophobia and exposed the user to virtual anxiety-provoking environments instead of real anxious situations. Since then, there have been significant advances in the number of problems studied, as well as their complexity. A review of the main results obtained with VR therapy for emotional disorders is presented below.

**Virtual Reality Based Applications for Emotional Disorders**

1 Phobias

1.1 Acrophobia

The first experience aimed at testing the utility of VR for the treatment of acrophobia, fear of heights, was carried out by the Kaiser-Permanente Medical Group of California. A system wherein the patient had to pass through a deep gully crossing over a suspension bridge and a narrow board was developed (Lamson, 1994). The use of the system with 32 patients obtained a 90 percent success rate.

Apart from this first experience, six case studies and four controlled studies have been reported to date. The first case studies were carried out by Rothbaum and North’s groups at the University of Clark Atlanta (North, North & Coble, 1996a,b,c; Rothbaum, Hedges, Kooper, Opdyke, Williford, & North, 1995). Furthermore, Choi, Jang, Ku, Shin & Kim (2001), and Jang, Ku, Choi, Wiederhold, Nam, Kim & Kim (2002) also demonstrated that VR exposure technique is effective in the treatment of acrophobia. Nevertheless, in a single case study, Kamphuis, Emmelkamp and Krijn (2002) did not find a clinically significant improvement. However, in other work published one year later, Bouchard, St-Jacques, Robillard, Coté and Renaud (2003) found statistically significant improvement in fear of heights in a series of 7 patients (five females and 2 male). Moreover, the gains were maintained at 6-month follow-up.

The first controlled study on the effectiveness of VR exposure for the treatment of acrophobia was carried out by Rothbaum, Hodges, Kooper, Opdyke, Williford & North (1995). Students with fear of heights were randomly allocated to one of two experimental conditions: a VR exposure group (N=12) versus a no-treatment control group (N=8). The results showed significant differences between the students who completed the VR treatment and those on the waiting list.

The remaining three controlled studies made with clinical populations were conducted by Emmelkamp’s research group. In the first one, Emmelkamp, Bruynzeel, Drost & van der Mast (2001) evaluated the effectiveness of a low-budget virtual reality exposure versus exposure in vivo in a within-group design. Although VR exposure was as effective as in vivo exposure, firm conclusions could not be drawn due to the limitation of a potential order effect influencing the results. In the second study (Emmelkamp, Krijn, Hulsbosch, de Vries, Schuemie & van der Mast, 2002), participants were also randomly allocated to either VR exposure treatment or in vivo exposure. VR exposure was shown to be as effective as in vivo exposure for all measures (including a “Behavioral Avoidance Test” consisting of climbing open stairs) and improvement was maintained at 6-month follow-up. Finally, another study developed by this group (Krijn, Emmelkamp, Biemond, de Wilde de Ligny, Schuemie & van der Mast, 2004) was aimed at examining two different conditions of VR exposure treatment, varying in their degrees of immersion by using either a head-mounted display (HMD) for low immersion, or a computer automatic virtual environment (CAVE) for high immersion. To control the effect of time, a no-treatment control group was added. Thirty seven patients took part in the study, and they were assigned randomly to one of the three conditions. Results showed that VR exposure was more effective than no treatment, with no differences found between the two presence conditions (HMD versus CAVE). Gains were maintained at 6-month follow-up. All studies used visual and audio stimuli and some form of tactile stimuli (such as a platform or a railing that the participant could hold on to), thus increasing the sense of presence.

In conclusion, it appears that VR exposure has proven to be effective for the treatment of fear of heights. The four controlled studies and most of the case studies show that VR exposure is effective in treating fear of heights.
1.2 Claustrophobia

Positive results about the effectiveness of VR exposure for the treatment of claustrophobia, fear of enclosed or confined spaces, have been reported in the three studies carried out by Botella’s research group. The first study (Botella, Baños, Perpiñá, Villa, Alcañiz & Rey, 1998a) consisted of a case report. The participant was a 43-year-old woman who received 8 VR exposure sessions. All fear measures were reduced after treatment and were maintained at one-month follow-up. In the second work (Botella, Villa, Baños, Perpiñá & García-Palacios, 1999) the same VR exposure therapy was applied to a patient with a diagnosis of two specific phobias (claustrophobia and storms), panic disorder and agoraphobia. Results showed an important change in all measures after treatment. In addition, a generalization of improvement to other phobic and agoraphobic situations not specifically treated was observed. Furthermore, changes were maintained at 3-month follow-up. In another study, Botella, Baños, Villa, Perpiñá & García-Palacios (2000) tested the effectiveness of VR exposure therapy following a controlled design. Results again supported the effectiveness of VR exposure. An improvement was observed in all measures (including a Behavioral Avoidance Test consisting of keeping the person in a closet) and gains were maintained at 3-month follow-up.

In short, although results obtained in the aforementioned studies are promising, additional studies with larger samples, using group designs including control groups, are still needed in order to draw firmer conclusions.

1.3 Small animal phobia

The group at the University of Nottingham and the Institute of Psychiatry developed the first VR system for the treatment of arachnophobia (Grimsdale, 1995). Through an HMD, participants viewed a spider whose realism gradually increased until the patient’s tolerance allowed him/her to face the spider. In addition, Hoffman’s research group has reported three studies examining the effectiveness of VR exposure for the treatment of phobia of spiders: a case report and two controlled studies. The case report (Carlin, Hoffman & Weghorst, 1997) showed the efficacy of immersive computer-generated virtual reality and mixed reality (consisting of touching real objects which patients also saw in VR) in a 37-year-old female with severe and incapacitating fear of spiders.

Later, this promising result was supported by two controlled studies. In the first one, García-Palacios, Hoffman, Carlin, Furness & Botella (2002) compared VR exposure therapy with a waiting list condition in a between group design with 23 participants who received an average of four one-hour exposure sessions. Results showed that 83% of patients in the VR treatment group improved in a clinically significant way (including a Behavioral Avoidance Test, consisting of exposure to real spiders) compared with 0% in the waiting list no treatment condition. The second work (Hoffman, García-Palacios, Carlin & Botella, 2003) explored whether treatment effectiveness was increased by providing the patient the illusion of physically touching the virtual spider. Results showed that the participants in the tactile augmentation group showed the greatest progress on behavioral assessment as observed in the Behavioral Avoidance Test at post-treatment. Therefore, we can conclude that the effectiveness of VR exposure for the treatment of arachnophobia is well established, since it has been proven that is more effective than non treatment. However, its effectiveness compared with in vivo exposure still remains unknown.

1.4 Flying Phobia

Several case studies have been reported, all of them providing results favoring the utility of VR therapy for the treatment of fear of flying (Baños, Botella, Perpiñá & Quero, 2001; Klein, 1999; North, North & Coble, 1997; Rothbaum, Hodges, Watson, Kessler & Opdyke, 1996; Wiederhold, Gervitz & Wiederhold, 1998).

On the other hand, another seven studies, which differ in the degree of methodological control achieved, also provide support for the effectiveness of VR for the treatment of flying phobia. Wiederhold (1999) compared VR exposure therapy with “Imaginal exposure therapy” (that is, exposure treatment done through imagination). Three groups were included in the study: VR with no physiological feedback (wherein users did not receive information about their physiological state) (N=10), VR with physiological feedback (wherein users received information about their physiological state) (N=10) and imaginal exposure with no physiological feedback (N=10). Contrary to what was expected, there were no differences between groups after treatment. However, statistically significant differences between groups at three-month follow-up were found: 80% of the VR Exposure with no physiological feedback group, 100% of the VR Exposure with physiological feedback group, and 10% of the imaginal exposure group could fly without medication or alcohol at follow-up. Kahan, Tanzer, Darvin & Borer (2000) investigated the effects of anxiety management training (techniques focused on coping anxiety symptoms) and VR exposure therapy; the results showed that 21 out of 31 patients flew after treatment. However, as Krijn, Emmelkamp, Olafsson & Biemond. (2004) point out, no conclusion about the effectiveness of VR exposure can be drawn due to several methodological shortcomings (e.g., the design consisted of a package rather than pure VR exposure, and the number of sessions differed across patients).

In the study carried out by Mühlberger, Herrmann, Wiedemann, Ellgring & Pauli (2001), thirty patients were randomly assigned to either VR exposure condition or relaxation condition. Results showed that fear of flying improved in both treatment groups. VR exposure was found to be more effec-
tive than relaxation on specific fear of flying questionnaires. In a more controlled study, Rothbaum, Hodges, Smith, Lee & Price (2000), three experimental conditions were used to compare VR exposure therapy (four sessions of VR exposure and four sessions of anxiety management therapy) with in vivo exposure therapy (two sessions of traditional in vivo exposure and four sessions of anxiety management therapy) and a waiting list (that is, no treatment). Forty-five patients were randomly allocated to one of these conditions. Both treatment conditions were more effective than a waiting list period, with no differences between treatments, neither after treatment nor at 12-month follow-up (Rothbaum, Hodges, Anderson, Price & Smith, 2002).

A second, more controlled study was carried out by Maltby, Kirsch, Mayers & Allen (2002). Using a between group design they compared VR exposure therapy (psycho-education and graded exposure) with an attention-placebo condition (education about the safety of a flight and mechanisms of airplanes). The VR exposure group showed a better outcome on most measures at post-treatment; however this superiority of the VR exposure group disappeared at 6-month follow-up. In another randomized controlled work, Mühlberger, Wiedemann & Pauli (2003), compared three experimental treatment conditions: 1) cognitive treatment and VR exposure therapy with motion simulation; 2) cognitive treatment and VR exposure therapy with no motion simulation; and, 3) cognitive treatment alone. A non-random waiting list group was also used. Only participants who received VR exposure (with or without motion simulation) showed reductions in their fear of flying measured by questionnaires at post-treatment. Furthermore, motion simulation did not enhance treatment effectiveness.

Finally, Botella, Osma, García-Palacios, Quero & Baños (2004) carried out a multiple baseline design controlled study where the use of VR exposure was the only therapeutic component (consisting of 6 exposure sessions). Nine participants took part in the study, and results showed that VR produced a decrease of the fear, avoidance and belief in catastrophic thoughts; all participants flew after treatment. Moreover, these results were maintained at 1-year follow-up.

In short, results obtained thus far suggest the utility of VR for the treatment of flying phobia. However, more controlled studies are needed with larger samples and comparable treatment conditions with regard to number of sessions and length of sessions in order to draw firmer conclusions.

1.5 Driving Phobia

Wald & Taylor (2000) carried out the first case report examining the efficacy of VR exposure therapy for treating the fear of driving. A decrease in anxiety and avoidance was produced, with gains maintained at 7-month follow-up. In a second controlled work, Wald (2004) presented efficacy data from a multiple baseline across-subjects design that included five participants who followed a VR exposure treatment with eight weekly sessions. There were significant reductions in fear and avoidance symptoms in three out of five participants that were maintained at one-year follow-up, as measured by self-monitoring (in a driving diary) and interviews (SCID-IV, First et al., 1996; Driving History Interview, Ehlers, 1990). However, VR exposure did not result in an increase in actual driving frequency for any of the participants. Given these limited results, the author concluded that VR exposure might be most useful as a preparatory intervention or as an adjunct for in vivo exposure rather than as a stand-alone intervention.

Finally, Walshe, Lewis, Kim, O’Sullivan & Wiederhold (2003) have reported an open study aimed to investigate the effectiveness of the combined use of computer generated environments involving driving games and a VR driving environment for the treatment of driving phobia. Fourteen subjects who met DSM-IV criteria for Specific Phobia after a motor vehicle accident participated in the study. Participants who experienced “immersion” in one of the driving simulations (7 out of 14) completed the exposure program. Significant reductions for all measures were produced at post-treatment supporting the utility of VR and computer games in the treatment of driving phobia even when co-morbid conditions such as post-traumatic stress disorder and depression were present.

In conclusion, studies on the use of VR exposure therapy are still contradictory and preliminary for this specific phobia. The open trial by Walshe et al (2003) offered promising findings. However, the study by Wald (2004) offers very limited results regarding the use of VR in the treatment of driving phobia. The literature on in vivo exposure therapy for driving phobia is also very scarce (Towned & Grant, 2006) and there are no available controlled studies with a group design. Controlled studies are needed in order to investigate if this phobia has a differential response to exposure therapy.

1.6 Public Speaking Fear/Social Phobia

Anderson, Rothbaum & Hodges (2003) reported two case studies using anxiety management treatment, in vivo exposure and VR exposure. Results showed a decrease in specific anxiety symptoms at post-treatment. The authors also informed that the results for these two cases were similar to the effectiveness of “traditional” treatment (cognitive behavior therapy). Légeron’s group has also designed (Roy, Klinger, Légeron, Lauer, Chemin & Nugues, 2003) and recently tested (Klinger, Bouchard, Légeron, et al., 2005) a VR-based protocol to treat social phobia. This last work is a preliminary controlled study in which a VR exposure therapy group was compared with a cognitive behavior therapy group (control condition). The virtual environments used recreated four situations related to social anxiety: performance, intimacy, scrutiny, and assertiveness. The results showed that both groups improved significantly.
Slater and colleagues (Slater, Pertaud & Steed, 1999) have been working on software designed for fear of public speaking and its validation (Pertaud, Slater & Baker, 2002). In this last work, Pertaub et al. studied the anxiety response of 40 individuals with fear of public speaking in a virtual reality environment. Participants had to give a 5-minute presentation to a neutral, positive, or negative audience that consisted of eight avatars. Results confirmed that all three virtual environments could generate anxiety in participants. Harris, Kemmerling and North (2002) reported a study with a subclinical population. Two conditions were contemplated: VR exposure therapy and a waiting list control group. VR exposure therapy included four exposure sessions of 15 minutes each. Participants in the VR condition showed an improvement on several questionnaires after treatment.

In summary, preliminary results suggest that VR may be a useful tool for the treatment of fear of public speaking. However, there is only one controlled study in the literature (Harris et al., 2002) and it has been carried out with a subclinical sample. In the near future more controlled studies will likely be conducted. Fear-provoking virtual environments are already available and results, although preliminary, are in favor of the efficacy of VR exposure for the treatment of social anxiety.

2. Panic disorder and agoraphobia.

Panic disorder and agoraphobia (PDA) is a highly incapacitating psychological disorder. PDA is an anxiety disorder characterized by attacks of anxiety or terror, often (but not always) occurring unexpectedly and without reason. These attacks are associated with somatic symptoms such as dyspnea, palpitations, dizziness, vertigo, faintness, or shakiness and with psychological symptoms such as feelings of unreality (depersonalization or derealization) or fears of dying, going crazy, or losing control; there is usually chronic nervousness and tension between attacks. Agoraphobia is the fear of having a panic attack in general in any place whether it be the grocery store, at work or in the privacy of one’s own home.

Virtual environments for the treatment of PDA are available (Botella, Villa, Garcia-Palacios, Baños, Perpiñá & Alcañiz, 2004; Moore, Wiederhold, Wiederhold & Riva, 2002; Vincelli, Choi, Molinari, Wiederhold & Riva, 2000). Due to the complexity of PDA compared to specific phobias, studies carried out to test the effectiveness of VR exposure therapy for the treatment of this disorder have included the exposure to anxiety-provoking virtual environments as a part of a cognitive behavioral treatment program. This program also includes other techniques such as breathing retraining, relaxation, cognitive restructuring (that is, techniques focused on replacing irrational beliefs with more accurate and beneficial ones), and education (that is, information about the problem and how to manage it).

VR treatment efficacy for PDA has been demonstrated in several controlled studies with clinical samples that use VR for situational exposure. Vincelli et al. (2003) tested the efficacy of a CBT program in which exposure to agoraphobic situations was applied using a clinical intervention protocol called Experiential Cognitive Therapy (ECT) for the treatment of PDA that included VR environments designed three years prior by Vincelli, Choi, Molinari and Riva (2000). Eighteen participants with PDA were assigned to three experimental conditions: 1) the ECT group, 2) the traditional CBT group and, 3) a waiting list control group. Both treatment groups were equally effective, and each was more effective than the control group. However, this study had some limitations. Firstly, the sample size was small. Secondly, participants were given self-exposure assignments between sessions, which made it difficult to determine if the improvement was due to the ECT or to in vivo exposure. Thirdly, the treatment groups received different numbers of sessions: 8 for the ECT group and 12 for the CBT one. Finally, relevant measures for PDA such as the Panic Disorder Severity Scale and the Anxiety Sensitivity Index were not included. In a later study, Choi et al. (2005) compared two experimental treatment conditions: one group received the traditional Panic Control Program developed by Barlow and Craske (1994) consisting of 12 sessions, while the other group received the aforementioned ECT with 4 sessions. Forty people with PDA participated in the study. Results again showed an improvement in both treatment conditions with no differences between them at post-treatment. However, at 6-month follow-up, the ECT group’s results were inferior to those of the Panic Control Program. Again, though, the treatment groups received different number of sessions (the ECT group was smaller). Finally, a recent study by Peñate, Pitti, Bethencourt, De La Fuente and García (2008) compared two treatment conditions: CBT with VR exposure to agoraphobic situations and CBT with in vivo exposure to agoraphobic situations. The authors observed a slight amelioration of symptoms in the group that received VR exposure compared with the in vivo exposure group. However, analyses did not reach statistical significance between groups neither at post-treatment nor at three-month follow-up.

All of the aforementioned studies show the efficacy of VR exposure to agoraphobic situations for the treatment of PDA. However, all of them apply the Interceptive Exposure (IE) component in the traditional manner (in vivo), so the efficacy of IE using VR was not explored. The VR program for PDA developed by Botella et al. (2004) enables therapists to simultaneously use virtual reality interoceptive exposure to present bodily sensations (including rapid audible heartbeats and panting as visual effects) while patients are immersed in various VR environments (e.g. a bus or a mall) in the consultation room. In a previous controlled study (Botella et al., 2007), we compared three experimental conditions: In vivo exposure (wherein both exposure to agoraphobic situations and IE were conducted in vivo), VR exposure (wherein
exposure to agoraphobic situations was conducted using virtual scenarios and IE was conducted using the effects offered by the VR program as well as traditional exercises), and a waiting list control. Results revealed that both treatment conditions showed similar efficacy, and that each was more effective than the control group. In spite of the efficacy and acceptability of VR exposure reported by the participants in this study (Botella et al., 2007), the VR condition did not use the IE VR component in a controlled manner. For this reason, in a recent study (Perez-Ara et al., 2010), the effects of using VR IE and traditional methods for IE were compared. We did this by comparing the efficacy of a single CBT program in two applications: one in which VR was used for both the situational exposure and IE components, and another in which VR was used for situational exposure, but the IE component was applied in the traditional manner. Results showed that both treatment conditions significantly reduced the main clinical variables at post-treatment. These results were maintained or even improved for both conditions in six of the outcome variables at three-month follow-up. However no significant differences were found between the two treatment conditions, so it seems that provoking physical sensations with VR effects was as powerful as evoking them with traditional exercises (such as hyperventilation, climbing or descending stairs, spinning in a chair, etc.) traditionally used in IE (Barlow, Craske, Cerny & Klosko, 1989). These promising findings support the utility of the Panic-Agoraphobia program (Botella et al., 2004) in applying both VRE to agoraphobic situations and VR-IE.

Despite the few studies available and the limitations of the studies that have been presented, VR exposure could be useful for the treatment of PDA. However, most of the work in this field remains to be done. For instance, it is necessary to replicate these in larger clinical samples, including follow-up assessments, and to validate the virtual interoceptive exposure component.

3. Stress-related disorders

3.1. Post-traumatic stress disorder

Post-traumatic Stress Disorder (PTSD) is a psychological disorder that can occur following the experience or witnessing of life-threatening events such as military combat, natural disasters, terrorist incidents, serious accidents, or violent personal assaults such as rape. People who suffer from PTSD often relive the experience through nightmares and flashbacks, have difficulty sleeping, and feel detached or estranged, and these symptoms can be severe and long enough to significantly impair the person’s daily life. The use of cognitive behavioral programs that include exposure-based techniques is currently the treatment of choice for PTSD. The treatment program for PTSD with the most empirical support is Prolonged Exposure, developed by Foa & Rothbaum (1998), which involves imaginal exposure to the traumatic experience.

