Virtual Reality in Psychotherapy: Review

GIUSEPPE RIVA, Ph.D.

ABSTRACT

Virtual reality (VR) has recently emerged as a potentially effective way to provide general and specialty health care services, and appears poised to enter mainstream psychotherapy delivery. Because VR could be part of the future of clinical psychology, it is critical to all psychotherapists that it be defined broadly. To ensure appropriate development of VR applications, clinicians must have a clear understanding of the opportunities and challenges it will provide in professional practice. This review outlines the current state of clinical research relevant to the development of virtual environments for use in psychotherapy. In particular, the paper focuses its analysis on both actual applications of VR in clinical psychology and how different clinical perspectives can use this approach to improve the process of therapeutic change.

INTRODUCTION

WHAT IS THE FUTURE of psychotherapy? How will future changes impact on psychotherapy, psychologists, and our patients? Recently, a panel of 62 psychotherapy experts using Delphi methodology tried to answer these questions.[1] According to their answers, only 18 out of the 38 therapeutic interventions analyzed were predicted to increase in the next decade. In particular, the use of VR and computerized therapies were ranked third and fifth, preceded only by homework assignments (first), relapse prevention (second), and problem solving techniques (fourth). On the other side, traditional psychotherapy interventions such as hypnosis (32nd), paradoxical interventions (33rd), or dream interpretation (35th) were predicted to drastically diminish.

Even if these data may be provocative to some psychotherapists, there is no doubt that rapid and far-reaching technological advances are changing the ways in which people relate, communicate, and live. Technologies that were hardly used 10 years ago, such as the internet, e-mail, and video teleconferencing, are becoming familiar methods for diagnosis, therapy, education, and training.

However, the possible impact of VR on psychotherapy could be even higher than the one offered by the new communication technologies.[2] In fact, VR is at the same time a technology, a communication interface, and a compelling experience. Because VR could be part of the future of clinical psychology, it is critical to all psychotherapists that it should be defined broadly. To ensure appropriate development of VR applications, clinicians must have a clear understanding of the opportunities and challenges it will provide to professional practice.

The paper tries to outline the current state of clinical research that is relevant to the development of virtual environments for psychotherapy use. In particular, the paper focuses its analysis on both actual applications of VR in clinical psychology and how different clinical perspectives can use this approach to improve the process of therapeutic change.

VR IN PSYCHOTHERAPY: THE PRESENT

Research in the VR field is moving fast.[2,3] If we check the leading psychology database—PSYCINFO—using "virtual reality" as key words,

we find 996 journal articles listed (quick search query, accessed April 18, 2005). Most of them (371) were written in the last 3 years and include different controlled trials (Table 1).

Shifting our analysis to psychotherapy application, it is easy to find that the most common application of VR in this area is the treatment of phobias. Since the early 1990s, when Hodges and colleagues[4,5] reported on a project that used virtual environments to provide acrophobic patients with fear-producing experiences of heights in a safe situation, VR exposure therapy (VRE) has been proposed as a new medium for exposure therapy.[6] The rationale behind its use is very simple: in VR the patient is intentionally confronted with the feared stimuli while allowing the anxiety to attenuate. Because avoiding a dreaded situation reinforces all phobias, each exposure to it actually lessens the anxiety through the processes of habituation and extinction. Moreover, VRE offers a number of advantages over *in vivo* or imaginal exposure; it can be administered in traditional therapeutic settings, and is more controlled and cost-effective than *in vivo* exposure.

In different controlled studies, VRE was as effective as *in vivo* therapy in the treatment of acrophobia,[7,8] spider phobia,[9] and fear of flying.[10–13] However, in fear of flying treatment, Maltby and colleagues did not find significant differences between VR exposure or attention-placebo group treatment at 6-month follow-up.[13] Other phobias currently under investigation are agoraphobia,[14] claustrophobia,[15] panic disorder with agoraphobia,[16–18] and public speaking disorder.[19,20]

VRE is also used as an alternative to typical imaginal exposure treatment for Vietnam combat veterans with posttraumatic stress disorder (PTSD).[21] Rothbaum and colleagues[22] exposed a sample of 10 combat veterans with PTSD to two virtual environments: a virtual Huey helicopter flying over a virtual Vietnam and a clearing surrounded by jungle. All the patients interviewed at the 6-month follow-up reported reductions in PTSD symptoms ranging from 15% to 67%.

Riva and colleagues[23–25] are using experiential cognitive therapy (ECT), an integrated approach ranging from cognitive-behavioral therapy to VR sessions, in the treatment of eating disorders and obesity. In this approach, VR is mainly used to modify body image perceptions. What is the rationale behind this approach? Different studies show that body image dissatisfaction can be considered a form of cognitive bias.[26,27] The essence of this cognitive perspective is that the central psychopathological concerns of an individual bias the manner in which information is processed. In most cases, this biased information processing occurs automatically. Also, it is generally presumed that the process occurs more or less outside the person's awareness, unless the person consciously reflects upon his or her thought processes (as in cognitive therapy).

According to Williamson and colleagues,[26] body size overestimation can be considered as a complex judgment bias, strictly linked to attentional and memory biases for body-related information: "If information related to body is selectively processed and recalled more easily, it is apparent how the self-schema becomes so highly associated with body-related information. If the memories related to body are also associated with negative emotion, activation of negative emotion should sensitize the person to body-related stimuli, causing even greater body size overestimation."

It is very difficult to counter a cognitive bias. In fact, biased information processing occurs automatically, and the subjects are not aware of it. So, for them, the biased information is real. They are not able to distinguish between perceptions and biased cognitions. Moreover, any attempt at convincing them otherwise is usually useless and sometimes produces strong emotional defense. In fact, the denial of the disorder and resistance to treatment are two of the most vexing clinical problems in these pathologies.[28,29]

Given these difficulties, there are two different approaches to the treatment of body image disturbances[27]:

- *Cognitive-behavioral strategies*: This approach is based on assessment, education, exposure, and modification of body image. The therapy both identifies and challenges appearance assumptions and modifies self-defeating body image behaviors.[30–32]
- *Feminist approach*: Feminist therapists usually use experiential techniques, such as guided imagery, movement exercises, and art and dance therapy.[33,34] Other experiential techniques include free-associative writing