Rothbaum et al. (1999) published the first case study in the use of VR exposure in the treatment of PTSD. Since then, an increasing number of studies are showing the utility of VR exposure for PTSD, resulting in a significant reduction of patients’ symptoms related to the traumatic event they have experienced. Most of these works have been centered on war victims (war veterans or active military personnel) and a majority has been conducted with terrorist attack victims and motor vehicle accidents victims. For instance, Rothbaum’s team has reported clinical situation improvements in Vietnam war veterans in several case studies (Rothbaum et al., 1999; Rothbaum, Hodges, Ready, Graap y Alarcon, 2001; Rothbaum, Ruef, Litz, Han y Hodges, 2004) and in an open clinical trial (Rothbaum, Ruef, Litz, Han y Hodges, 2004). However, preliminary results obtained in a controlled study conducted by Gamito el al. (2009) did not find significant differences from pre to post-treatment (fifth session) in the participants who were exposed to the virtual environment. In any case, this is still a study in progress in where only data referred to half of treatment sessions were analysed. Finally, in a more recent clinical pilot study Gamito et al. (2010) assigned 10 participants to 3 groups: VR exposure therapy, prolonged exposure and waiting list control group. Participants were Portuguese veterans who fight in African colonial wars more than 30 years ago. Patients who received VR exposure condition showed a significant reduction of symptoms related to PTSD (anxiety and depression). These results, although no conclusive, show that VR can be effective to treat elderly war veterans.

On the other hand, in the last 4 years numerous studies with active soldiers using Irak and Afghanistan wars VR environments for the treatment of this problem have been published: four case studies (Gerardi, Rothbaum, Ressler y Heekin, 2008; Reger y Gahm, 2008; Tworus, Szymanska y Illnicki, 2010; Wood, Wiederhold y Spira, 2010); a case series study (McLay, McBrien, Wiederhold y Wiederhold, 2010); three open clinical trials with 20 or more participants participants (Reger et al., 2011; Rizzio et al., 2009; Rizzio et al., 2010); and a small random controlled study which compared VR exposure versus treatment as usual (McLay et al., 2011). The positive results obtained in all these works point out the utility of VR for the treatment of combat-related PTSD in active soldiers.

Thirdly, regarding terrorism victims, VR has showed its utility in the treatment of survivors of the September 11th attack in New York (Difede & Hoffman, 2002) and positive preliminary results have been also found in a small control study which compared VR exposure versus a waiting list control group (Difede et al., 2007). Finally, there exist preliminary data on the use of VR for the treatment of terrorist bulldozer attack victims in a case study (Freedman et al., 2010).

Preliminary data are also available on the use of VR for the treatment of motor vehicle accidents PTSD victims in two
case series studies (Beck, Palyo, Winer, Schwagler y Ang, 2007; Walshe, Lewis, Kim, O’Sullivan y Wiederhold, 2003).

In general, results obtained in all these aforementioned studies are very promising regarding the utility of VR for the treatment of PTSD. Furthermore, we should highlight that in the study conducted by Difede and Hoffman (2002), the VR treatment was more effective that traditional treatment, resulting in success when the treatment of choice currently for PTSD (imaginal prolonged exposure) had failed. However, it is also important to notice that most of these studies are uncontrolled ones (case studies, case series, clinical open trials), thereby is necessary to replicate the results in controlled studies with bigger samples in order to draw firmer conclusions regarding the efficacy and effectiveness of VR in the treatment of PTSD.

Finally, another approach is proposed by Botella et al. (2006a). In the previously mentioned studies, the approach is to simulate traumatic events with high realism with the aim of exposing the participants to the feared aspects of the trauma. Botella’s design follows a different approach. The aim is to design clinically significant environments for each participant, while attending to the meaning of the trauma for the individual, rather than to simulate the physical characteristics of the traumatic event with high realism. The aim is not realism, but using customized symbols and aspects which provoke and evoke an emotional reaction in the participant. This can help to achieve the emotional processing of the trauma, while creating a safe and protective environment. In the EMMA research project funded by the European Union (Engaging Media for Mental Health Applications, IST-2001-39192) we have developed a virtual environment ‘EMMA’s World’ that acts as an adaptive display to treat emotional disorders. We have obtained data about the efficacy of ‘EMMA’s World’ (Botella et al., 2006b; Botella et al., 2010; Baños et al., 2009, 2011).

In summary, VR technology may provide a useful means to treat PTSD. The results thus far are preliminary but encouraging. It remains to be seen, however, what the appropriate applications of the technology will be, whether or not there is a significant advantage to using this technology compared to other strategies that are currently available, and what factors may contribute to its effects.

3.2 Adjustment disorders and pathological grief

As noted, ‘EMMA’s World’ was designed to treat PTSD. However, the treatment of PTSD shares strategies and components that may also be useful in treating other stress-related problems, such as Adjustment Disorders or Pathological Grief. In these cases are people who have suffered an adverse life event and they could not overcome it. ‘EMMA’s World’ permits customization of the environments according to the needs and preferences of patients. For these reason, we thought that the system could be applied to different disorders. The therapist is free to tune the patient experience according to the specific therapeutic needs. In fact, it allows real-time modifications of the virtual scenarios (a beach, a field, a desert, a solitary and snow-covered place); the use of different realistic natural effects (fog, rain, change from night to day, earthquake, rainbow); the use of objects and significant symbols (from 3D objects to real photographs of something/someone significant to the person) to anchor the virtual experience to the personal history. All this is thought to help to catalyse, potentiate and facilitate the process of change.

In brief, in ‘EMMA’s World’ the focus has been on designing an application to elicit emotions with the goal to reduce or modify them, and on designing affectively significant environments, including those elements with the potential of activating emotions. To do that, “EMMA’ World” has proved that it is not necessary to copy physical reality exactly as it is. A patient can experience virtual presence in the traumatic or stressful situation he/she suffered even when the virtual environment does not represent completely or with total precision the real world. In this way, the therapist can use the system to provide meaningful experiences able to induce a deep and permanent change in their patients.

The systematic application of “The World of Emma” to patients suffering different disorders has shown that it is a highly versatile VR application and this has allowed its use in the case of other psychological disorders in which emotions play an important role, such as Adjustment Disorders and Complicated Grief. In fact, we have already obtained promising preliminary results in all of them (Andreu-Mateu et al., 2012; Baños, Botella et al., 2008; Botella, Osma et al., 2008).

Limitations of Virtual Reality

As we have seen, there has been a steady growth in the use of VR in mental health due to the advances in information technology and the decline in costs (Riva, 2002). However, several barriers still remain:

The first is the lack of standardization in VR devices and software. The PC-based systems, while inexpensive and easy-to-use, still suffer from a lack of flexibility and capabilities necessary to individualize environments for each patient (Riva, 1997). To date, very few of the various VR systems available are interoperable. This makes their use in contexts other than those in which they were developed difficult.

The second is the lack of standardized protocols that can be shared by the community of researchers. In the two clinical databases – Medline and PsycInfo - there are only five published clinical protocols: for the treatment of eating disorders (Riva et al., 2001b), fear of flying (Klein, 1999; Rothbaum et al., 1999), and panic disorders (Vincelli et al., 2001).
The third is the costs required for the set-up trials. As we have just seen, the lack of interoperable systems added to the lack of clinical protocols forces most researchers to spend a lot of time and money in designing and developing their own VR application: many of them can be considered “one-off” creations tied to proprietary hardware and software, which have been tuned by a process of trial and error. According to the European funded project VEPSY Updated (Riva et al., 2001a) the cost required for designing a clinical VR application from scratch and testing it on clinical patients using controlled trials may range between 150000 and 200000 €. The costs of technological applications decrease very rapidly as they become commercial products that can be used by many users.

Finally, the introduction of patients and clinicians to VEs raises certain safety and ethical issues (Durlach & Mavor, 1995). In fact, despite developments in VR technology, some users still experience health and safety problems associated with VR use. However, for a large proportion of VR users, these effects are mild and subside quickly (Nichols & Patel, 2002).

Conclusions and future perspectives

VR has helped the ICTs field to find a significant space in mental health treatment. In particular, VR helps the patient to confront his/her problems in a meaningful yet controlled and safe setting. Furthermore, it opens the possibility of experiencing his/her life in a more satisfying way. In fact, as previously was stated, therapists can use VR to provide meaningful experiences capable of inducing deep and permanent change in their patients (Watzlawick, Weakland, & Fisch, 1974).

However, some efforts are still required to move VR into commercial success and therefore routine clinical use: the more a complex and costly a technology is, the less the user is likely to accept it. Therefore, a critical challenge for the future is the development of easy-to-use and customizable virtual environments that may be adapted in real time to the patient’s needs. An example of this approach comes from the possibility of using in different ways the VR application ‘EMMA’s World’.

A second challenge for the future is the evolution of a typical VR experience. Currently, most of the existing VR applications for mental health are based on single PCs located in the office of a therapist. However, the technological scenario is changing quickly. According to the recent “ISTAG SCENARIOS FOR AMBIENT INTELLIGENCE 2010” ( Ducatel et al., 2000) the evolutionary technology scenarios in support of the Knowledge Society of the 2000s will be rooted within three dominant trends:

Pervasive diffusion of intelligence in the space around us, through the development of network technologies and intelligent sensors towards the objective of so-called “Ambient Intelligence” (Aml) (Riva, 2003);

Increasingly relevant role of mobility, through the development of mobile communications, moving from the Universal Mobile Telecommunications System (UMTS) “Beyond 3rd Generation” (B3G) (Laxminarayan & Istepanian, 2000);

Increase of the range, accessibility and comprehensiveness of communications, through the development of multi-channel multimedia technologies (IJsselsteijn & Riva, 2003).

To exploit the full potential of this evolving situation the development of future ICTs based applications will require multidisciplinary teams of engineers, computer programmers, and therapists working in concert to treat specific clinical problems. In particular, ICT must be made available to the health care community experts in a format that is easy-to-understand and which invites participation.

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Introduction

Virtual Reality (VR) is a computer tool that allows the user (in our field, the patient) to experience a virtual but clinically significant situation applicable to his/her disorder within a safe environment and under the supervision of a therapist. This tool, which is considered a step prior to real or in vivo exposure (Riva, 2009), can be customized and adapted to the needs of each patient. In addition, virtual environments are less likely than treatments such as exposure therapy to affect or cause patients to reject their doctor’s orders, as has been noted in the use of VR for patients suffering from anxiety disorders (Olatunji, Cisler and Deacon, 2010).

VR has proven a useful, efficient tool in the study and treatment of different aspects of eating disorders (ED). The first studies to analyze the effects and usefulness of virtual environments in helping patients suffering from these disorders focused on the evaluation and treatment of altered body image (Perpiñá et al., 1999; Perpiñá, Marco, Botella and Baños, 2004; Riva, Bacchetta, Baruffi, Rinaldi and Molinari, 1999; Riva et al., 2000). These studies, in which the virtual application was a component specifically designed for the treatment of an altered body image, showed the tool’s effectiveness in addressing this disorder. In addition, the tool was shown to successfully reduce eating disorder symptoms and the associated psychopathology while achieving higher treatment compliance rates and increasing patient motivation in the treatment process (Perpiñá et al., 2004).

Another indispensable element in the treatment of both EDs and obesity is the normalization of eating patterns. In terms of the advantages and challenges that VR presents as a therapeutic tool, it is logical to ask whether this tool can help patients approach aspects of eating that are not easily accessible in therapy or other issues difficult to address both in therapy sessions and beyond. This is the case of food exposure and of eating certain foods “forbidden” by the patients.

In the past few years, studies have shown that the exposure to virtual food produces the same feelings as the exposure to real food (Ferrer-Garcia, Gutierrez-Maldonado, Caqueo-Urizar and Moreno, 2009; Gorini, Grièz, Petrova and Riva, 2010). Specifically, in order to stabilize eating patterns in the case of patients suffering from obesity and/or EDs, another virtual environment is being tested. This non-immersive environment consists of a virtual kitchen where foods with different calorie counts are stored either in the refrigerator or cabinets (Perpiñá et al., 2009). The foods are arranged so that they can be stored, cooked and then eaten. The kitchen has a table where the food is served and then eaten while following certain guidelines (eat slowly, savor the food, etc.). The program is still in the stage of experimentation and validation, but the preliminary results with respect to the emotional impact of both controls and patients have been highly satisfactory (Perpiñá et al., 2010). This same virtual environment has been re-
cently used as part of virtual food exposure for a patient with restrictive anorexia nervosa (AN), a type highly resistant to treatment (Cardi et al., 2012). After the virtual exposure to foods and after eating “virtually”, the patient displayed less anxiety, a diminished fear of food and fewer safety-seeking behaviors; the food-related symptoms were reduced and the patient’s Body Mass Index (BMI) increased.

People with AN avoid food, which they associate with negative emotions, thoughts and images. Patients are also characterized by poor insight and little motivation to change, combined with a high rate of abandoning treatment. For all these reasons, the therapist is up against one of the most difficult mental disorders to treat and patients with whom it is hardest to reach therapeutic alliance (Casanovas et al., 2007; Treasure and Ward, 1997). Based on the results of different studies, new research into VR should be done since this technology allows patients to confront their fears, overcome their difficulties and to accept situations that may not have even occurred to them in real life.

The purpose of this study was to analyze the usefulness and effectiveness of a virtual environment as a complementary tool in cognitive-behavioral treatment to normalize the eating patterns of a patient diagnosed with purgative AN.

**METHOD**

**Patient Data**

N. is a female age 21, single, with a medium socioeconomic status. At the time of the consultation, she was living in a student apartment in the Valencian Community, where she was studying at the university.

**Chief Complaint**

In the first interview, the patient’s BMI was 17.40. The patient opted for treatment on her own because she acknowledged that the problem was interfering in her relationships with others and affecting her academic performance. She had severe dietary restraint one or two meals per day consisting of coffee with milk, vegetables and/or fruit along with daily binging episodes (abundant quantities of high-calorie foods following by an overwhelming sensation of having lost control) following by self-induced vomiting. She admitted feeling very ashamed of her episodes of binging-purging and expressed an intense fear of gaining weight. She presented a distorted body image; a fear of getting fat; mistaken and dysfunctional beliefs regarding weight maintenance and nutrition in general, and a constant concern regarding eating, weight and her figure.

Due to her eating disorder, the patient presented the following physical effects: amenorrhea for the past six months, constipation, hypothermia, sensitive teeth, back pain, stomach pain and discomfort, heartburn, brittle fingernails, hair loss, exhaustion and sleeping problems. She did not present Russell’s sign or swelling of the parotid glands. In the physical examination, her cell blood count, biochemical analysis and TSH were normal. In the cognitive examination, she exhibited reduced concentration, attention and memory; a downturn in her academic performance and self-esteem and an exacerbation of her premorbid obsessive symptoms. In the emotional sphere, she had symptoms of both depression and anxiety. Finally, in terms of her social interactions, she reported a deterioration in her personal relationship and a tendency to isolate herself.

**History of the problem**

At the age of 12, she began a restrictive diet during summer in order to lose weight. She soon became very concerned about her weight and about food, dropping to 37kg at that time. After returning to her regular weight, at the age of 14 she relapsed into her food restriction patterns once again, though this time accompanied by weekly vomiting episodes. When she started high school, her eating patterns and weight stabilized. From ages 17 to 19, she resorted to vomiting sporadically to alleviate stress and dysphoria, both of which were probably caused by the demands of that particular moment in her life (the pressure to choose a career; questioning her own identity; exam week at the university, etc.).

During her second year at college, the problem became more severe (which coincided with a break-up after a three-year relationship and the stress of final exams). It got to a point where she suffered three binging episodes a day. She visited her primary care physician after spotting blood in her vomit. This doctor referred her to an endocrinologist and to the Mental Healthcare Unit. After seeing a psychiatrist and receiving a prescription for Cipralex and Orfidal, she was referred to Clinical Psychology. None of her family members was aware of the problem.

**Description of Treatment**

As part of the multidisciplinary approach, the patient received cognitive-behavioral therapy for her disorder on an outpatient basis.

The treatment goals for the medium and long term were the following: the normalization of the patient’s eating patterns and recovery of a healthy body weight; the elimination of potentially dangerous behaviors such as dietary restraint, binging and vomiting; greater satisfaction with her body image; reduced symptoms of anxiety and depression, and the recovery of her premorbid interpersonal functioning.

The initial therapy objectives were to increase N.’s motivation for therapy and her ability to talk about her disorder with
those close to her in order to ensure their collaboration in her psychical and psychological recovery; to educate the patient and her family members about healthy eating patterns; to provide the patient with strategies to understand and modify her dysfunctional behaviors, cognitions and emotions; to address the emotional problems associated with her disorder; and to train N. in coping strategies in order to prevent potential relapses in the future.

In order to achieve these goals, the following techniques were used: motivational techniques from Motivational Interviewing, which was developed for the psychotherapeutic treatment of addictions (Miller and Rollnick, 2002); psychoeducation about healthy eating habits and weight and to help her understand and handle the disorder; behavioral strategies in order to reduce high-risk behaviors and increase healthy behaviors; cognitive techniques for changing the patient’s thinking and attitudes towards her weight and figure; problem-solving techniques and relapse prevention.

The Virtual Reality Environment

The virtual reality environment consists of a kitchen with two main areas. The first is the prep area, with a countertop, cabinets, burners and a fridge that contains all of the elements necessary to prepare a meal, serve it and then eat it “virtually.” When the food is eaten, it is accompanied by the sound of chewing and the portions of food on screen gradually disappear. The foods are located in the fridge, cabinets and shelves, which the user can access freely or block if desired. The second kitchen area is mainly for eating foods the right way: there is a table and a chair for the patient to sit along with all of the necessary items for a meal (dishes, a glass, silverware, a napkin). The eating style can be set to fast or slow. The size of certain foods can be increased or decreased (chocolate, potatoes, pizza, etc.) so that they take up the whole screen (i.e. the kitchen) or get so small that they disappear. There is also an option for alternative behaviors (making a phone call or turning on the radio) in order for the patient to distract him/herself from the impulse to eat. In addition, the software allows therapists to help their patients to address negative thoughts, think positive thoughts and training in positive self-instructions. Finally, the software provides visuals of the positive or negative consequences of the decision and behavior that the patient has just displayed (an image of body organs depicted as happy or sad).

The technical software requirements were a PC Pentium V, 2-D mouse and a 19” monitor. The patient sat in front of the monitor accompanied by her therapist in a dimly lit room that helped to create a greater sense of immersion in the virtual environment.

Therapeutic Process

In addition to the cognitive-behavioral treatment, the patient attended six VR sessions that began a month and a half after the start of her outpatient treatment. The objectives of this therapeutic tool were to help her establish healthy eating habits; to provide her with progressive exposure to certain forbidden foods; to assist her in changing her dysfunctional thoughts related to food and weight, and to train her in strategies that would help her avoid losing control while eating and thus keep her from binging and vomiting.

Each session lasted for 60 minutes and in all sessions there was a focus on aspects such as the appeal, fear and avoidance of “forbidden” foods as well as the patient’s ability to control her impulse when exposed to these foods. After virtually eating the forbidden food, she was asked to discuss her emotions, the degree of reality she experienced during the session and any similarities with her usual experiences with food. In addition, her intrusive thoughts related to eating were explored in each session and she was encouraged to abandon these thoughts for other more adaptive ones. Each session is described in detail below.

Session 1. The main objective of this session was to reinforce the healthy eating habits introduced in the cognitive-behavioral treatment sessions. In this session, the goal was to highlight the importance of establishing a few healthy eating habits: always eat in the same place; eliminate distractions while eating; pay attention to the flavor, smell and texture of the food, and put away packages or bags after serving in order to reduce the temptation to continue eating and binge. After emphasizing these aspects and highlighting the importance of eating five meals a day, N. was invited to virtually eat the foods on the menu she had chosen (a chicken breast with salad and an apple for dessert). The program was also used to remind N. of the importance of eating slowing and positive reinforcement was provided through an onscreen image of healthy internal organs as she ate.

Session 2. To continue to work towards the normalization of healthy eating habits, this session focused on the importance of planning meals and controlling stimuli (serve food on dishes and put away food packages) in order to avoid binging caused by hunger and emotional eating. This session also addressed gaining the power and control that her self-forbidden foods exercised over her, and efforts to achieve greater self-control through progressive exposure to each of these foods and/or through the right internal dialogue. The patient verbalized the negative thoughts that facilitated loss of control when eating (“I shouldn’t eat this because it’s so fattening,”) as well as positive self-instructions to help her gain power over these negative thoughts (“If I binge now, I will binge again tomorrow and I’ll be right back to square one,” or “My body needs energy to study and this food is part of the nutritional pyramid.”).
Session 3. In order to begin progressive exposure to forbidden foods, the patient was asked to rank foods from least difficult to most difficult. To do the ranking, N. had to assess the level of difficulty and then rank from least difficult to one of them, starting with a food ranked as moderately difficult. Throughout the narrative, the therapist reiterated all of the previous training while emphasizing the importance of introducing a given food into the patient’s real-life eating habits in a healthy, moderate way.

Session 4. This session continued with progressive exposure to forbidden foods and added training on behaviors other than binging as ways to overcome impulsive behaviors and out-of-control eating. N. chose a new forbidden food with a higher level of difficulty and was encouraged to eat it virtually while verbalizing her emotions and negative thoughts related to the experience. After the exposure and with the goal of avoiding the urge to continue eating, certain alternative behaviors were practiced in the program, such as making a phone call to a friend or relative. The patient was taught about the hunger mechanism and the advisability of waiting five minutes before continuing to eat. N. added her own alternative behaviors to this strategy such as drinking a cup of tea or reading a book.

Session 5. Through a hypothetical interpersonal event (an argument) or a functional event (exam week) that often led N. into an episode of emotional eating, the patient was confronted with her own urge to lose control when confronted with a forbidden food. The main objective of this session was to continue practicing the self-control strategies learned in the previous sessions: positive verbalizations and alternative behaviors such as making a phone call.

Session 6. In this session, the patient reviewed the situations she experienced in the previous sessions and highlighted the most important aspects: healthy eating habits, positive verbalizations, progressive exposure to forbidden foods and alternative behaviors to avoid the urge to continue eating and consume more than her body needs.

Measures

Beck Depression Inventory-II (BDI-II; Beck, Steer and Brown, 1996; Spanish language version: Sanz, Perdigón and Vázquez; 2003- Inventario de Depresión de Beck). A self-report inventory that assesses the presence and severity of symptoms of depression. It is comprised of 21 questions with 4 answer choices (from 0 to 3).

Beck Anxiety Inventory (BAI; Beck and Steer, 1993; Spanish language version: Comeche, Díaz and Vallejo; 1995 - Inventario de Ansiedad de Beck). This inventory evaluates somatic anxiety symptoms for both anxiety disorders as well as depressive disorders. It has 21 questions that are answered using a 4-point Likert scale (from 0 to 3).

Eating Disorders Inventory-2 (EDI-2; Garner, 1991; Spanish language version: Corral, González, Pereña and Seisdedos, 1998). This inventory is comprised of 91 items and uses a 6-point Likert-type answer scale (from 0=Never to 5=Always). The items are grouped into 11 sub-scales that evaluate attitudes, behaviors and more general aspects associated with DT: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation and social insecurity.

Intra-session Questionnaire: An ad hoc questionnaire designed to assess the emotions (well-being, nervousness, guilt and discomfort) associated with eating foods in VR during the session as well as the urge to throw up, fear and the need or desire to avoid food. It also included two questions on the patient’s presence and perception of reality during the sessions. Answer scale from 1 “None” to 10 “A lot”.

Analogous Visual Scale: An ad hoc questionnaire designed to assess the experience with the VR component, including satisfaction with treatment, usefulness of treatment and willingness to recommend the treatment to a friend or acquaintance with the same problem. Answer scale from 1 “None” to 10 “A lot”.

Results

Over the course of the VR sessions, the patient displayed an increase in well-being and a reduction of the negative emotions experienced when exposed to forbidden foods, in spite of the fact that the foods displayed in the sessions got progressively more difficult. In addition, according to N.’s own assessment, her urge to vomit and her fear and need to avoid these foods diminished from the first exposure session through the last session (see Table 1 and Figure 1).

With respect to her experience with VR, N. expressed that the VR practice sessions left her feeling motivated and confident. Table 1 shows that she gave a high score when asked how similar the VR session was to reality and experienced a feeling of involvement in the virtual environment.

When comparing the pre and post-scores of the eating-related symptoms evaluated with the EDI-2, there was a slight improvement in all of the factors, with a greater difference in maturity fears, perfectionism and drive to thinness. However, there was no change in interpersonal distrust and a slight rise in social insecurity (probably owed to the fact that during treatment, the patient began to participate in social interactions that she had previously been avoiding). In addition, in depression and anxiety symptoms, she displayed a notable decrease at the end of the six VR sessions (see Table 2). Finally, she experienced slight weight gain, from 46.90 kg. before starting the VR sessions to 47.60 kg. when the VR component
Normalization of the eating patterns in a patient with anorexia nervosa, purgative subtype, with the support of a virtual environment. A case study

Table 1. Urge to purge. Fear/avoidance of eating. Reality of the experience.

<table>
<thead>
<tr>
<th>Session</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Sesión 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urge to purge</td>
<td>7</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>--</td>
<td>4</td>
</tr>
<tr>
<td>Fear</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>Avoidance</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Situation similar to what usually occurs</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Reality of the experience</td>
<td>7</td>
<td>9</td>
<td>8</td>
<td>9</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Session 1: Chicken, salad, apple; Session 2: Croissant; Session 3: ¼ pizza; Session 4: Toast and jelly; Session 6: Sardine sandwiches

The virtual experiences were evaluated as highly real by the patient. N. expressed a high level of satisfaction with the VR component and with its perceived usefulness (8 out of 10 in both cases) and she said she would recommend the program to a friend with the same problem (9 out of 10).

Discussion and Conclusions

The objective of this study was to analyze the benefits of adding a VR component to normalize eating patterns as part of the treatment for anorexia nervosa, specifically in the purgative subtype. The patient, N., showed significant improvement in her eating patterns and overall well-being. Her binging and vomiting episodes decreased significantly, and she added forbidden foods to her diet, such as toast and pizza. Her social interaction level also increased progressively.

At the qualitative level, the patient verbalized positive affirmations during the last session, such as: “I’m not going to eat this today because I wasn’t planning on it, but I will eat it in the weeks to come”; “I have a craving for this but the fact is I’m not actually hungry”; “If I compromise today, I will surely compromise tomorrow as well”; “My problem doesn’t control me, I control my problem”; “It’s healthy and it’s on the nutritional pyramid”; “To study, my body needs energy.”

The sessions were also a good place for the patient to practice alternative behaviors that were not explored in conventional one-on-one therapy: reading a book, working on the computer, going to visit her aunt, going out for a walk, going shopping or listening to relaxing music.

The virtual experiences were evaluated as highly real by the patient. N. expressed a high level of satisfaction with the VR component and with its perceived usefulness (8 out of 10 in both cases) and she said she would recommend the program to a friend with the same problem (9 out of 10).
which is critical to the treatment of any mental disorder and especially relevant in the case of ED, where patients are often hesitant about treatment and a high percentage abandon treatment altogether. In the case of this patient, the use of VR allowed her to virtually expose herself to situations she had never even imagined and to put into practice what had been recommended in therapy, reducing her fears and increasing her sense of self-effectiveness. As a result, the VR component has effectively functioned as a prior step to exposure in the real world. In the case of ED treatment, VR has a high potential to become the intermediate step between what happens in the doctor’s office and what happens in reality. It is not far-fetched for patients to be able to add foods that they had not allowed themselves to have for years after virtually “eating” a piece of virtual pizza and having discussed this with their therapist (Perpiñá, Botella and Baños, 2003). As when VR is applied to other mental disorders, researchers have noted that by creating a sense of presence and reality among patients in virtual environments, these same elements help patients to apply what they’ve experienced in real life (Botella et al., 2004).

The results obtained in this study have been very similar to those found for a patient with restrictive AN using the same software (Cardi et al., 2012). In both cases, the VR component helped the patients to normalize their eating pattern with the resulting improvement in their BMI and in their eating and emotional symptoms. Although these results are still preliminary, they indicate that the virtual environment has been capable of mobilizing both restrictive and constructive aspects in therapy, as well as the impulsive and purgative aspects of the disorder.

Unlike the study by Gorini and colleagues (2010), who showed that the emotional impact of viewing virtual food was higher than that of photographed food, the software of this study was not immersive, that is, a VR helmet was not used to immerse the patient in a 3-D environment. As described above, the setting for the VR sessions was a dimly lit room with a relatively large screen to facilitate immersion but the VR helmet was not used. The patient’s reactions and opinions of the virtual environment, however, showed that the situation seemed real enough to the patient and similar to her daily experiences. As found in another study (Perpiñá et al., 2003), for someone with these specific difficulties, the virtual environment and the possibility of interacting with the virtual environment and food are clinically significant because they allow other mechanisms—more psychological than technical—to take over. As a result, patients can allow themselves to “get involved” in the reality and setting that are established in the VR experience.

The advance of new therapeutic strategies that increase treatment adherence and the motivation to change in the case of EDs is another important topic. In its 1995 clinical guide, the APA distinguished between the effectiveness of an intervention and its clinical effectiveness or usefulness. The first generation of VR studies was aimed at demonstrating the effective-

### Table 2. Pre-Post Data of VR sessions

<table>
<thead>
<tr>
<th>Measure</th>
<th>PRE</th>
<th>POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulimia</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Body dissatisfaction</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Impulse Regulation</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Impulsividad</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Bulimia</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Drive for thinness (DT)</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>Asceticism</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Interpersonal distrust</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Maturity fears</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Asceticism</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Self-effectiveness</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>BDI</td>
<td>40</td>
<td>19</td>
</tr>
<tr>
<td>Ineffectiveness</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>BAI</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>Interoceptive awareness</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Asceticism</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Bulimia</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td># binges and vomiting</td>
<td>2/3 times per day</td>
<td>1 once a week</td>
</tr>
<tr>
<td>BMI</td>
<td>17.43</td>
<td>17.70</td>
</tr>
</tbody>
</table>
ness of this tool in therapeutic interventions (Bush, 2008) but now that its effectiveness has been shown, the question of its efficiency has also appeared. This includes the degree to which patients accept the treatment and the question as to whether VR contributes any additional advantages to the existing techniques. EDs are highly dysfunctional syndromes that involve severe damage for the person and his or her environment; therefore, the more tools we have to help patients recover, the more strategies we will have at our disposal to deal with these difficult disorders.

This research involved just one case study and this is clearly its greatest limitation. However, the results of this and other similar studies are accruing experience and evidence of how a therapeutic assistance tool can contribute to the general treatment of EDs, which have their own specific treatment difficulties. This study has included VR as a complementary tool to traditional cognitive-behavioral therapy. VR was used to rehearse gradual exposure techniques, control of stimuli and training in alternative behaviors, thus permitting the therapist to directly supervise the patient during the session. In addition, VR allowed for things that couldn't actually happen (i.e. making a food increase in size to symbolize its power over the patient), allowing the patient to confront her fear of not being able to control her urge to eat.

In the future, studies should continue exploring this strategy as a supplement to regular psychotherapeutic intervention and as a way of exposing patients to the situations that cause them the greatest fear and emotional upset in a controlled environment.

References


Acknowledgements:

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Virtual Reality Applications in Attention Deficit Disorder with Hyperactivity: An Approximation

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Summary:
The goal of this work is to analyze the areas of application of virtual reality in attention deficit disorder with hyperactivity. Taking into account the brief and recent history of this technology in the area of childhood, we have reviewed all publications dealing with the topic from 1990-2012. Based on our research, we have distinguished two basic applications: 1) virtual reality as an instrument for the assessment and diagnosis of this disorder; 2) virtual reality as a procedure for intervention and treatment. In this case, virtual reality can be applied as the sole technique or as part of multimodal programs, combined with cognitive-behavioral techniques or with neurofeedback. This work presents the advances and drawbacks of this technology with respect to attention deficit-hyperactivity disorder.

Key words: Virtual reality, hyperactivity disorder, assessment, treatment.

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INTRODUCTION:

Virtual Reality (referred to here as “VR”) is a dynamic technology that can be used to generate three-dimensional environments where individuals are immersed in a virtual environment or “world” in which different senses are stimulated. In terms of the virtual tools and environments as well as the field of application and proposed objectives, VR is constantly evolving (Sherman and Craig, 2003).

In the 1990s, VR was incorporated to the area of childhood and adolescence, especially in the field of education (García Ruiz, 1998). In this field, VR made a positive contribution in terms of getting students’ attention and having a positive influence on their learning curve (Sherman and Juckins, 1992). At the same time, the three-dimensional graphic representations allowed students to navigate graphic models, interact with these models and appreciate more details than they would in the real world, thus stimulating their concentration and motivation (Pimentel and Teixeira, 1992). These were the advantages noted in the first studies on the use of VR, but further research revealed certain drawbacks and side effects associated with VR applications, especially nausea and social isolation (Carr and England, 1995).

At the same time, VR has been increasingly used in the area of psychological alterations and disorders diagnosed during childhood. Problems such as test anxiety (Knox, Schacht and Turner, 1993), developmental disorders, autism (Kijima, Shirakawa, Hirose and Nihei, 1994; Strickland, Marcus, Hogan, Mesibov and McAllister, 1995; Bauminger, Gal and Goren-Bar, 2007; Mitchell, Parsons and Leonard, 2007; Herrera et al., 2008) and brain damage (Reid, 2002; You et al., 2005; Bryant et al., 2006; Fluet et al., 2009) are some of the areas where VR research has been done. In terms of health psychology, VR applications designed to help patients deal with and gain control over the pain caused by invasive medical procedures (Hoffman, Patterson, Carrougher and Sharar, 2001; Steele, et al., 2003 Loreto-Quijada, Gutiérrez-Maldonado, Gutiérrez-Martinez and Nieto-Luna, 2011), pediatric burns (Hoffman, Doctor, Patterson, Carrougher and Furness, 2000; Das, Grimmer, Sarporn, McRae and Thomas, 2005; Markus, et al., 2009) and childhood cancer (Schneider and Workman, 1999; Gershon, Zimand, Lemos, Rohtbaum and Rothbaum, 2005) have been supported by numerous studies published over the past decade. These studies have shown the potential for the use of VR in the field of pediatric neuro-rehabilitation (Parsons, Rizzo, Rogers and York, 2009; Wang and Reid, 2011).

The use of VR technology in attention deficit-hyperactivity disorder DSM-IV-TR (APA, 2000) has been preceded by studies and debates centering on two main questions in this sphere: a) the accuracy of the diagnoses made with traditional tests and tools (DuPaul, Power, Anastopoulosy Reid, 1998) and b) the limited effects of the usual treatment modes (pharmacological treatment and behavioral therapy). For decades, the controversy around the diagnosis of the disorder and the therapeutic results has stimulated new developments in assessment and treatment based on the technological advances made over the past years.
The studies published on VR and ADHD allow us to distinguish three courses of action: a) the development of software that uses virtual settings to recreate classrooms and other school settings (desks, virtual professor, blackboards, windows with street access, etc.) in order to reproduce the natural context and reduce the attentional deficits that characterize children with ADHD in these settings (Rizzo et al., 2000; Gutiérrez-Maldonado, 2002; Gutiérrez-Maldonado, Alsina-Jurnet, Carballo-Beciu, Letosa-Porta, Magallón-Neri, 2007; Gutiérrez-Maldonado, 2009; Gutiérrez-Maldonado, Letosa-Porta, Rus-Calafell and Peñaloza-Salazar, 2009; Gutiérrez-Maldonado, Magallón-Neri, Rus-Calafell and Peñaloza-Salazar, 2009), b) the application of this technology for the assessment and diagnosis of minors diagnosed with ADHD (Rizzo et al., 2006) and c) the use of VR in the treatment of basic and associated symptoms. In this case, studies seek to determine the effects of this tool as the sole therapeutic tool or when combined with other procedures and alternatives.

In this context, the objective of this work consists in making an initial assessment of the research done to date on the application of VR technology to attention deficit-hyperactivity disorder. This will allow us to identify the tool, the areas of applications and potential developments in the future. To achieve this, we have done a search for bibliography using the ISI Web of Knowledge platform, covering the period from 1990 to 2012. The following descriptors were used: virtual reality, children, ADDH, treatment, assessment, Continuous-Performance Test-CPT.

**Virtual Reality Applications in ADHD**

At a time when there was already a certain tradition of developing virtual environments in the clinical context (North, North and Coble, 1997; Botella, Baños, Perpiñán and Balester, 1998; Botella, Villa, Baños, Perpiñán and García-Palacios, 1999), a software was designed specifically for ADHD. Known as the “Virtual Classroom” (Rizzo et al., 2000), the software was developed as part of an investigation aimed at developing VR applications for the study, assessment and rehabilitation of cognitive and functional processes among clinical populations that have some type of involvement in the SNC.

The Virtual Classroom simulated a classroom in which the child has to do different Continuous-Performance Tests (CPTs) and respond to the stimuli that appear on the blackboard (ten minutes). The children were asked to complete the tasks both with and without visual, auditory and mixed distractions. The study by Doyle, Biederman and Seidman (2000) showed that when this virtual tool was used, the combination of visual and auditory tasks yielded more diagnostic information than the unimodal Continuous-Performance Test, which was the test most commonly used. Later, Rizzo et al. (2001) developed a specific application based on the original tool in order to evaluate the attention deficits associated with hyperactivity disorder. The performances of a control group (minors without a diagnosis) were compared with those of children diagnosed with ADHD. The performances of both groups were compared while they carried out visual and auditory attention tasks; as they worked on these tasks, different distractive stimuli were systematically manipulated within the virtual environment. The results obtained from this study revealed the advantages of VR in neuropsychological assessment and cognitive rehabilitation.

In Spain, Gutiérrez-Maldonado et al. (2007) did an adaptation of the Virtual CPT based on the studies by Rizzo et al., (2000) in order to assess the validity of these tests as a way to detect ADHD. There are visual and auditory tasks presented in four modes: auditory without distractions, auditory with distractions, visual without distractions and visual with distractions. The authors worked with a sample of 20 children (ages 6-11); half of the sample (10 children) had a diagnosis of ADHD and the remaining half were children of the same age with no diagnosis. The results allowed them to conclude that the Virtual CPT is an effective tool for distinguishing between ADHD children and child controls without a diagnosis. There were differences between both groups in the errors of omission and commission respectively, with poorer performances by the group with ADHD as the tasks progressed and in the overall test results. The performance patterns of the hyperactive minors were similar independently of the nature of the different tasks (visual or auditory, with or without distractions), although the auditory task with distractions tended to be the most effective at distinguishing children with the disorder. Based on the results of the study, the authors concluded that the Virtual CPT allowed for the detection of ADHD cases, providing greater ecological validity than other tools by simulating one of the situations (school) in which children carried out most of their day-to-day activities.

Recently, another Continuous-Performance Test was developed in Spain. Similar to the Virtual CPT, the AULA Nesplora (AULA) (Climent Banterla and Iriarte, 2011) has proven effective in the assessment of ADHD (Fernández-Fernández, Morillo-Rojas and Alonso-Romero, 2012; Díaz-Orueta, Iriarte, Climent and Banterla, 2012).

**Virtual Reality as an ADHD Assessment Tool**

As a tool for assessment, VR is an alternative to the standard tests for sustained attention (CPTs) that have been used for decades in this field because of their efficacy (Schultheis and Rizzo, 2001). Continuous-Performance Tests (CPTs) are objective tools for assessing sustained attention, response time and/or resistance to distractions and ability to inhibit responses and they are used very widely today (Harper, Aylward and Brager, 2002).

According to the stimuli mode and the way stimuli are presented, there are visual, auditory and simple CPTs (the pa-
same time, although the VR/CPT yielded results similar to had poorer performances on all of the assessments. At the middle of the screen) and with the TOVA/CPT. According to the data obtained from the study, children with ADHD with the same CPT but without virtual reality (a standard computer screen was used and speakers were turned off so mimicking natural situations, the external validity can be increased without negatively affecting the internal validity of the test (Gutierrez-Maldonado et al., 2007). The investigations published to date show that the use of VR in the assessment and diagnosis of ADHD is based on several courses of action: a) comparing the results obtained from standard CPTs and VR in terms of detecting attentional deficit among ADHD children, b) using VR to evaluate children with ADHD as well as other problems and psychological disorders, and c) using VR as a measure of therapeutic efficacy to determine the results of the administered treatments. The assessment of the therapeutic results is commonly done by contrasting the different groups of minors who have received treatment using standard CPTs in some cases and EEGs in others (Lansbergen, van Dongen-Boomsma, Buitelaar and Slats-Willemsen, 2011).

Pollak et al. (2009) have contrasted the efficacy of three assessment tools used in ADHD: the CPT, the VR/CPT (Aula Virtual) and the TOVA/CPT. A total of 37 boys ages 9-17 participated in the study; 20 of the minors had been diagnosed with ADHD and 17 were controls. All participants were evaluated in three different ways: with the VR/CPT tool, with the same CPT but without virtual reality (a standard computer screen was used and speakers were turned off so the participant would only see the numbers that appeared in the middle of the screen) and with the TOVA/CPT. According to the data obtained from the study, children with ADHD had poorer performances on all of the assessments. At the same time, although the VR/CPT yielded results similar to those obtained with the TOVA, it was the most appealing of the assessments according to the participants. Ultimately, the authors concluded that the VR/CPT was a sensible and easy-to-use assessment tool that could assist in the diagnosis of ADHD.

Gutiérrez-Maldonado et al. (2009) utilized their own virtual tool based on the Virtual Classroom (Rizzo et al., 2000) to evaluate children with ADHD. They compared the performances of 20 minors (ages 6-11), 10 with a diagnosis of ADHD and 10 without the disorder. Based on the findings of the authors, VR applications allowed them to present distracting stimuli similar to those found in a natural context, a fact which increased the ecological validity of this tool in comparison with the standard CPTs commonly used in these cases. The results obtained in the study provide support for the validity of this type of tool in evaluating attentions difficulties and proved similar to the findings of the Virtual Classroom. Other studies have emphasized that VR applications help to reduce the errors of omission more effectively than a standard CPT, while also noting that VR is more widely accepted and appealing to the minors who participated in the study (Pollak, Shomaly, Weiss, Rizzo and Gross-Tsur, 2010; Shriki et al., 2010).

On the other hand, Bioulac et al. (2012) analyzed the evolution over time of the performances of hyperactive minors and those of peers not diagnosed with ADHD. According to these results, the performances of hyperactive minors worsened significantly over time in this type of tasks, unlike what was observed for the control group, which sustained their performances over time. In short, children with ADHD were clearly more vulnerable to the effect of time passing in terms of their performances on the assigned tasks.

**ADHD Treatment through Virtual Reality**

In the studies published on the use of VR technology as an intervention procedure in ADHD treatment, two courses of action appear: a) specifying the efficacy of VR as a therapeutic procedure by contrasting different groups and b) including VR in multimodal treatment programs. As can be seen (Table 1), VR is compared with cognitive-behavioral procedures and neurofeedback.

Considering that VR is a technology that has only recently been applied in the area of mental health, the first studies to examine the therapeutic usefulness of VR for ADHD refer to a study by Othmer and Kaiser (2000) in order to analyze the efficacy of neurofeedback administered in conjunction with VR technology. This study evaluated 120 children with different diagnoses: epilepsy, mood disorders and ADHD. The results showed that the treatment improved the cognitive performance of the patients, noting that VR’s more realistic representative of physiological activity made patients more committed to treatment. It also had a positive effect on their understanding and involvement in the biofeedback tasks.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Participants</th>
<th>Description of the Study</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Othmer and Kaiser (2000)</td>
<td>120 children, Children diagnosed with: - Epilepsy - Mood disorders - ADHD</td>
<td>Test the efficacy of the implementation of neurofeedback with VR technology. Twenty thirty-minute sessions or more.</td>
<td>The multimodal neurofeedback treatment that includes VR generally increases the patient’s commitment to treatment.</td>
</tr>
<tr>
<td>Lee, Cho, Ku, Kim, Lee, Kim and Kim (2001)</td>
<td>20 adolescents: All displayed impulsivity and were clinically suspected of ADHD. Two groups were created: - VR group (10 subjects) - Control group: without VR (10 subjects)</td>
<td>The participants were evaluated using an EEG evaluation through the CPT, twice in the case of the VR group (before and after the intervention) and once in the control group. The VR group received 10 sessions (10 minutes each) with the VR tool.</td>
<td>Improvement in the attentional symptoms of the VR group. In the control group, there were fewer shifts in behavior.</td>
</tr>
<tr>
<td>Cho, Ku, Jang, Kim, Lee, Kim, Lee and Kim (2002)</td>
<td>26 adolescents with learning disabilities, attention deficits and impulsive tendencies, clinically suspected of ADHD. - VR Group: Cognitive training and VR with an HMD device (n=8) - Non-VR group: Cognitive training (n=9) - Control (did not receive treatment) (n=9)</td>
<td>8 sessions (20 minutes each) for 2 weeks. The VR and Non-VR groups were assessed with a CPT before and after receiving the training. The control group was assessed only once.</td>
<td>The combined use of VR and cognitive training proved most effective for improving the attentional abilities of the minors who participated in the study. The immersive VR increased the motivation for treatment.</td>
</tr>
<tr>
<td>Cho, Kim, Shin, Lee, Lee, Kim and Kim (2004)</td>
<td>28 adolescents (ages 14-18) with social problems and clinically suspected of ADHD. - VR Group (n=10) - Non-VR (n=9) - Control group (n=9)</td>
<td>Both groups, VR and non-VR, received training in neurofeedback. VR Group (with a full HMD immersion system) Non-VR (use of a computer monitor). Control group (did not receive treatment). 8 sessions (20 minutes each) for 2 weeks. Assessment of results with a CPT.</td>
<td>The VR and non-VR groups obtained better results after the training in comparison to the control group. The VR group tended to achieve the best results. This suggests that immersion VR combined with neurofeedback is applicable for the treatment of impulsivity and lack of attention.</td>
</tr>
<tr>
<td>Yan, Wan, Liu, Zong, Jiao, Yue, Li, Yang, Lan and Liu (2008)</td>
<td>12 minors, 10 boys and 2 girls (ages 8-12) diagnosed with ADHD.</td>
<td>20 neurofeedback sessions with VR. The participants were assessed with a CPT.</td>
<td>The results showed significant improvements in terms of both the patient’s ability to control his/her behaviors as well as attention.</td>
</tr>
<tr>
<td>Anton, Opris, Dobrean, David and Rizzo (2009)</td>
<td>28 adolescents (ages 14-18) with social problems and clinically suspected of ADHD. - VR Group (n=10) - Non-VR (n=9) - Control group (n=9)</td>
<td>Both groups, VR and non-VR, received training in neurofeedback. VR Group (with a full HMD immersion system) Non-VR (use of a computer monitor). Control group (did not receive treatment). 8 sessions (20 minutes each) for 2 weeks. Assessment of results with a CPT.</td>
<td>The created tool did not represent a new therapeutic mode; instead, it is a supplement to therapy that increases the efficacy of treatment.</td>
</tr>
</tbody>
</table>
The pioneering work of Othmer and Kaiser was followed by other studies with similar objectives. Cho et al. (2004), for example, confirmed the efficacy of combining training in neurofeedback and VR to reduce poor attention and impulsivity among a group of 28 adolescents (ages 14-18). All of the participants had social issues and were suspected to suffer from ADHD though none had yet received a clinical diagnosis. They were assigned to three groups: VR, alternative treatment to VR and the control group. The VR and alternative treatment groups received eight neurofeedback training sessions that lasted a little over two weeks, while the control group merely waited and did not receive any treatment during this period. The difference among the experimental groups resided in the type of immersion utilized; the HMD (head-mounted display), a full-immersion system, was used for the VR group, while a computer monitor with a fixed view point was used for the alternative treatment to VR. Participants were evaluated with a continuous-performance test (CPT) before and after the full training session while the control group was evaluated only once. The results revealed that both experimental groups (VR and alternative treatment to VR) got higher scores on the CPT than controls after the neurofeedback training session. In addition, the VR group tended to have better results, thus suggesting that the immersive VR could be administered in conjunction with neurofeedback in order to improve the results of patients with attention difficulties and impulsivity.

On the other hand, Yan et al., (2008) emphasized that as a method for positive feedback and when used alone, neurofeedback can prove monotonous, negatively affecting the motivation and the attention demanded of minors with ADHD. Based on this limitation, a decision was made to use neurofeedback and VR together. Participants were evaluated with a Continuous-Performance Test (IVA/CPT) commonly used in studies on neurofeedback (Moreno et al., 2011) and the authors found that the attention of the minors improved after receiving 20 training sessions. In the authors’ opinion, a system combining neurofeedback and VR is useful in the treatment of children with ADHD.

Years earlier, Lee et al. (2001) had noted the novel nature of VR when used as a therapeutic tool as well as the results obtained with it. In this study, the authors compared the results obtained from two groups of ten adolescents, all clinically suspected of ADHD. The adolescents were evaluated using an EEG and VR was administered to only ten of them. These adolescents attended ten sessions, each ten minutes long. The VR group was evaluated with a Continuous-Performance Test (CPT) before and after exposure to the VR technique. The control group was only evaluated once with the CPT. The results showed an improvement in the attention of the minors treated, highlighting the following advantages: a) the VR tool allowed different environments to be developed for treating children with ADHD, b) fewer people had to be involved in the treatment, c) the tool facilitated constant progress in the performance of the minors during treatment, avoiding the secondary effects derived from exhaustion, fatigue, etc. and d) it provided the possibility for administering multimodal treatments that integrated VR and the cognitive training techniques in order to increase the attention and concentration of those affected. This was the objective of the study by Cho et al. (2002), who applied VR techniques as part of a cognitive training program to improve the attention of three groups of minors. All the participants had some type of learning disability, attention difficulties and impulsive tendencies although none had been diagnosed with ADHD. The participants were divided into three groups based on the type of treatment administered: cognitive training and VR with an HMD (head-mounted display), cognitive treatment alone and a control group that received no treatment. The training lasted for two weeks and all of the minors were evaluated with a CPT before and after the sessions. The results showed that the combined application of VR and cognitive training was more effective in terms of improving the attentional capacity of the minors participating in the study.

A similar line of study was adopted in the research conducted by Anton, Opris, Dobrean, David and Rizzo (2009) to implement VR in a treatment program based on cognitive-behavioral techniques for children with ADHD. The program consisted of applying cognitive-behavioral techniques in a virtual school environment. The treatment involved 16 weekly sessions of cognitive and behavioral techniques for both the child and his/her family. Based on the results of the study, the authors concluded that this alternative did not represent a new therapeutic mode on its own; instead, it showed how to take advantage of the tools available to increase the ability of therapists and provide them with the support required to obtain the best results from the therapeutic process.

In addition to the use of VR as a tool for assessment and intervention in ADHD, there have been new developments aimed at applying virtual reality to other psychological problems and alterations. These compare both the therapeutic modes as well as the effects, which vary depending on the disorder in question. For example, Rizzo, Bowerly and Buckwalter (2002) suggested that this technology could be useful in the pathologies that come into play in attentional difficulties, i.e. acquired brain damage injuries and neodegenerative disorders (Alzheimer’s, vascular dementia, etc.) This approach has been followed in other studies such as that by Gutiérrez-Maldonado et al. (2007), who applied VR in the school setting, comparing three groups of students with different alterations: ADHD, school phobia and test anxiety.

Based on the results, the authors concluded that VR is a valid technique for the assessment and treatment of different problems observed in the school setting. The authors added that the intrinsically motivating nature of virtual reality could prove decisive in raising the validity of the assessment procedures and treatment adherence among a clinical population of children and adolescents.
CONCLUSIONS:

After analyzing the studies published on the period in question, it is possible to reach certain conclusions on VR technology applied to attention deficit-hyperactivity disorder (ADHD):

The results obtained so far support the use of VR as a practical, sensible assessment tool for the detection and assessment of ADHD.

In addition to increasing the ecological validity of the procedure, the studies done to date highlight how this tool is able to increase the attention and concentration of minors with attentional deficits and reveal that the more immersive the technique, the more effective it proves.

The VR application allows for increased control over environmental situations, an aspect that is desirable in both the assessment of the disorder and in the treatment programs.

VR allows for environments (virtual settings) that are similar to reality, mainly school classrooms, thus exposing minors to the natural situation “live.” This contributes to reducing the cost and time of therapy treatments administered to ADHD patients.

VR encourages self-training and overlearning. After several practice sessions, the patient learns the ability he/she needs to confront the situations that mainly appear in the classroom.

The virtual settings that have already been developed recreate the school setting, with the main target of reducing the attentional deficits that characterize children with ADHD and improving their academic performance.

The therapeutic applications of VR in ADHD are associated with neurofeedback treatment and behavioral-cognitive therapies.

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Pictogram Room: Natural Interaction Technologies to Aid in the Development of Children with Autism

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Abstract
The pictogram room is a set of educational video games for children and adults with autistic spectrum disorder (ASD). Aspects like music and structured learning have been taken into account in the game designs, because many studies have indicated that such aspects improve the learning results among people with ASD.

To define the educational goals of the project, specific difficulties in key development areas have been considered: corporal language, attention and imitation.

There is already extensive knowledge on how to provide effective support to people with ASD through visual structure and music. Based on this knowledge, we have created a pedagogical proposal aimed at overcoming their difficulties while making use of their personal strong points and taking advantage of new technologies as well.

Keywords: Autism, corporal language, technology, augmented reality, games

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Introduction and Thesis
Numerous studies have shown that vision is the sense that is best preserved in autistic spectrum disorder (ASD) and that even concepts that do not usually evoke visual images can activate the areas that are supposedly reserved for the visual processing of the parietal and occipital cortex among people suffering from this disorder (Kana et al., 2006, Gaffrey et al, 2007). In relation to these findings, different studies have shown that most people with ASD are visual as opposed to verbal thinkers (Grandin, 1995; Jordan and Riding, 1995) and the most common intervention programs in ASD—including the TEACCH (Mesibov and Howley 2010) and the PECS (Frost and Bondy, 2002)—mainly use learning that is mediated visually, although such learning can be adapted to other sensory modes or used in conjunction with them.

On the other hand, several studies have noted that music is an excellent supplement for visual supports and an effective tool for fostering joint attention (Reitman, 2005) and education (Standley, 1996), encouraging communicative behaviors (Edgerton, 1994), and developing language, cognitive concepts, motor abilities and behavior in early intervention programs (Standley and Hughes 1996). Other studies have noted that music helps increase word recognition, icon identification, sketched concepts and pre-verbal abilities in early intervention (Register, 2001) and music as a facilitator and as reinforcement for increasing the verbal response among children with limited verbal communication (Braithwaite and Sigafoos, 1998). Finally, still other studies have evidenced that music helps to organize and structure information (Claussen and Thaut, 1997) and to foster interactions and social relations (Ulfarsdottir and Erwin, 1999).

Information and communication technologies (ICTs) are increasingly used in the educational intervention of ASDs as they provide multimedia and virtual reality tools to help people develop social abilities (Golan and Baron-Cohen, 2006; Parsons, Mitchell and Leonard, 2005), fictional games (Herrera et al., 2008) and communication (Miller et al., 2006), to cite just a few examples. In an exploration of the reports by parents, professors, therapists and researchers, Hart (2005) noted that children with autism had a high affinity for computers.

Although it is possible to work with other sensory modes, the main component of most of the devices and applications that involve computer-assisted learning is the visual and the auditory channel. If we consider the studies cited above regarding visual supports and regarding music, it appears evident that technologies which combine both factors could provide an excellent opportunity for providing effective supports.

Augmented reality is a field of investigation of ICT that combines the information we perceive from the real world with information generated by the computer in real time. Its name makes reference to the fact that this technology combines real information with graphics. In a prior study (Herrera, Jordan and Gimeno, 2006), we analyzed the advantages and drawbacks of this technology among people with ASD both with and without intellectual disability.
Technologies evolve very quickly and since that study, efforts have also been aimed at developing technologies known as “natural interaction.” With these technologies, people use their own bodies and natural gestures to interact with the computer, without the need to use any device (keyboard, mouse, joystick, remote control, etc.) to handle the digital information and thus interact with the device. The main developments with this technology have used open source codes, allowing them to be spread rapidly while giving the research community easy access and allowing IT applications to be developed. (http://www.openni.org/). To provide support for this technology, different devices have been launched over the past few months; when connected to a computer or a video console, these allow the user to interact naturally with the IT applications and videogames (Microsoft Kinect, Asus Xtion Pro, etc).

**Project Description**

**Origin**

The daily experiences of professionals who work in educational intervention for autism have shown that most people with autism can learn to use pictograms in a variety of situations. These involve communicating with cards used to request something (as in the PECS system cited earlier), and the use of schedules, hours and other types of visual supports (developed for use in the system, for example, in the TEACCH program referred to above).

However, the fact that people use the pictograms and are able to associate them with certain situations, tasks or their own communicative intent does not mean that they actually understand what is being graphically displayed on the pictograms. The experience of numerous professionals who work with people with autism on a daily basis indicates that when the pictogram suffers even a minor modification, recognition often ceases. Small variations in the background color, modifications in the outline of the drawings or variations in the sizes of different parts of the drawing can create an obstacle that keeps people with autism from recognizing the pictogram.

This leads us to believe that in those cases, people with autism may simply be memorizing a certain group of colors, shapes and sizes without distinguishing what is actually being shown. In the figure above, for example, a person with autism may not recognize that the person in the figure is holding a glass of water which in turn is represented by another visual element. In addition, the person with autism may not understand that both elements are associated and incorporated to an action or gesture.

Given this difficulty, in one of the studies cited previously (Herrera, Jordan and Gimeno, 2006), an initial prototype was developed. The prototype involved a screen that displayed the image of the person looking at the screen and his or her surroundings in real time. The computer then superimposed other images on this real image, using a position indicated by a system of infrared marks. This created an important restriction, since the user had to don each of these elements in order for the system to acknowledge the position of each part of her body at all times.

As can be observed in the figure, images generated by the computer (like the person’s body outline, the water drinking pictogram and the cup pictogram) are superimposed on the real image of the person. This way, the person with ASD is represented in the water drinking pictogram and can access this representation in a way that is totally visual.

This demonstrator, which was not utilized with people with autism but only to test the viability of certain pedagogical theories, was the first step of a research trend that soon evolved into the Pictogram Room project. Led by the Autism and Learning Disabilities Group at the Universidad de Valencia, the project also involved researchers from the University of Birmingham and the Universidad Pompeu Fabra. Two associations that work with people with autism and their families in Spain, Autismo Burgos and Autism Ávila, collaborated...
Pedagogic Design

The main goal of the Pictogram Room Project was to achieve a pedagogic design that could potentially create an approach to the difficulties of people with autism whose developmental abilities are most affected by the disorder.

In this regard, visual supports, music and playability criteria were selected in order to foster the motivation of the user and a predisposition towards learning. Thus intervention aspects such as self-recognition, joint attention, communication and relationships with others were all addressed.

Self-recognition and the development of body awareness

One of the main goals is self-recognition (Rosa et al., 2010) and the development of body awareness. People with autism and intellectual disability often display an evident lack of self-awareness (Ferrari and Wendy, 1983). One of the most commonly used experimental procedures to determine self-awareness among toddlers with normal child development has been the use of a procedure of self-recognition in the mirror or the “rouge test” (Amsterdam, 1972; Bertenthal and Fischer, 1978; Lewis and Brooks, 1978). In this procedure, the child’s nose is dotted with a bit of make-up and the child is then placed in front of the mirror. If the child begins to touch his own nose as opposed to the mirror, she is considered to have recognized herself. When Ferrari and Matthews (1983) applied this paradigm, they found that nearly half of the people with autism who participated in their study did not display clear self-recognition. In addition, the authors established a strong link between the lack of self-recognition among people with autism and their mental age. In other words, people with autism who did not display self-recognition before the mirror were those with a mental age lower than the development level at which children developing normally recognize themselves in the mirror. Therefore, the level of cognitive development achieved by the child appears to be critical to developing the ability of recognizing oneself. Different studies of evolution concur that the age at which average children present clear self-recognition before the mirror is approximately 18-24 months (Bertenthal and Fischer, 1978; Lewis and Brooks, 1979); however, there were no cases of self-recognition earlier than the age of 15 months. According to Michael Lewis, all children achieve visual recognition by the age of 24 months except for children with autism and/or with other alterations in development that keep them from reaching the minimal mental age of 15-18 months.

Thus, based on the affordances described above regarding the use of AR, the Pictogram Room would target people with autism and intellectual disability who do not display clear visual recognition of themselves in the mirror and who have a mental age of around 15-18 months. However, the main criterion would be the inability or difficulty to recognize oneself and not the mental age, since as we know the sequence of acquiring abilities is not always the same for people with autism as it is for people with normal development.

Another aspect to approach is the ability to differentiate oneself from others, an ability that is often very difficult for people with autism (Ferrari and Wendy, 1983; Goldfarb, 1967 and 1970; Hobson and colleagues, 2006; Mahler, 1952; Russell and Jarrod, 1999). To respond to this, the sketch of the body outline is overlaid onto the image of the person looking in the mirror during the educational games of the Pictogram Room. Thus, the movements of the body outline sketch correspond to those of the user. This way, the user with autism receives a visual, schematic representation of
her body at all times, a figure that moves and responds accord-
ing to the user’s own movements and actions. The overlay of
the body sketch is also used for interactions with other people
in order to help the person with autism differentiate himself
from others through different stimuli of the body sketch of
each person (i.e. color, size, texture). In addition, AR allows us
to increase the salience of the cause-effect reactions that are
produced in the environment through visual variations such
as light intensity, coloring, shading, different textures, etc.

Educational games available in Pictogram Room

The first version of the Pictogram Room project was pub-
lished in March 2012 and it can be accessed at http://www.
pictogramas.org. The website provides a total of forty educa-
tional games focused on two dimensions of developments:
body awareness and postures. Subsequent versions will con-
figure with this pedagogical proposal, incorporating other
educational games related to joint attention, imitation and
communication.

Different games have been grouped around different work
dimensions associated with a child’s development. Let’s take,
for example, ‘The Body.’ This series has several sets of activi-
ties that have been designed to favor the development of body
awareness. With this set of games in front of the mirror, the
aim is for the participant to gradually pay more attention to
the different parts of her body and the figure who represents
her. In all of the games, the educator has to help the participant
in addition to also playing his role within the game.

The website has five subgroups for users to work on differ-
ent concepts such as ‘Moving’, which fosters an understand-
ing of the cause-effect relations related to body movement. In
‘Touching’, the user has to pay attention to his hands in order
to make progress in the games. The user takes a series of in-
stant photos of herself in ‘My Pictures’ and then will have to
pick out her own photos when they are compared with those
of other people. In ‘My Figure’, the participant meets the pic-
togram who will represent him on screen; the last subgroup
is ‘Parts of My Body’ which we will describe in more detail
below.

Each subgroup has four activities that address different con-
cepts and gradually increase in difficulty (so that each series
has a total of twenty educational games). This is the case of the
last subgroup, ‘The Body’, which has four games.

In the first game, ‘Parts of My Body’, the participant has to
move different parts of her body quickly in order to progress in
the game. The second game is similar but this time, the partici-

apant can choose to work with a blank background similar to
the one used on poster boards with pictograms. On this poster
board, a gray figure appears and as the different parts of the
figure’s body are colored in, the user must move those body
parts to advance in the game. In the third exercise, the user
is represented by a gray pictogram and she has to color in the
pictogram by using different parts of her body to touch paint
cubes that appear on screen. Each paint cube is specific to a
different part of the body. Working either alone or with the ed-
cuator, the person with autism is thus provided with a fun way
of learning body awareness. Finally, the ‘Coloring Rain’ series
has the classic game ‘Space Invaders’ in which pictograms rain
down and a part of the body lights up. The participant has to
choose the ones that are missing in order to fill in the colors
of his body.

On the project website, each project user can generate sev-
eral students and configure the different elements that appear
in the game for each student, including videos, images and
sounds. In addition, the user can track the progress of the stu-
dent and unblock the activities she sees fit. This configuration
is updated automatically each time the application is initial-
ized.

Conclusion

This text presents some of the ways in which virtual reality
can improve the care of people diagnosed with autistic spec-
trum disorders. The combination of new technologies and
therapeutic intervention opens new treatment options that
could be highly promising.

However, empirical research is needed to determine the
relevance (efficacy, efficiency and effectiveness) of programs
such as the one described here. Therefore, the next logical step
will involve gathering more information on the results of such
programs.
Figure 4: The 'Parts of My Figure' game with a video backdrop in real time

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Predictors of referential thinking: analyses of clinical subjects and controls

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Abstract

Background. Referential thinking (RT) is a common characteristic of human mentation. In psychopathology, RT has been traditionally associated with psychosis. In this study we analyze RT (self-references, SR) differences between clinical and control samples, and we identify variables to predict RT. METHODS. 120 adults (70 patients and 50 control subjects from the general population), with a mean age of 34.49 (SD, 10.63); 60% female. RESULTS. The number of SR among patients, especially patients with diagnosed psychoses, was significantly greater than that among controls. No significant differences in RT were observed among patients characterized by axis II diagnoses or between patients characterized on different axes. The variables that were most predictive for SR were psychotic thinking (MCMI-II personality inventory, thought disorder), conceptual disorganization (BPRS psychiatric scale), age, and vulnerability indicators of mood disturbances (DAS scale). This set of state and trait variables accounted for 56.4% of the RT variance. CONCLUSIONS. There were more differences between patients and controls in terms of frequency of SR than of content (RT processes occur along a continuum). RT may be both a manifestation of state (with an additive effect on other psychopathologies), and a manifestation of trait (a characteristic of psychotic processes, one possibly associated with vulnerability indicators of mood disorders).

Key words: referential thinking; self-references; psychosis; clinical predictors; vulnerability predictors.

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Introduction

Referential thinking (RT) consists of self-attributions (or self-references, SR) about social events, objects or other people in the person’s immediate environment. A gaze, a gesture or any other expression by another individual is over-interpreted by the subject, who begins to feel observed, criticized, laughed at, or blamed for something (American Psychiatric Association, 2000).

The development of the appropriate RT is a natural process that gives meaning to our experiences in relation to others. Social interactions and self-referential emotions such as shame or guilt regulate the way self-concepts develop. They increase awareness of one’s own perspectives and those of others and serve as the basis for attributing the propositional content of the mental states of others (theory of mind) (Zinck, 2008). As a cognitive process, RT is prominent during adolescence because of emerging concerns with one’s look and appearance, continual evaluation of the self and others, and heightened participation in emotionally-laden social interactions. The frequency of RT (or self-references, SR) among women and men is often similar (Lenzenweger, Bennett, & Lilenfeld, 1997), especially when individuals are confronting emotionally charged situations.

RT is related to the natural human effort to give meaning to social and emotional experience. So-called “intuitive thinking” (rapid, holistic, and associationistic information processing) is positively correlated with SR, and predicts RT by its relationship with positive affect. Particularly when things are going well, RT may play a role in affirming a sense that life is meaningful, regardless of the non-rational content of the thoughts (King & Hicks, 2009). In psychopathology, SR are traditionally associated with psychotic disorders; moderate SR are present in paranoid personality disorder, schizotypal personality disorder, social phobia (Meyer & Lenzenweger, 2009), as well as in other disorders (e.g., body dysmorphic disorder or avoidant personality disorder).
Unstable SR (self-centrism) are relevant in psychopathologic diagnoses, especially in cases of psychosis (Gross, Huber, Klosterkötter, & Linz, 2008). SR may represent attenuated symptoms of psychosis, observed among ultra high-risk criteria and basic symptoms, both with a significant index of transition to psychosis (Schultze-Lutter, Ruhrmann, Berning, Maier, & Klosterkötter, 2010). A reduced presence of SR is observed in the residual phase of schizophrenia, as with other prodromal indicators (Wong et al., 2012). Thus, SR are an essential predictive tool for early therapeutic psychological intervention.

Investigators consider RT an indicator of proneness to psychosis, and some forms of AR (about observation: “they look at me”) more related to other indicators psychotic symptoms such as hallucinations and persecutory delusions, than other AR (about communication: “talk or whisper about me”) (Startup, Sakrouge, & Mason, 2010). Freeman (2007) considers SR an indicator of the development of delusional disorder along with anxiety and excessive interpersonal sensitivity. In such disorder, SR range from intentionally attributed to slightly menacing or severely threatening. RT is not synonymous with paranoia (Cicero & Kerns, 2010). Unpleasant SR indicate a threat to self (and are therefore related to paranoia) in contrast to pleasant SR (which are related to other emotional states or disorders). It is argued that the RT process may depend on a central mechanism such as aberrant salience (Kapur, 2003), moderated by self-esteem issues; the process may lead to pleasant (high self-esteem) or unpleasant (low self-esteem) SR (Cicero & Kerns, 2011).

According to Lenzenweger (2006), RT, magical ideation, and perceptual aberrations constitute the schizotypy construct, a personality organization that harbors a latent liability to schizophrenia. RT can be considered an aspect of positive schizotypy because it involves attenuated delusional cognition. This positive schizotypy appears to be more related to deficits in the theory of mind than to a broad form of schizotypy (Gooding & Pflum, 2011).

Self-referential processing is automatic; therefore, subjects suffering from paranoid delusions show a lower threshold of automatic control over self-referential information. Mood plays a relevant role in this context, highlighting the importance of cognitive attribution biases (i.e., self-serving bias) to safeguard a subject’s self-esteem. Thus, an externalizing (and personalizing) bias leads one to blame others for one’s own failures (Diez-Alegría, Vázquez, Nieto-Moreno, Valiente, & Fuentenebro, 2006; Bentall, Corcoran, Howard, Blackwood, & Kinderman, 2001; Wing, Cooper, & Sartorius, 1974) referred to this form of RT (related to depressive moods and feelings of shame) as “blame.”

In summary, RT is related to an increased sense of self-defensiveness (a trait or a sensitivity), substantial affective involvement (reactivity), and the relevance we attribute to the social environment (universal reactivity to social stimuli).

Although RT was recognized many years ago, there is a lack of empirical data in this field, specifically in clinical populations. The aims of this study were (1) to analyze RT (or SR) differences (qualitatively and quantitatively) between clinical and control samples, and (2) to identify vulnerabilities and socio-demographic, clinical, and dispositional variables predictive of RT. We predicted, an RT continuum between patients and controls that could be identified on the basis of quantitative measures (SR) and qualitative analysis (content); we hypothesized, first, that there would be quantitative differences between patients and controls (higher scores in patients) but there would be no qualitative difference between patients and controls in terms of SR content (universal reactivity to social stimuli). As a diagnostic condition, RT is most evident as a precursor or symptom of psychosis, especially as an indicator for positive schizotypy, disorganization, or continuous cognitive defense traits or sensitivity. Therefore, as a second hypothesis, the AR would be higher among psychotic patients. Related to the above, the third hypothesis predicts that there will be higher scores in SR among cluster A patients with personality disorders, i.e., those patients closest to the psychotic spectrum. In relation with the RT continuum (and components of state and trait), the fourth hypothesis predicts that there would be quantitative differences between diagnosis in axis I, II, or both (higher scores in diagnosis of both axis); participants with a psychopathological history or not (higher scores in participants with history), and with or without use of psychotropic medication (higher scores in participants with medication). We also suggest, as fifth hypothesis, that RT is a cognitive vulnerability factor (trait or sensitivity) linked to mood.

**Methods**

**Participants**

A total of 128 subjects (60% female) from Seville, southern Spain, participated in the study. The patients (n = 70, 58%) were from a private psychological clinic and included 25 males and 45 females (age range, 19–58; mean age, 35.2, standard deviation: SD = 10.5). The control group (n = 50, 42%), included 23 males and 27 females (age range, 18–61; mean age, 33.5 years, SD = 10.8). All participants were informed of the goals of the study and each participant gave written consent.

Table 1 compares general measures between patients and controls. The analysis showed no statistically significant differences between the selected variables for the comparison of groups of participants. The variances are homogeneous in all variables (age: 0.036; SDS: 0.399; sincerity: 2.642; and durations of symptoms - men-women-comparison: 1.94, F\text{Levere} P > .05).
Instruments

The subjects completed an initial self-administered survey that identified socio-demographic status (SDS) (Hollingshead, 1975), current illnesses, psychopathological antecedents, histories and duration of symptoms, psychopharmacologic treatments, and other drug use.

Brief Psychiatric Rating Scale (BPRS) (Lukoff, Liberman, & Nuechterlein, 1986). The BPRS is a 24-item measure for clinicians to determine the presence and severity of psychopathological symptoms: suspiciousness; unusual thought content; grandiosity; hallucinations and hostility; somatic concern; anxiety; depression; guilt; elated mood; suicidality; conceptual disorganization; excitement; tension; mannerisms and posturing; uncooperativeness; self-neglect; bizarre behavior; motor hyperactivity; distractibility; motor retardation; blunted affect; emotional withdrawal. In a 7-point scale, lower BPRS scores reflect absence of symptomatology, higher scores indicate severe psychopathology. The scale provides construct validity for the monitoring of schizophrenic indicators (Andersen, 1989). It has been validated for Spanish populations with alpha reliability (.59 to .70) and reliability retest (.70) (Peralta, Martín, & Cuesta Zorita, 1994).

Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988). The BAI is a 21-question self-report (0 to 3) inventory used to assess the intensity symptoms (mostly physiological) of anxiety. The alpha reliability of the BAI is .93, and has been validated for Spanish populations (Magán, Sanz, & García-Vera, 2008).

Beck Depression Inventory (BDI) (Beck, Rush, Shaw, & Emery, 1979). Spanish translation by Vazquez and Sanz (1999). The BDI is a 21-question self-report (0 to 3) inventory that assesses the strength of depressive symptoms with reliability (alpha, .83, and retest reliabilities ranging from .60 to .72) and validity (convergent and discriminant) for Spanish populations.

Penn State Worry Questionnaire (PSWQ) (Meyer, Miller, Metzger, & Borkovec, 1990). The PSWQ is a 16-item (1 to S) questionnaire that rates worry or cognitive anxiety. In Spanish populations, the internal consistency is .90; the test–retest reliability is .82, and the validity (convergent and discriminant) ranges from .44 to .67 (Sandín, Chorot, Valiente, & Lostao, 2009).

Dysfunctional Attitudes Scale (DAS) (Weissman & Beck, 1978). Spanish translation by Sanz and Vazquez (1994; 1993). The DAS is a 40-item (1 to 7) scale that assesses cognitive vulnerability to depression. In Spanish populations, reported internal consistency (.84), and validity. The scale has three factors: attitudes about achievement, dependency, and autonomy.

General Health Questionnaire (GHQ-28) (developed by David Goldberg; Spanish edition by Lobo, Pérez-Echeverría and Artal, 1986). The GHQ is a 28-item (0 to 3) questionnaire used to rate symptomatology. It has four scales: depression, anxiety, social dysfunction and somatization. In Spanish populations, reported reliability retest (.90), the sensitivity ranges from 44% to 100%, and the specificity ranges from 74% to 93%.

Referential Thinking Scale (REF) (Lenzenweger et al., 1997) The REF is a 34-item self-report true/false questionnaire about SR, with an internal consistency ranging from .83 to .85, a test–retest reliability of .86 (4 week interval), and adequate validity. The scale provides strong indicators of schi-
zotopy (such as magical thinking and perceptual aberrations) (between .75 and .85 on the first two principal components) and weaker indicators of anxiety and depression (between .33 and .17). Startup et al. (2010) created a strong validity indicator that separates the RT of other pathological symptoms (e.g., hallucinations were associated with RA of observation, while the AR of communication not) into two parts, and with a cut-off value of 6 points for the whole scale. The Spanish translation of the REF achieves an internal consistency of .90 (.83 and .82 for each half) and a test–retest reliability of .76 (average interval of 44 days in patients). The validation criterion (with reference to the BPRS) was a cut-off of 7 points for a specificity of 66% and a sensitivity of 58% (Senín-Calderón et al., 2010).

Eysenck Personality Inventory Sincerity Scale (S-EPI) (Eysenck & Eysenck, 1990). The EPI Sincerity Scale is a 9-item true/false self-reporting measure that quantifies the social desirability and sincerity.

Millon Clinical Multiaxial Inventory (MCMI-II) (Spanish version) (Millon, 1999). The MCMI-II is a 175-item true/false inventory that includes 10 basic personality scales (schizoid, avoidant, dependent, histrionic, narcissistic, antisocial, aggressive-sadistic, compulsive, passive-aggressive and self-defeating) and three severely pathological personality scales (schizotypal, borderline and paranoid); it also integrates control scales, scales for axis I (anxiety, somatoform, bipolar manic, dysthymia, alcohol dependence, drug dependence), and scales for the most severe disorders on axis I (thought disorder, major depression, delusional disorder).

Design, procedures, and statistical analyses

We applied an ex-post-facto design, with a comparison measures method (mainly AR) as a function of the conditions patients/controls or general diagnostics, and finally determine RT predictors using a model regression.

Patients were selected by incidental sampling from a patient group receiving cognitive therapy at a private psychological clinic, between February 2008 and September 2010. The control group was selected using snowball sampling, which was done by two collaborators from the University of Seville during the same time interval. One-third of the clinical sample was randomly selected to repeat the REF in order to determine the test–retest reliability.

Assessment instruments were delivered to the patient group in the second therapy session in the following order: initial interview made for authors, BAI, BDI, PSWQ, DAS, GHQ-28, REF, EPI Sincerity (EPI), MIPS, MCMI-II. Patients completed tests at his home, and they delivered the instruments in the subsequent therapy session. The BPRS Scale was applied in the first session by the psychologist who performed the therapeutic process. The control group completed an initial interview, REF scale, the sincerity scale (EPI) and MIPS questionnaire. All tests were carried out in self-report format.

Descriptive statistics and comparisons of means (t-test) were used to compare the following characteristics of patients and controls: age, socio-demographic status (SDS), EPI Sincerity (meeting the homoscedasticity criterion, F_{lev} = .83), and the Pearson chi-squared using gender x group (2 x 2) contingency tables. Responses to the items in the REF were compared using chi-squared 2 x 2 contingency tables (true/false, patient/control), with Fisher’s corrections in some cases. We conducted comparisons of means (t-test, F or H), with post hoc analyses and assumptions about the homogeneity of variance. In some comparisons, because of the small sample size and the likelihood of type II errors, the Bonferroni procedure was used.

For the multiple linear regression analyses, we used variables with similar content; these included socio-demographic measures (age, SDS), clinical measures (BPRS, BAI, BDI, PSWQ, and GHQ-28), vulnerability measures (DAS global and factors), and dispositional measures (MCMI-II, axes I and II). Statistical significance was established by a 95% confidence interval (p < 0.05) criterion. Statistic analyses were conducted using SPSS v. 15 for Windows.

Results

In the measure of RT, there are no statistically significant differences between gender or SDS (Table 2); similarly, there are no significant differences between age groups, F (4, 115) p < .05, but the data are heteroscedastic. The Kruskal-Wallis H test did not reveal any significant differences between age groups, χ² (4, N = 120) = 8.22, p = .084. In addition, there were no significant differences between the SR values in age categories, even excluding subjects age 56 or older, F (3, 116) = 1.893, p = .135, and homogeneity criteria are met: F_{Levene} = 2.681, p = .050.

As expected, the SR scores of patients and controls are significantly different (although the comparisons involved heteroscedastic data). SR are present on 13 of 34 survey items (Table 3). Although SR are more frequent in patients than in controls, the difference is significant on only 12 items.

There are significant differences in SR between diagnostic groups, F (7, 70) = 4.476, p = .0001, homoscedasticity: F_{Levene} = 1.505, p = .183. When excluding categories with only a few cases (eating disorders and addictions), statistically significant differences are noted between groups (with homoscedasticity) once again (ANOVA, Table 4 for 5 df). There were significant differences in SR between patients with different psychotic disorders and those in the various diagnostic
groups (Bonferroni test, p < .05), except those with somatoform and dissociative disorders. The elimination of “other conditions that may be a focus of attention in Axis I” (the category closest to normal functioning), did not significantly alter the results: F (4, 65) = 5.240, p = .001, F_{Levene} = 1.434 (p > .05).

There were no statistically significant differences in the SR of patients with different personality disorder groups (based on non-parametric comparisons, Table 4). Outstanding scores were observed in group C and this was most pronounced in those classified with non-specified forms (i.e., combinations of personality disorders).

We found no significant differences in the SR of patients represented on axis I, axis II, and on both axes (Table 4). However, the average SR value is lowest in axis I patients and highest in patients that occur on both axes; the latter combines diagnosis (suggesting severity); the difference between the first axis and the combined axis category is not statistically significant, t (67) = −1.908, p = .061, F_{Levene} = 0.841, p = .362.

Concerning the overall sample, the SR of subjects with a psychopathological history (M = 9.00, SD = 7.77) were significantly greater than the SR of subjects without a psychopathological history (M = 5.11, SD = 5.13), t (120) = −2.49, p = .018. Given that most subjects with antecedents were patients, the analysis was repeated by comparing patients and controls, with the same result (M = 10.39, SD = 7.91 vs. M = 6.21, SD = 5.66, respectively), t (28) = −2.53, p = .013.

An ANOVA was conducted on the RT values of patients in the following categories: relapse, current psychopathologies, and no psychopathology history. The results showed significant differences between the groups, but variances were not homogeneous (Table 4). When we applied the t-test for unequal variances, we did not find any statistically significant differences between the groups (t1,2 = 0.070, t1,2 = 0.075, t1,2 = 0.121; p > .05). The same results were obtained using only the group of patients, F (2, 70) = 6.639, p = .002, F_{Levene} = 3.974, p < .05; none of the post hoc analyses revealed a category with SR values significantly different than those of the other categories: t1,2 = 0.091, t1,2 = 0.136, t1,2 = 0.170; p > .05.

To verify the effects of psychotropics on REF scores, we applied a difference of means test. This test revealed that subjects taking psychotropic medications scored higher on SR than those not taking medications (data with non-homogeneous variances). The same analysis, conducted only for patients, also revealed significant differences between these two groups, t (70) = −2.42, p = .020; data with non-homogeneous variances: F_{Levene} = 8.385, p < .05.

Finally, we applied a stepwise multiple linear regression analysis to analyze socio-demographic, clinical, vulnerability to depression, and dispositional variables on RT (SR). Based on this analysis, we found that 56.4% of the total SR variance could be explained by a combination of the thought disorder MCMI-II sub-scale (40.5%), the conceptual disorganization
Discussion

As noted by Meyer and Lenzenweger (2009), a person might be more sensitive to the immediate environment if he/she has experienced a psychopathological disorder (axis I or axis II) or has psychopathological antecedents. However, this difference (i.e., patients versus controls) with or without psychopathology history) is quantitative (frequency-dependent) and not qualitative; in addition, it is common for most kinds of SR to also occur in controls (i.e., they are universal reactivity to social stimuli). These results confirm our first hypothesis, that an RT continuum exists between patients and controls,

Table 3. Percentage of responses for each item on the REF scale, and a comparison of the responses between patients and controls.

<table>
<thead>
<tr>
<th>REF Scale items</th>
<th>% response</th>
<th>Chi-Squared</th>
<th>More common in...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31.7</td>
<td>22.187**</td>
<td>Patients</td>
</tr>
<tr>
<td>2</td>
<td>13.3</td>
<td>6.462*</td>
<td>Patients</td>
</tr>
<tr>
<td>3</td>
<td>21.7</td>
<td>15.762**</td>
<td>Patients</td>
</tr>
<tr>
<td>4</td>
<td>8.3</td>
<td>7.792!*</td>
<td>Patients</td>
</tr>
<tr>
<td>5</td>
<td>9.2</td>
<td>2.748!</td>
<td>Patients</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>6.095*</td>
<td>Patients</td>
</tr>
<tr>
<td>7</td>
<td>9.2</td>
<td>5.287**</td>
<td>Patients</td>
</tr>
<tr>
<td>8</td>
<td>24.2</td>
<td>1.779</td>
<td>Patients</td>
</tr>
<tr>
<td>9</td>
<td>43.3</td>
<td>6.206*</td>
<td>Patients</td>
</tr>
<tr>
<td>10</td>
<td>18.3</td>
<td>0.312</td>
<td>Patients</td>
</tr>
<tr>
<td>11</td>
<td>19.2</td>
<td>1.477</td>
<td>Patients</td>
</tr>
<tr>
<td>12</td>
<td>16.7</td>
<td>1.344</td>
<td>Patients</td>
</tr>
<tr>
<td>13</td>
<td>10</td>
<td>1.524</td>
<td>Patients</td>
</tr>
<tr>
<td>14</td>
<td>12.5</td>
<td>3.311</td>
<td>Patients</td>
</tr>
<tr>
<td>15</td>
<td>3.3</td>
<td>2.956!</td>
<td>Patients</td>
</tr>
<tr>
<td>16</td>
<td>28.3</td>
<td>3.944*</td>
<td>Controls</td>
</tr>
<tr>
<td>17</td>
<td>6.7</td>
<td>0.980!</td>
<td>Patients</td>
</tr>
<tr>
<td>18</td>
<td>21.7</td>
<td>9.433**</td>
<td>Patients</td>
</tr>
<tr>
<td>19(R)</td>
<td>20</td>
<td>0.000</td>
<td>No differences</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td>1.624!</td>
<td>Patients</td>
</tr>
<tr>
<td>21</td>
<td>6.7</td>
<td>0.980!</td>
<td>Patients</td>
</tr>
<tr>
<td>22</td>
<td>4.2</td>
<td>0.006!</td>
<td>Patients</td>
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<tr>
<td>23</td>
<td>4.2</td>
<td>1.008!</td>
<td>Patients</td>
</tr>
<tr>
<td>24</td>
<td>23.3</td>
<td>2.577</td>
<td>Patients</td>
</tr>
<tr>
<td>25</td>
<td>7.5</td>
<td>0.031!</td>
<td>Patients</td>
</tr>
<tr>
<td>26</td>
<td>9.2</td>
<td>1.032!</td>
<td>Patients</td>
</tr>
<tr>
<td>27</td>
<td>7.5</td>
<td>0.031!</td>
<td>Patients</td>
</tr>
<tr>
<td>28</td>
<td>31.7</td>
<td>5.392*</td>
<td>Patients</td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td>8.000**</td>
<td>Patients</td>
</tr>
<tr>
<td>30</td>
<td>35.8</td>
<td>5.220*</td>
<td>Patients</td>
</tr>
<tr>
<td>31</td>
<td>45</td>
<td>2.805</td>
<td>Patients</td>
</tr>
<tr>
<td>32</td>
<td>22.5</td>
<td>0.995</td>
<td>Patients</td>
</tr>
<tr>
<td>33</td>
<td>34.2</td>
<td>7.648**</td>
<td>Patients</td>
</tr>
<tr>
<td>34</td>
<td>7.5</td>
<td>3.737!</td>
<td>Patients</td>
</tr>
</tbody>
</table>

Statistical significance: *p < .05; ** p < .01; ! = Fisher correction; (R) = item reverse.

BPRS subscale (5.9%), age (6.2%), and the DAS global (3.8%) (Table 5).
The SR values are much less homogenous in patients than in control groups; this must be studied carefully. It is possible that psychopathology is a highly heterogeneous process that reflects personal states and/or traits, and not just a measure of the schizotypy trait as Lenzenweger (2006) proposed when he created the REF Scale. A diagnostic or psychopathological condition (state) may strengthen the SR contents already present or make them harder to cope with when they begin to manifest.

Table 4. Comparisons of self-references (SR) among patients with diagnosed disorders.

<table>
<thead>
<tr>
<th>Grouped diagnoses from Axis I</th>
<th>n</th>
<th>mean (SD)</th>
<th>F/H/t</th>
<th>df</th>
<th>p</th>
<th>FL.evene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive disorders(1)</td>
<td>14</td>
<td>6.57 (7.39)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment Disorders(2)</td>
<td>13</td>
<td>5.23 (4.19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dissociative and somatoform disorders(3)</td>
<td>4</td>
<td>7.75 (5.56)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety disorders(4)</td>
<td>20</td>
<td>7.35 (4.90)</td>
<td>5.056</td>
<td>5</td>
<td>.001</td>
<td>1.900</td>
</tr>
<tr>
<td>Schizophrenia and other psychotic disorders(5)</td>
<td>6</td>
<td>18.33 (9.56)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Conditions that may be a focus of clinical attention(6)</td>
<td>5</td>
<td>3.20 (1.92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clusters of Personality Disorders (Axis II)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster A(1)</td>
<td>2</td>
<td>15.50 (9.19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster B(2)</td>
<td>1</td>
<td>16.00 (4.19)</td>
<td>2.272</td>
<td>3</td>
<td>.518</td>
<td>1.834</td>
</tr>
<tr>
<td>Cluster C(3)</td>
<td>7</td>
<td>8.71 (4.02)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality Disorder NOS(4)</td>
<td>6</td>
<td>10.33 (9.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axes I and II diagnoses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis I(1)</td>
<td>54</td>
<td>6.68 (6.37)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axis I(2)</td>
<td>3</td>
<td>9 (4.58)</td>
<td>1.929</td>
<td>2</td>
<td>.153</td>
<td>0.656</td>
</tr>
<tr>
<td>Both(3)</td>
<td>13</td>
<td>10.62 (7.83)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case History in Psychopathology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None(1)</td>
<td>92</td>
<td>5.11 (5.12)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A case history different from the one…(2)</td>
<td>5</td>
<td>16.60 (10.5)</td>
<td>10.78</td>
<td>2</td>
<td>.000</td>
<td>6.420**</td>
</tr>
<tr>
<td>A case history already treated (3)</td>
<td>23</td>
<td>7.35 (6.17)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychopharmacologic Treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With prescription(1)</td>
<td>88</td>
<td>4.73 (4.49)</td>
<td>3.20</td>
<td>38.1</td>
<td>.003</td>
<td>17.716**</td>
</tr>
<tr>
<td>Without prescription(2)</td>
<td>32</td>
<td>9.56 (9.56)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Predictive analysis of referential thinking (RT)

<table>
<thead>
<tr>
<th>Significant variables</th>
<th>R2 Adjusted</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCMI – thought disorder</td>
<td>.405</td>
<td>.333</td>
<td>2.617</td>
<td>.012</td>
</tr>
<tr>
<td>BPRS – conceptual disorganization</td>
<td>.464</td>
<td>.375</td>
<td>3.399</td>
<td>.002</td>
</tr>
<tr>
<td>Age</td>
<td>.526</td>
<td>-.259</td>
<td>-2.510</td>
<td>.016</td>
</tr>
<tr>
<td>DAS – global</td>
<td>.564</td>
<td>-.251</td>
<td>2.153</td>
<td>.037</td>
</tr>
</tbody>
</table>

The SR values are much less homogenous in patients than in control groups; this must be studied carefully. It is possible that psychopathology is a highly heterogeneous process that reflects personal states and/or traits, and not just a measure of the schizotypy trait as Lenzenweger (2006) proposed when he created the REF Scale. A diagnostic or psychopathological condition (state) may strengthen the SR contents already present or make them harder to cope with when they begin to manifest.

According to Johns and Van Os (2001) heterogeneity could be evidence of a continuum between patients and the general population, and among patients themselves. Also imply that if we refer to schizotypy, differences between patients, and between controls, may be less pronounced and stable than expected. On the other hand, the variability in RT scores among the patients themselves underscores the importance of SR instability as a pre-delusional stage, a precursory symptom (and therefore a latent condition for the classical development of psychotic process) (Schultze-Lutter et al., 2010) or a risk symptom (or syndrome) associated with different psychopathologic pathways (McGorry, 2010).
There were some differences in SR between the diagnostic groups, particularly highlights in schizophrenic patients and patients with other psychotic disorders; this confirmed our second hypothesis: i.e., that RT is most evident as a precursor to or a symptom of psychosis (positive schizotypy, disorganization, continuous cognitive defense traits). Moreover, we found differences in SR between patients in different phases of psychosis disorder manifestation: two patients were in an active phase, two were in a stable disease stage, and the rest were in a residual stage. Therefore, RT develops during the prodromal stage, reaches its peak during the active phase, and is retained during the residual stage. During the residual stage, SR is a useful predictor of improvement or deterioration, which is why, in a previous work, we noted a decrease of SR in the remission stage, and a recuperation of the scores in the monitoring stage of psychotic patients, with a necessary increase of neuroleptic dosis (Rodríguez-Testal et al., 2009). This strengthens the notion that RT can be a state (psychopathology) or a trait (pre-delusional stage).

Some conditions from axis I, such as adjustment disorders and relational problems (e.g., other conditions that may be a focus of clinical attention on axis I) have SR scores that are closer to the scores characteristic of controls. Other psychopathologies, such as anxiety, depression, eating disorders, etc., show markedly high self-referential values.

One way to check the status of traits that have been carried over from personality disorders is to see whether the patients’ SR scores are high; in fact, these clinical conditions can be considered pre-psychotic (specially cluster A). Unfortunately, although the total number of axis II diagnoses in the sample of this study (23%) represents a reasonable proportion of these cases in a clinical setting, it is not large enough to be conclusive about the results. The high average SR in patients from group A is consistent with the observations of Lenzenweger et al. (1997) and Meyer and Lenzenweger (2009) regarding subjects with schizotypal and paranoid disorders. However, in the NOS category (combination of personality disorders), it appears once again that the interpretation of additives (conditions of severity) must take into account conditions of both state and trait. Therefore, we cannot support the hypothesis 3.

Hypothesis 4 was confirmed, suggesting that there may be a combination of state and trait factors in increased AR. Thus, psychopathology history (patients or controls) can be an indicator of vulnerability. Taking psychotropic drugs (patients or controls) a status condition that affects some extent. And having diagnoses in both axes, can be an indicator of psychopathological additivity (state and trait).

In regression analyses, we observed that the first two parameters were represented by the clinical variables (trait or state) of psychotic thinking (MCMII thought disorder) and conceptual disorganization (BPRS), both of which reflect the onset of positive symptoms. The first component is connected with the development of suspicion, mistrust, and distorted thinking, but not with delusional activity. The second component, conceptual disorganization, indicates the onset of a breakdown of coherent thought (i.e., formal thought disorders). Therefore, the REF Scale detects the developmental progression of psychoses. In addition, as noted by Startup et al. (2010) the REF Scale is useful because it identifies the severity of psychotic disorders. The last two variables in the regression equation, age and DAS, represent “trait” conditions; the first is related to developmental maturity, underscoring the importance of SR in younger subjects, and the second indicates vulnerability to depression (possibly related to guilt items on the REF Scale), thus confirming our fifth hypothesis, that RT is a cognitive vulnerability factor (trait or sensitivity) linked to mood (the involvement of affective variables in the development of RT).

Some limitations of the present study should be considered. A broader sampling of participants would allow analyses for more thorough diagnostic assessments, instead of global categories of disorders. For example, the inclusion of patients who suffer from obsessive-compulsive disorder and from social phobia (within the “anxiety disorders” category) may also dilute the information about RT, because of the continuous self-referential activity in social phobia disorders is very different than obsessive-compulsive disorder. Moreover, we applied only one measure (cross design). As mentioned above, RT is a pre-delusional element and in order to establish the progression of psychosis, at least two different measurements should be taken: one in the pre-delusional stage and another in the delusional stage. Finally, we encountered some difficulties when applying the REF Scale to assess RT. For example, a woman was diagnosed with delusional disorder (jealous type). This patient rated only 1 on the REF Scale, and after she had completed the test, she commented: “What wears me down is the fact that people start whispering something about me when I am on the bus, or when I am walking down the street, and people laugh at me in my face.” Therefore, RT requires a self-report about internal mentation, which is difficult to otherwise articulate or categorize. Inevitably, self-reporting introduces distortions in the dataset.

Conclusions

The fact that control subjects and patients do not distinguish the content of SR implies that there is a continuum in the process of RT development. On the other hand, our data suggest that, in the absence of diagnosis, the pathological effects of SR are weakened by internal resources or coping in emotionally-laden social interactions. We found that subjects with pathologies either lack resources or become more vulnerable when SR defensive schema appears; this is especially prevalent in cases of psychosis, and with psychopharmacologic treatments.
Referential thinking may be both a state manifestation (its presence itself possibly has an additive effect on other pathologies), and a trait manifestation (a characteristic of psychotic processes, and also possibly associated with mood disorders). Future work should focus on the nature of the trait/state condition of RT in psychopathology.

REFERENCES


Resilience is a concept that explains how people cope with violent or threatening situations during their life. It is more than just resistance and much broader than adaptability, which is just part of resilience (Manciaux, 2003). Although there is no universally accepted definition for resilience, nearly all authors describe it as a process, capacity, growth, positive approach or ability (González-Arratia, 2007).

At the same time, resilience is a concept with many different nuances; some authors relate it to the concept of post-traumatic growth, associating it with the ability to walk away from an adverse experience, learn from it and improve oneself. Other authors, however, use the term in a more restricted manner, making reference to the process of confrontation that helps a person remain intact, without including his/her post-traumatic growth (Vera, Carbelo and Vecina, 2006). Bonanno (2004) emphasized the importance of differentiating between the concepts of resilience and recovery, as both represent different moments in time; recovery involves a gradual return to normal functioning, while resilience is one’s ability not only to recover but also to be strengthened by the traumatic experience.

For Cyrulnik, (2002), the term refers to a process or an evolution. In other words, people themselves cannot be referred to as “resilient” but their evolution and process of organizing their own life histories can. Therefore, resilience should not be considered a static ability since it varies over time and according to circumstance. In other words, it is the result of a balance between risk factors, protective factors and a human being’s own personality.

In terms of poverty, research on resilience has basically focused on three levels of protective factors: individual attributes and attitudes, the family and the community. For people living in poverty, there are detrimental conditions in the environment that could be considered a threat for the local population. However, the level of threat will depend on how vulnerable the population is, since a threat often awakens internal attributes of an individual or group to respond to the threat (Seccombe, 2002). Blaikie, Cannon, David and Wisner (1996) argued that the vulnerability of a population depends on three elements:

- **Exposure**: refers to one’s susceptibility to dangerous phenomena due to one’s proximity to the area and one’s physical vulnerability.

- **Social vulnerability**: refers to a population’s predisposition to being affected as the result of its degree of marginality or social segregation and its resulting conditions of disadvantage or relative weakness.

- **Inadequate resilience**: understood as individuals’ limitation to access and mobilize personal resources and their shortcomings in terms of absorbing the impact of the adverse situation.

It thus stands to reason that the limited opportunities resulting from situations of poverty and inequality are what keeps individuals from reaching their full potential. However, several studies have shown that some people have the ability to adapt and overcome adversity, probably because, when considering the three components of vulnerability (exposure, social vulnerability and inadequate resilience), their resilience is high (Gauto, 2008).

Therefore, the question of whether or not an individual is resilient when faced with a specific situation depends on the active resources she has available at a given time and place and...
the strategy she uses to confront and overcome the adverse circumstances. At certain times, the individual will only have certain resources available and it is likely that different strategies will be used for each specific moment and situation. For this reason, individual life situations should be understood and the active resources available must be identified. In other words, it is essential to do both a micro-analysis (of the individuals and their homes) and a macro-analysis (of their surroundings), without overlooking the connections between the two (Gauto, 2008).

Poverty is understood as the lack of the fundamental abilities necessary for a decent living, i.e. when an individual cannot earn enough on her own because she lacks the abilities that the majority possess (De la Torre, 2004). Altimir (1978) defines poverty as a situational syndrome that combines infraconsumption, malnutrition, precarious living conditions, low levels of education, poor health conditions, an unstable position in the production system, attitudes of discouragement and anomie, little participation in social integration mechanisms and perhaps adherence to a particular scale of values that differ to some extent from that of the rest of society.

More recently, in order to further clarify this concept of poverty, other immaterial aspects have been incorporated in the assessment such as those related to expanding and strengthening social capital and wellbeing. In its broader definition, poverty thus refers to a condition in which a person does not have sufficient income; cannot easily access free or subsidized government services or benefits (such as social security, healthcare, etc.); does not own a house or any other type of personal asset; has reached only a low level of education and had only minimal job training or none at all, and finally, does not have enough time for education, rest or recreation. All of these limitations reduce an individual’s autonomy and cause their family and social networks to be limited or non-existent (Arriagada, 2005).

From this perspective, it is possible to say that the struggle to overcome poverty is an issue as relevant as ever given the progressive drop in economic growth and the high level of financial instability worldwide. Thus, the goal of this study is to identify the variables that explain the resilience of a group of people living in extreme poverty: the female beneficiaries of the human development program Oportunidades¹ and their partners.

For this study, personal resources were divided into four areas: individual, school, family and social. These personal resources allow the individual to relate to his surroundings, some of which are critically important during times of crisis or situations of vulnerability, since they allow the individual to behave with resilience.

**Method**

**Participants**

This study covered 602 households that entered the program Oportunidades from 2002 to the date upon which the surveys were conducted. The sample was selected from a universe of 5,512 households. There were two inclusion criteria for the sample. First, beneficiaries had to be active in the program and second, they had to be from urban areas in the states of Guanajuato, Estado de México, Morelos, Tlaxcala, Guerrero, Michoacán, Veracruz and Puebla (all close to Mexico City). A total of 1,257 cases met the criteria. From this list of households, 700 homes were selected at random, 100 or which were backups. The surveys were conducted with 602 program recipients and 311 domestic partners. It was only possible to interview a little over half of the domestic partners given that most worked in other cities; some of the program recipients were widows, divorced or single mothers and in some cases, the domestic partners had migrated in search of better working conditions.

In the study sample, 65.2% are women and 34.8% are domestic partners of the recipients. The average age is 43.71 (DE=12.58). According to their place of origin, 58.7% come from a village, 32.5% from a small town and just 3.6% from Mexico City. Those who are not from the place where they are now living have been living at their current residence for 22.02 years (DE=11.59) on average. At the same time, the average number of people benefiting from the Oportunidades program is 2.61 (DE=1.48) per household.

**Variables**

The dependent variable of the study is resilience, which is defined as the ability to confront, overcome and be strengthened by adverse situations. Scores higher than the average were considered high resilience. The independent variables that were considered are grouped in four areas: individual, school, family and social. The individual areas included thirteen variables: optimism, self-esteem, anxiety, depression, stress, locus of control, achievement motivation, problem solving, coping, emotional intelligence, sense of humor, religious coping and intelligence. The school area is comprised of four variables: the student-teacher relationship, teaching styles, learning styles and family involvement in school. Although the participants were adults, they were asked to respond to the questions in this section based on their own experience in school. The family area has two variables. The first

¹ The program for human development opportunities (Oportunidades) is a Mexican federal initiative whose objective is to help extremely poor families get out of poverty. Its activities are designed to encourage and strengthen both the individual and collective capacities of the beneficiaries. Through income transfers and investment in health, nutrition and education, the program seeks to end the intergenerational circle of poverty in Mexico. The program benefits approximately five million households. In all cases, the women are the program recipients and they receive the economic support (with a few exceptions such as disability).
is family relations, which is understood as a family’s ability to communicate both verbally and affectionately and a family’s capacity to maintain stability and unity when facing a predicament or events that could even cause family members to fall ill (García, Landeros, Arroja and Pérez, 2007). The second is parenting styles, which refers to the different ways of bringing children up and teaching them; this includes aspects such as establishing limits and social norms (Esteve, 2005). Finally, the social area has three variables: belongingness, social support and social identity.

Instruments

Several instruments were used in this investigation. First, a closed questionnaire was designed to gather sociodemographic, economic and educational information from the participants. Several instruments were also used to measure individual, social and family variables as well as resilience. The instruments were tested during a pilot study among an adult population living in poverty in Mexico City and neighboring areas in order to verify the relevance of the scales. Validity analyses were done through an exploratory factor analysis and reliability analysis using Cronbach’s alpha to gauge its psychometric properties. The information on the instruments is detailed in Appendix 1; the left column shows the original scales and the right column shows the total number of items that resulted after the psychometric analyses of the pilot study data were applied to the final study.

Procedure

The data from this investigation are part of a broader study entitled “Identification of a Model of Resilience and its Relationship to Social Mobility among Beneficiaries of the Human Development Program Oportunidades”. The aim of this study is to explore the specific weight of variables from different spheres (individual, school, family and social) on resilience and the impact resilience has on social mobility.

For this article, we opted for an explanatory study because we sought to make inferences regarding this phenomenon, particularly searching for individual, school, family and social resources linked to resilience.

This is a cross-sectional study in terms of time and in terms of the setting, it is a survey-based fieldwork study with a non-experimental design.

Results

Initially, descriptive statistics were analyzed and revealed that the average personal income per month is approximately US$93.25 (DE=95.86), with a minimum of zero and a maximum of US$51.51 while the average family income per month was approximately US$165.74 per household (DE=102.17), with a minimum of zero and a maximum of US$624.08. The average number of people living off of this family income is 4.62 personas per household (DE=1.87) with a minimum of 1 and a maximum of 13 people.

In terms of how participants say they spend the money they receive from the Oportunidades program, the funds go first to food (41.1%), school expenses (28.1%) and clothing and shoes (19.4%). As for who contributes the most to the family income, most respondents indicated that it was the recipient herself (47.8%), followed by her domestic partner (39.6%) and then her children (9%).

To describe the living conditions, 79.2% live in a house and 20.2% reside in a single room. The average number of rooms in the household (not counting kitchen or bathroom) is 1.79 rooms (DE=0.87), with a minimum of one and a maximum of 6 rooms, while the average number of people living in the same house is 4.8 people per household (DE=2.03), with a minimum of 1 and a maximum of 15 people, where the majority live with their domestic partner and children (68.7%).

In terms of the educational level, 29.1% of those surveyed had never gone to school; 28% had been to elementary school but had not finished, and 21.6% had finished elementary school. In spite of the fact that respondents corresponded to an extremely low socioeconomic population with a very limited education, the pilot study and the psychometric analysis of the instruments showed that they did understand the questions posed on the questionnaire. It is also important to note that the survey takers often applied the scale as an interview, given that a good number of the participants did not know how to read or write. With respect to the health of the respondents, 25.5% reported that they suffer from some illness; the two most frequently mentioned were hypertension and diabetes. Additionally, 16.4% stated that one of the people living in the household suffers from a physical or mental illness.

In terms of the psychological variables that were measured, the highest variables were religious coping with a mean of 3.22 (DE=0.57); internal locus of control with a mean of 3.27 (DE=0.59); social identity with an average of 3.28 (DE=0.60), and achievement motivation with a mean of 3.35 (DE=0.55). The highest resilience scales were self-confidence (M = 3.30) and family and social support (M = 3.33). The averages of all the variables included in the study are shown on Chart 1.

Five multiple regression analyses were done in order to identify the research variables that best explain resilience. The independent variables that were introduced in the first four regressions correspond to the variables in each separate area (individual, school, family and social) and the fifth regression analysis included all the variables. Analyses were done
Chart 1
Psychometric Information of the Pilot Study Variables (N = 913)

<table>
<thead>
<tr>
<th>Scales</th>
<th>Factors</th>
<th>Items</th>
<th>Var</th>
<th>α</th>
<th>M</th>
<th>SE</th>
<th>VP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimism</td>
<td></td>
<td>3</td>
<td>51.85</td>
<td>.739</td>
<td>3.12</td>
<td>0.02</td>
<td>1</td>
</tr>
<tr>
<td>Self-esteem</td>
<td></td>
<td>8</td>
<td>46.63</td>
<td>.830</td>
<td>2.09</td>
<td>0.02</td>
<td>13</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td>20</td>
<td>.942</td>
<td></td>
<td>37.38</td>
<td>0.43</td>
<td>8</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td>21</td>
<td>.956</td>
<td></td>
<td>31.60</td>
<td>0.43</td>
<td>7</td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td>43</td>
<td>.842</td>
<td></td>
<td>0.30</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>Locus of control</td>
<td>Externality</td>
<td>4</td>
<td>50.29</td>
<td>.909</td>
<td>2.89</td>
<td>0.03</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Internality</td>
<td>5</td>
<td>21.18</td>
<td>.853</td>
<td>3.27</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td>Achievement motivation</td>
<td>Skill</td>
<td>9</td>
<td>48.75</td>
<td>.936</td>
<td>3.35</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Competitiveness</td>
<td>4</td>
<td>20.32</td>
<td>.880</td>
<td>2.63</td>
<td>0.03</td>
<td>4</td>
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<tr>
<td>Problem solving</td>
<td>Rational</td>
<td>10</td>
<td>23.39</td>
<td>.875</td>
<td>2.94</td>
<td>0.02</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Evasive-Impulsive</td>
<td>10</td>
<td>17.55</td>
<td>.852</td>
<td>2.30</td>
<td>0.02</td>
<td>6</td>
</tr>
<tr>
<td>Coping</td>
<td>Support seeking</td>
<td>7</td>
<td>19.26</td>
<td>.84</td>
<td>3.08</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Direct</td>
<td>7</td>
<td>19.09</td>
<td>.823</td>
<td>2.84</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Denial</td>
<td>5</td>
<td>11.62</td>
<td>.852</td>
<td>2.48</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td>Emotional intelligence</td>
<td>Personal satisfaction</td>
<td>19</td>
<td>23.4</td>
<td>.937</td>
<td>3.28</td>
<td>0.02</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Impulsiveness</td>
<td>11</td>
<td>14.75</td>
<td>.909</td>
<td>2.02</td>
<td>0.02</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Empathy</td>
<td>7</td>
<td>5.67</td>
<td>.872</td>
<td>3.13</td>
<td>0.02</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Insecurity-Insensitivity</td>
<td>9</td>
<td>4.83</td>
<td>.827</td>
<td>2.11</td>
<td>0.02</td>
<td>8</td>
</tr>
<tr>
<td>Sense of humor</td>
<td>Sense of humor</td>
<td>9</td>
<td>48.72</td>
<td>.894</td>
<td>2.78</td>
<td>0.02</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Humor as a social resource</td>
<td>4</td>
<td>11.85</td>
<td>.833</td>
<td>2.37</td>
<td>0.02</td>
<td>2</td>
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<tr>
<td>Religious coping</td>
<td>Religious coping</td>
<td>28</td>
<td>49.19</td>
<td>.970</td>
<td>3.22</td>
<td>0.02</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Negative religious coping</td>
<td>4</td>
<td>7.48</td>
<td>.772</td>
<td>2.30</td>
<td>0.03</td>
<td>3</td>
</tr>
<tr>
<td>Intelligence (Beta III)</td>
<td></td>
<td>268</td>
<td>.910</td>
<td>68.98</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive abilities</td>
<td>Verbal comprehension</td>
<td>50</td>
<td>.88(r)</td>
<td>9.92</td>
<td>0.25</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Word fluency</td>
<td>100</td>
<td>.70(r)</td>
<td>17.73</td>
<td>0.36</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Student-teacher relationship</td>
<td>Satisfaction with school</td>
<td>8</td>
<td>34.46</td>
<td>.922</td>
<td>3.11</td>
<td>0.03</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Advice and emotional support</td>
<td>7</td>
<td>16.68</td>
<td>.895</td>
<td>2.25</td>
<td>0.03</td>
<td>36</td>
</tr>
<tr>
<td>Teaching approaches</td>
<td>Directive style</td>
<td>10</td>
<td>54.11</td>
<td>.928</td>
<td>3.06</td>
<td>0.03</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Participative style</td>
<td>8</td>
<td>6.28</td>
<td>.915</td>
<td>2.89</td>
<td>0.03</td>
<td>33</td>
</tr>
<tr>
<td>Learning styles</td>
<td>Theoretical-Pragmatic</td>
<td>9</td>
<td>51.02</td>
<td>.883</td>
<td>3.00</td>
<td>0.02</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Active-Reflexive</td>
<td>6</td>
<td>7.81</td>
<td>.884</td>
<td>3.08</td>
<td>0.02</td>
<td>1</td>
</tr>
<tr>
<td>Family involvement in school</td>
<td>Parent involvement</td>
<td>7</td>
<td>60.3</td>
<td>.921</td>
<td>2.56</td>
<td>0.04</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Homework help</td>
<td>5</td>
<td>12.33</td>
<td>.918</td>
<td>2.08</td>
<td>0.04</td>
<td>32</td>
</tr>
<tr>
<td>Tutor</td>
<td></td>
<td>13</td>
<td>69.98</td>
<td>.964</td>
<td>3.01</td>
<td>0.04</td>
<td>56</td>
</tr>
<tr>
<td>Family Relations</td>
<td>Warmth and support</td>
<td>6</td>
<td>47.67</td>
<td>.920</td>
<td>2.99</td>
<td>0.03</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Conflict</td>
<td>7</td>
<td>14.57</td>
<td>.905</td>
<td>2.05</td>
<td>0.03</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Violence</td>
<td>4</td>
<td>6.74</td>
<td>.863</td>
<td>1.72</td>
<td>0.03</td>
<td>2</td>
</tr>
</tbody>
</table>
What does resilience refer to when talking about people living in extreme poverty in Central Mexico?

to determine the multicollinearity among the predictors and then the variables with a variance inflation favor of (FIV) ≥ 2 were excluded. The number of subjects participating in the different statistical analyses varied depending on the number of participants that entered in the corresponding regression equations. This variation is due to the fact that not all of the questions applied to all of the respondents.

Chart 2
Resilience Predictors in the Individual Area

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>CI 95.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant variable</td>
<td>.525***</td>
<td>[.163, .887]</td>
</tr>
<tr>
<td>Age</td>
<td>.000</td>
<td>[-.002, .002]</td>
</tr>
<tr>
<td>Gender</td>
<td>.006</td>
<td>[-.050, .062]</td>
</tr>
<tr>
<td>Per capita income</td>
<td>-3.91E-5</td>
<td>[.000, .000]</td>
</tr>
<tr>
<td>Negative self-esteem</td>
<td>-.031</td>
<td>[-.081, .019]</td>
</tr>
<tr>
<td>Optimism</td>
<td>.084**</td>
<td>[.028, .140]</td>
</tr>
<tr>
<td>Depression</td>
<td>-.004**</td>
<td>[-.007, -.002]</td>
</tr>
<tr>
<td>Stress</td>
<td>-.018</td>
<td>[-.099, .064]</td>
</tr>
<tr>
<td>CI Beta</td>
<td>.002</td>
<td>[-.001, .005]</td>
</tr>
<tr>
<td>Problem solving 1 (rational)</td>
<td>.044</td>
<td>[.021, .108]</td>
</tr>
<tr>
<td>Problem solving 3 (paralysis)</td>
<td>.030</td>
<td>[.017, .076]</td>
</tr>
<tr>
<td>Internal locus of control</td>
<td>.301***</td>
<td>[.246, .356]</td>
</tr>
<tr>
<td>Coping 1 (support seeking)</td>
<td>.066*</td>
<td>[.000, .131]</td>
</tr>
<tr>
<td>Coping 2 (direct)</td>
<td>.072*</td>
<td>[.007, .136]</td>
</tr>
<tr>
<td>Coping 3 (denial)</td>
<td>.035</td>
<td>[.013, .084]</td>
</tr>
<tr>
<td>Emotional intelligence 2 (impulsiveness)</td>
<td>.005</td>
<td>[.041, .050]</td>
</tr>
<tr>
<td>Emotional intelligence 3 (empathy)</td>
<td>.024</td>
<td>[.023, .070]</td>
</tr>
<tr>
<td>Emotional intelligence 4 (insecurity-insensitivity)</td>
<td>-.060*</td>
<td>[-.115, -.006]</td>
</tr>
<tr>
<td>Emotional intelligence 5 (Inability to accurately perceive reality)</td>
<td>.012</td>
<td>[.034, .058]</td>
</tr>
<tr>
<td>Religious coping 1 (religious coping)</td>
<td>.057</td>
<td>[.000, .115]</td>
</tr>
<tr>
<td>Religious coping 2 (negative religious coping)</td>
<td>.010</td>
<td>[.026, .045]</td>
</tr>
<tr>
<td>Achievement motivation 1 (skill)</td>
<td>.118**</td>
<td>[.051, .185]</td>
</tr>
<tr>
<td>Achievement motivation 2 (competence)</td>
<td>.060***</td>
<td>[.029, .091]</td>
</tr>
<tr>
<td>Sense of humor 1 (sense of humor)</td>
<td>.025</td>
<td>[.023, .073]</td>
</tr>
<tr>
<td>R2 adjusted</td>
<td>.588</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>30.295***</td>
<td></td>
</tr>
</tbody>
</table>

Note: N= 473 CI= Confidence Interval *p < .05. **p < .01. ***p < .001
For the individual area, the solutions indicate that the variables introduced in the regression equation explain 58.8% of the resilience variance \[ R^2 \text{adjusted} = 0.588, F = 30.295, p < .001 \]. The variables that best predict resilience are internal locus of control, skill and competence (factors within achievement motivation) optimism, support seeking and direct coping (coping factors), emotional intelligence and finally, freedom from depression symptoms. Due to excluded values, 473 participants entered into the regression equation. Chart 2 shows the regression coefficients and the confidence intervals for all the variables in the individual area.

For the area of school, the solution indicates that the variables entered in the regression equation explain 42.7% of the resilience variance \[ R^2 \text{adjusted} = 0.427, F = 26.164, p < .001 \]. The variable that best predicts resilience is reflexive learning style. Due to excluded values, 372 participants entered into the regression equation. Chart 3 shows the regression coefficients and the confidence intervals for all the variables in the school area.

For the area of family, the solution indicates that the variables entered in the regression equation explain 9.40% of the resilience variance \[ R^2 \text{adjusted} = 0.094, F = 12.007, p < .001 \]. The variables that best predicts resilience are warmth and support (family relations factor) and authoritarian and authoritative parenting styles. Due to excluded values, 742 participants entered into the regression equation. Chart 4 shows the regression coefficients and the confidence intervals for all the variables in the family area.

For the social area, the solution indicates that the variables entered in the regression equation explain 24.2% of the resilience variance \[ R^2 \text{adjusted} = 0.242, F = 29.648, p < .001 \]. The variables that best predicts resilience are social support, family support, support from friends, social identity, age and gender. Due to excluded values, 720 participants entered into the regression equation. Chart 5 shows the regression coefficients and the confidence intervals for all the variables in the social area.

---

**Chart 3**

Resilience Predictors in the School Area

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>CI 95.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant variable</td>
<td>1.367***</td>
<td>[0.987, 1.748]</td>
</tr>
<tr>
<td>Age</td>
<td>.002</td>
<td>[.002, .005]</td>
</tr>
<tr>
<td>Gender</td>
<td>.031</td>
<td>[.040, .103]</td>
</tr>
<tr>
<td>Per capita income</td>
<td>-3.914E-5</td>
<td>[.000, 0.000]</td>
</tr>
<tr>
<td>Cognitive abilities</td>
<td>.000</td>
<td>[-.005, .004]</td>
</tr>
<tr>
<td>Academic competence</td>
<td>.001</td>
<td>[-.003, .004]</td>
</tr>
<tr>
<td>Student-teacher relationship 1 (satisfaction with school)</td>
<td>.049</td>
<td>[.015, .113]</td>
</tr>
<tr>
<td>Student-teacher relationship 2 (advice and emotional support)</td>
<td>-.023</td>
<td>[.071, .025]</td>
</tr>
<tr>
<td>Student-teacher relationship 3 (Poor relationship with teachers)</td>
<td>-.041</td>
<td>[.090, .008]</td>
</tr>
<tr>
<td>Teaching approaches 1 (directive style)</td>
<td>.073</td>
<td>[.001, .148]</td>
</tr>
<tr>
<td>Leaning Styles 2 (reflexive)</td>
<td>.430***</td>
<td>[.365, .495]</td>
</tr>
<tr>
<td>Family-school involvement 1 (parent involvement in school)</td>
<td>.046</td>
<td>[.002, .090]</td>
</tr>
<tr>
<td>R^2 adjusted</td>
<td>.427</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>26.164***</td>
<td></td>
</tr>
</tbody>
</table>

Note: N= 372 CI= Confidence Interval *p < .05. **p < .01. ***p < .001

---

**Chart 4**

Resilience Predictors in the Family Area

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>CI 95.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant variable</td>
<td>2.418***</td>
<td>[2.206, 2.630]</td>
</tr>
<tr>
<td>Age</td>
<td>-.002</td>
<td>[.005, .000]</td>
</tr>
<tr>
<td>Gender</td>
<td>.033</td>
<td>[.033, .099]</td>
</tr>
<tr>
<td>Per capita income</td>
<td>4.108E-5</td>
<td>[.000, .000]</td>
</tr>
<tr>
<td>Family relations 1 (warmth and support)</td>
<td>.129***</td>
<td>[.074, .185]</td>
</tr>
<tr>
<td>Parenting styles 1 (authoritative)</td>
<td>.057*</td>
<td>[.006, .108]</td>
</tr>
<tr>
<td>Parenting styles 2 (authoritarian)</td>
<td>.079**</td>
<td>[.033, .125]</td>
</tr>
<tr>
<td>Parenting styles 3 (permissive)</td>
<td>.015</td>
<td>[.031, .060]</td>
</tr>
<tr>
<td>R^2 adjusted</td>
<td>.094</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>12.007***</td>
<td></td>
</tr>
</tbody>
</table>

Note: N= 742 CI= Confidence Interval *p < .05. **p < .01. ***p < .001
What does resilience refer to when talking about people living in extreme poverty in Central Mexico?

Finally, for the general model, the solution indicates that the variables entered in the regression equation explain 55.9% of the resilience variance \[ R^2_{adjusted} = 0.559, \quad F = 11.816, \quad p < .001 \]. The variables that best predict resilience are internal locus of control, achievement motivation (skill and competence), sense of humor as a social resource and direct coping. Due to excluded values, 266 participants entered into the regression equation. Chart 6 shows the regression coefficients and the confidence intervals for all the variables in the general model.

Discussion

Although the main feature of the sample is living in poverty, this study creates a clear view of the precarious living conditions of the participants. This precariousness is owed to their extremely low incomes, which they must use for food, education, health and housing. It is important to note that a family of four to five members survives on approximately US$166. It is thus not surprising that participants have little or no education and that the jobs they can access are generally underpaid. It is also easy to understand the vicious circle of poverty in which people drop out of school because their economic needs take priority over their studies; this in turn limits their job opportunities and reproduces poverty.

The values obtained for each scale correspond to the sum of the answers of all the items that comprise each of the factor and divided among the number of items of the scale. Thus the answer range will always go from one to four regardless of the number of items that comprise the factor.

The averages obtained on the scales of religious coping, internal locus of control, achievement motivation, personal satisfaction and social identity are all higher than 3.2, while the factors of the resilience variable with averages higher than 3.3 are family and social support and self-confidence. Bearing these results in mind, the high averages of religious coping, social identity and family support come as no surprise since Mexican people have strong family bonds, are highly religious and proud of their traditions (Morandé, 1984; 1991).

According to the first regression model, which was done with variables from the individual sphere, the resilience of the participants tends to be explained by high scores in internal locus of control, direct coping and coping through support seeking, achievement motivation (skill and competence) and optimism. It is also explained by low scores in depression and on the insecurity-insensitivity scale, which corresponds to the emotional intelligence variable. Therefore, believing that the consequences of one’s behavior are one’s own responsibility and goal setting (with the underlying behaviors of tenacity and work this implies) are two fundamental conditions for resilience.

In relation to the area of school, the variable that best predicts the resilience of the participants is the reflexive learning style since this allows the student to get involved with her own teaching-learning process, an involvement that proves effective in achieving educational goals.

In the sphere of family, resilience can be explained by high scores in warmth and support (family relations) and by authoritative and authoritarian styles. This finding concurs with a study by Domenech, Donovick and Crowley (2009), who showed that an authoritative parenting style was positively associated with a child’s cognitive and social functioning, high academic achievement, adequate self-esteem and social competence. According to these authors, an authoritarian parenting style helps establish limits and norms within both family and society through regular follow-up by the parents.

It was also observed that the variable of warmth and support in family relations enter into the regression model. This occurs because the family is our social institution par excellence, that vital space where feelings, emotions and at-
titudes are shared with others. Family is one of society’s resources; it is a privileged sphere for adopting values, a space for personal protection, profound communication and the opening scene to other contexts of socialization and education (Rojas, 2002). Therefore, the family system is tasked with developing biological, economic, educational and social functions (Ortiz, Padilla and Padilla, 2005), because it provides children with the psychosocial space they need to acquire, experience and test the distinctive elements of culture and the social norms that allow them to integrate into society.

In the social sphere, resilience is linked to social and family support, support from friends and to one’s social identity. According to Sluzaki (2000), social support allows individuals to develop stable relations with family members, friends and coworkers. These relationships have an impact on one’s quality of life, since they help cushion against the stress of everyday life, favoring adaptive responses among the subjects.

Finally, the general model that was obtained in the analysis revealed that the variables that best predict resilience are internal locus of control, direct coping, achievement motivation (skill and competence) and sense of humor as a social resource.

The predictive variables in the individual areas and in the general model are internal locus of control, direct coping, and competence and skill (as part of achievement motivation). This occurs because individuals with an internal locus of control pay attention to anything that can provide them with information for their behavior in the future. They are people who work to improve the conditions of their environment; they pay more attention to their abilities, skills and achievement reinforcement; they are concerned about their failures or mistakes; they are more resistant to external manipulations, and they have greater cognitive processing, more intentional learning, higher levels of functioning and more positive achievement activities. Thus, the internal locus of control is a component which has tangible similarities to resilience (Godoy-Izquierdo and Godoy, 2002).

With respect to achievement motivation, some people find novel and creative solutions to problems instead of repeating conventional solutions (Sagie, 1994). They are willing to take personal responsibilities for the consequences of their actions. Individuals with high achievement motivation seek out tasks that are challenging; they always compete to do things better than others and they reap satisfaction from exhibiting personal skill (Maehr, 1978). Another author, Anzola (2003), reports that the feeling of success, the confidence to start new projects and achievement motivation all reveal aspects of resilience.

In addition, direct coping is determined by the creative strategies used by subjects to overcome, reduce or tolerate the internal and external demands caused by the relationship between stress and the environment (González and Landero, 2006). Holahan and Moos (1990) found that when resilient people come up against difficulties or problematic situations, they resort to adaptive self-regulatory strategies, which are referred to as coping. Suffice to say that direct coping is closely linked to resilience, as revealed by Becoña (2006), who showed that resilience is successful coping with traumatic experience.

One variable that was predictive of resilience but only in the general model was sense of humor as a social resource. This is because the sense of humor has a coping function and, at the same time, it contributes to an increase in both physical and psychological wellbeing (Kuiper, Grimshaw, Leite and Kirsch, 2004). It is also a tool for self-protection and adaptation. In terms of stress control, the benefits of a sense of humor are owed to the cognitive assessment of a sense of humor as a life perspective or vision (Kuiper, Martin, Olinger and Dance, 1993) and the way in which laughter reduces stress (Yovetich, Dale and Hudak, 1990). A good sense of humor helps people confront problems and upsetting situations because it puts one’s whole life into perspective. For this reason, Cohen (2009) confirms that a sense of humor is one of the variables that has been most associated with resilience.

When exploring variables in both individual areas and in the general model, some variables remain while others were discarded. This is because variables with multicollinearity were eliminated when the statistical analyses were done. It should be noted, then, that none of the predictors included in the analysis has a variance inflation factor of two or higher.

The variables that predicted resilience in the sample were people who are economically vulnerable allowed us to reflect on their living conditions. Although there are numerous definitions of poverty in both the field of economy and in the field of psychology, Madariaga and Sierra (2000) propose understanding poverty as a situational syndrome characterized by under-consumption, malnutrition, precarious living conditions, low levels of education, poor sanitary conditions, job instability, a manifestation of discouragement with limited participation in the mechanisms for social integration and perhaps by an adherence to a particular scale of values that is somewhat different from that of the rest of society. From this perspective, the findings of the investigation are interesting, given that although poverty is a situation of vulnerability, the people who display an internal locus of control, achievement motivation and direct coping as their main strengths are able to better cope with adverse living conditions.
On a final note, it is important to mention certain limitations to this study. The first is that the survey was long, which made it tiring for participants and influenced their responses. In addition, although the instruments were tested and adapted for this type of population, there is a chance that not all of the questions were understood entirely due to the low level of education of those responding to the survey.

It is important to continue researching resilience. As a society and as individuals, we face more complex challenges each day, challenges that require more committed, integral solutions. It is necessary for human beings to learn to exercise their internal resources—and encourage others to use their own resources—to help them adapt to circumstances and take advantage of the opportunities that hard times provide. Thus, a fuller understanding of the factors that facilitate this task can be highly useful.

References


# Appendix 1

## Description of the measurement instruments. Individual variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Original scales</th>
<th>Pilot study results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-esteem</strong></td>
<td>Rosenberg Self-Esteem Scale</td>
<td>Experimental Questionnaire-16 (CE-16)</td>
</tr>
<tr>
<td>Items: 10. Factors: 1</td>
<td>Discrepancy (α = .81)</td>
<td>1. Self-esteem (α = .75)</td>
</tr>
<tr>
<td>Self-esteem (α = .75).</td>
<td>Importance (α = .82)</td>
<td>110 participants</td>
</tr>
<tr>
<td><strong>Problem solving</strong></td>
<td>Social Problem Solving Inventory Revised</td>
<td>Problem Solving Inventory (PSI).</td>
</tr>
<tr>
<td>Rational problem solving</td>
<td>Problem-solving confidence</td>
<td>2. Evasive-Impulsive (α = .85).</td>
</tr>
<tr>
<td>Impulsiveness</td>
<td>Approach-avoidance style</td>
<td>3. Paralysis (α = .80).</td>
</tr>
<tr>
<td>Avoidance styles</td>
<td>Personal control</td>
<td>300 participants</td>
</tr>
<tr>
<td>Positive problem orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative problem orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Locus of control</strong></td>
<td>Locus of Control Scale by La Rosa (Internality)</td>
<td></td>
</tr>
<tr>
<td>Items: 53. Factors: 5 (α = .78 a .89).</td>
<td>1. Internality (α = .91).</td>
<td></td>
</tr>
<tr>
<td>Fatalism/luck</td>
<td>2. Externality (α = .85).</td>
<td></td>
</tr>
<tr>
<td>Internality</td>
<td></td>
<td>918 participants</td>
</tr>
<tr>
<td>Affect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power of the macrocosm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power of the microcosm</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coping</strong></td>
<td>Ways of Coping Revised Scale by Folkman and Lazarus</td>
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</tr>
<tr>
<td>Items: 70. Factors: 8 (α = 0.65 to 0.80).</td>
<td>1. Support seeking (α = 0.84).</td>
<td></td>
</tr>
<tr>
<td>Escapismo.</td>
<td>2. Direct Coping (α = 0.82).</td>
<td></td>
</tr>
<tr>
<td>Precaución.</td>
<td>3. Denial (α = 0.65).</td>
<td></td>
</tr>
<tr>
<td>Acción instrumental.</td>
<td></td>
<td>918 participants</td>
</tr>
<tr>
<td>Minimización.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apoyo para enfrentar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autoculpabilización.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negación. (chekar que no sea negocia-ción)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Búsqueda de significado.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Optimism</strong></td>
<td>Life Orientation Test (LOT-R).</td>
<td></td>
</tr>
<tr>
<td>Authors: Scheier, Carver and Bridges (1994)</td>
<td></td>
<td>Items: 3. Factor: 1</td>
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<tr>
<td>Items: 10. Factors: 2 (α = 0.78).</td>
<td>Optimism (α = 0.74).</td>
<td></td>
</tr>
<tr>
<td>Optimism</td>
<td></td>
<td>50 participants</td>
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<tr>
<td>Pessimism</td>
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<tr>
<td>Variable</td>
<td>Original scales</td>
<td>Pilot study results</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Beck Anxiety Inventory Author: Beck, Epstein, Brown and Steer (1988)</td>
<td>Items: 21&lt;br&gt;Factors: 1&lt;br&gt;Anxiety (α = 0.92). The scale is adapted for the population.</td>
</tr>
<tr>
<td>Motivation to achieve</td>
<td>Achievement motivation Scale Author: La Rosa (1986)</td>
<td>Items: 11&lt;br&gt;Factors: 2&lt;br&gt;1. Skill (α = 0.94).&lt;br&gt;2. Competence (α = 0.88).&lt;br&gt;918 participants</td>
</tr>
<tr>
<td>Stress</td>
<td>Holmes and Rahe Stress Scale Authors: Holmes and Rae (1967)</td>
<td>Items: 43.&lt;br&gt;α = 0.84 The scale is adapted for the population.</td>
</tr>
<tr>
<td>Depression</td>
<td>A Self-Rating Depression Scale by Zung and Dirham Authors: Zung (1965) Adapted by: Calderón (1984)</td>
<td>Items: 20. Factor: 1&lt;br&gt;Depression (α = 0.89). &lt;br&gt;Depression (α = 0.94). The scale is adapted for the population.</td>
</tr>
<tr>
<td>Sense of humor</td>
<td>Multidimensional Sense of Humor Scale Authors: Thorson and Powell (1993). Items: 24. Factors: 3 (α = 0.912). Competence or ability to utilize humor Humor as a mechanism of control of a situation Social approval and attitudes towards humor</td>
<td>Items: 13&lt;br&gt;Factors: 2&lt;br&gt;1. Sense of humor (α = 0.89).&lt;br&gt;2. Humor as a social resource (α = 0.83).&lt;br&gt;80 participants</td>
</tr>
<tr>
<td>Intelligence</td>
<td>Beta III Authors: Kellogg and Morton (1999) Items: 268. Factors: 2: (α = 0.91)</td>
<td>Primary Mental Abilities Authors: Thurstone and Thurstone (1999) Items: 240. Sub-scales: Verbal comprehension Spatial visualization Reasoning Number facility Word fluency Beta III= C.I. Thurstone Scales:: 1. Verbal comprehension 2. Word fluency The scales are adapted for the population so the pilot study was not necessary.</td>
</tr>
<tr>
<td></td>
<td>Sub-Scales: Keys Incomplete shapes Matching pairs and unmatching pairs Incorrect objects Patterns</td>
<td>Systems of Belief Inventory (SBI-1SD-D) Authors: Guruke, et al. (2003) Items: 15. Factors: 2 (α = 0.94). Religious belief and practices Social support Brief RCOPE Authors: Koenig, Pargament, Perez and Smith (1998) Items: 21. Factors: 2 (α = 0.90 and α = 0.81) Positive religious coping Negative religious coping</td>
</tr>
<tr>
<td>Religious coping</td>
<td>Instrument of Attitudes Towards Religious Coping Author: Tinoco (2006) Items: 57. Factors: 10 (α = 0.95). Rituals Belief in God Church and liturgy Religious belonging University life and religion Belief in Jesus Church and sacraments Belief in the Virgin Religious conflicts Fellowship</td>
<td>Systems of Belief Inventory (SBI-1SD-D) Authors: Guruke, et al. (2003) Items: 15. Factors: 2 (α = 0.94). Religious belief and practices Social support Brief RCOPE Authors: Koenig, Pargament, Perez and Smith (1998) Items: 21. Factors: 2 (α = 0.90 and α = 0.81) Positive religious coping Negative religious coping</td>
</tr>
</tbody>
</table>
## Description of the measurement instruments: School Variables

<table>
<thead>
<tr>
<th>Variable</th>
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</tr>
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<tbody>
<tr>
<td><strong>Student-teacher relationship</strong></td>
<td>The Teacher-Student Relationship Inventory</td>
<td>Items: 14. Factors: 3. Satisfaction (α = 0.95). Instrumental help (α = 0.95) Conflict (α = 0.88).</td>
</tr>
<tr>
<td></td>
<td>Author: Ang, R. (2005)</td>
<td>1. Satisfaction with school (α = 0.92). Advice and emotional support (α = 0.90). Poor relationship with teachers (α = 0.80).</td>
</tr>
<tr>
<td></td>
<td>Items: 20. Factors: 3</td>
<td>95 participants</td>
</tr>
<tr>
<td><strong>Family involvement in school</strong></td>
<td>Parental Perception of General Invitations for Involvement from the School Scale</td>
<td>Items: 60. Factors: 7. Roles of participation in their children's education (α = 0.84). Parent efficacy to assist their children to be successful at school (α = 0.70). Perception of Specific Invitations to Parents (α = 0.88). Continues in the following column...</td>
</tr>
<tr>
<td></td>
<td>Authors: Walker, Wilkins, Dallaire, Sandler and Hoover-Dempsey (2005)</td>
<td>4. Perception of Parents to Specific Invitations to Involvement from the Child (α = 0.70). 5. Perception of Parents to Specific Invitations to Involvement with Teacher (α = 0.85). 6. Perception of Parents of the Life Context (α = 0.84). 7. Parental Time and Energy for Involvement at Home and in School Activities (α = 0.85).</td>
</tr>
<tr>
<td></td>
<td>Items: 12. Factors: 2</td>
<td>98 participants</td>
</tr>
<tr>
<td><strong>Teaching styles</strong></td>
<td>The Teacher Style Inventory</td>
<td>Items: 28. Factors: 4. Assertive (α = 0.79). Suggestive (α = 0.73). Collaborative (α = 0.82). Facilitative (α = 0.83).</td>
</tr>
<tr>
<td></td>
<td>Authors: Leung, Lue and Lee (2003)</td>
<td></td>
</tr>
<tr>
<td><strong>Learning styles</strong></td>
<td>The Learning Styles Questionnaire</td>
<td>Items: 80. Factors: 4. Activist (α = 0.62). Reflector (α = 0.71). Theorist (α = 0.69). Pragmatist (α = 0.66).</td>
</tr>
<tr>
<td></td>
<td>Author: Honey and Mumford (1986)</td>
<td></td>
</tr>
</tbody>
</table>
### Description of the measurement instruments: Family Variables

<table>
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<tr>
<th>Variable</th>
<th>Original scales</th>
<th>Pilot study results</th>
</tr>
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<tr>
<td><strong>Family relations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social support</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| The Inventory of Socially Supportive Behaviors (ISSB) | Authors: Milburn, N. (1987)  
Items: 40  
Factors: 4  
Cognitive support (α = 0.95)  
Emotional support (α = 0.91)  
Tangible support (α = 0.87)  
Guidance (α = .76) | Items: 21  
Factors: 3  
1. Social support (α = 0.95)  
2. Family support (α = 0.90)  
3. Support from friends (α = 0.71) |
| The Multidimensional Scale of Perceived Social Support | Authors: Zimet, Dahlem, Zimet and Farley (1988)  
Items: 12  
Factors: 3  
Significant other (α = 0.91)  
Family (α = 0.87)  
Friends (α = 0.85) | |
| **Parenting styles** | | |
| Social identity | | |
| The Social and Personal Identities Scale | Authors: Nario-Redmond, Biernat, Eidelman and Palenske (2004)  
Items: 16  
Factors: 2  
Personal identity (α = 0.80)  
Social identity (α = 0.79) | Items: 6  
Factor: 1  
Identity (α = 0.90) |

### Description of the measurement instruments: Social Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Original scales</th>
<th>Pilot study results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social support</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| The Inventory of Socially Supportive Behaviors (ISSB) | Authors: Milburn, N. (1987)  
Items: 40  
Factors: 4  
Cognitive support (α = 0.95)  
Emotional support (α = 0.91)  
Tangible support (α = 0.87)  
Guidance (α = .76) | Items: 21  
Factors: 3  
1. Social support (α = 0.95)  
2. Family support (α = 0.90)  
3. Support from friends (α = 0.71) |
| The Multidimensional Scale of Perceived Social Support | Authors: Zimet, Dahlem, Zimet and Farley (1988)  
Items: 12  
Factors: 3  
Significant other (α = 0.91)  
Family (α = 0.87)  
Friends (α = 0.85) | |
| **Social identity** | | |
| The Social and Personal Identities Scale | Authors: Nario-Redmond, Biernat, Eidelman and Palenske (2004)  
Items: 16  
Factors: 2  
Personal identity (α = 0.80)  
Social identity (α = 0.79) | Items: 6  
Factor: 1  
Identity (α = 0.90) |

- 170 participants
## Description of the measurement instruments: Dependent Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Original scales</th>
<th>Pilot study results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Connor-Davidson Resilience Scale</td>
<td>Items: 25. Factors: 5 (α global = 0.89)</td>
</tr>
<tr>
<td></td>
<td>Authors: Connor and Davidson (2003)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personal competence, high standards and tenacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trust in one's instincts, tolerance and strengthening effects of stress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Positive acceptance of change and secure relationships with others</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spiritual influences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Resilience Scale for Adults</td>
<td>Items: 43. Factors: 5 (α global = 0.93)</td>
</tr>
<tr>
<td></td>
<td>Authors: Friborg, Hjemdal, Rovsing and Martinussen (2003)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personal competence</td>
<td>1. Self-confidence (α = 0.93)</td>
</tr>
<tr>
<td></td>
<td>Social competence</td>
<td>2. Social competence (α = 0.90)</td>
</tr>
<tr>
<td></td>
<td>Family cohesion</td>
<td>3. Individual strengths (α = 0.84)</td>
</tr>
<tr>
<td></td>
<td>Social resources</td>
<td>4. Personal structure (α = 0.83)</td>
</tr>
<tr>
<td></td>
<td>Structured style</td>
<td>217 participants</td>
</tr>
</tbody>
</table>

Note: The number of participants in the pilot study of each instrument was based on the number of items of each instrument (Nunnally, 1995). A total of 2,308 people participated.
Reviewers

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Norms of the publication APCS

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Original papers are to be sent to the Annuary of Clinical and Health Psychology per email (including all the related files in a compatible word processor and specifying the title of the attached file(s) as well as the name of the word processor in the email). This means is to be used with the purpose of shortening the procedure for publication in case the paper is finally admitted.

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Papers shall have a maximum of 4,500 words -excluding Title, Abstract, Keywords and References- written in double space (size DIN A-4), without indentations or page breaks, pages printed only one face and consecutively numbered. Articles are to be written in English or Spanish. Spanish versions will be traduced into English if accepted for publication.

The first page of every submitted article is to contain the following:

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Full address, including phone and email, of the author with whom the journal is to be in contact.

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Tables and illustrations (graphics, figures, etc.) contained in papers are to be submitted separately, each one in a different page, correlatively numbered and together with a header containing the number and title of the same allowing the clear identification of its content. The desired and approximate place for tables and / or illustrations is to be indicated in the text. Tables are to be simple and in accordance with the norms and styles of APA, Excel or Word format, and are not to include vertical lines. Pictures and graphics must be 150 pixel resolution and a minimum size of 10 cm wide.

All quotations appearing in the paper are to be present in the list of references and all references are to be quoted in the text. Quotations are to be inserted in the text (never as footnote). Authors’ surnames are to be written in lower-case with the exception of the first letter. Initials of names are not to be specified unless necessary in order to distinguish two authors with the same surname (Example: J.M. Zarit y Zarit, 1982). If the author’s surname is part of the narration, only the year of publication of the article is to be included between brackets (example: According to Olesen (1991) three different types of sensory afferents in migraines can be distinguished...). If the surname and publication date are not part of the narrative, both elements are to be included between brackets, separated by a comma. (Example: Three different sensory afferents in migraines can be distinguished (Olesen, 1991)...

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• Introduction and Justification of the work. Objectives and hypothesis
• Method: participants; design, variables and control conditions; materials and / or instruments and procedure.
• Results
• Discussion
• Conclusions
• References

Specific Norms for theoretical works

The Annuary of Clinical and Health Psychology gathers theoretical articles from different points of view (cognitive, dynamic, behavioural, systemic, etc.) that represent important contributions on the different contemplated contents. Articles in this section are to contain, as well as the others, a logical order and a clear and structured presentation. They are to express a justification for the relevance of the subject dealt with (in the introduction) and an express practical contribution so that the professional may obtain a reference of the application nature (independently from the theoretical line) of the subject to be treated (in the discussion of the same). The structure is to be the following:

• Introduction and thesis (aspect to be expound or defended)
• Discussion
• Conclusions (short and clearly delimited)
• References
Specific norms for the exposition of clinical cases

In this section, the description of one or more clinical cases is to be collected, which presume a contribution and/or important repercussion to the knowledge of the analyzed process, due to their peculiarities. Articles in this section, besides following a logical order and clear presentation, may follow these structures:

- Theoretical Background or Introduction
- Participants or Description of the clinical case(s)
- Processes for Assessment
- Treatment
- Results
- Discussion
- References

In the description of cases, no real name or initials of the patients with whom the research for publication has been performed are to be mentioned.

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Works meeting the requirements mentioned above will be anonymously reviewed by experts on the subject, who will inform the direction of the journal of the valuation and possible modifications to be made to the same. Such valuation will be sent by the direction to the author within a maximum period of three months. Once the article has been valuated, modified (if applicable), reviewed and definitely accepted, the publication of the article is to be determined by the direction and the main author is to be informed of the date and issue where the article is to be published. In any case, the final decision for publication of an article is responsibility of the direction of the journal. Accepted articles not appearing in the last issue of the journal, are to be published in the next editions, and, in the meantime, they will be kept in the list of accepted articles pending publication. Articles not meeting the established norms or not accepted for publication will neither be submitted to review nor given back to the authors, although the reasons for their exclusions are to be notified. In any case, the journal reserves the right to introduce modifications appropriate for the fulfilment of the established norms. The delivery of an article to the Annuary of Clinical and Health Psychology assumes the acceptance of all the above mentioned norms by the authors of the submitted original work.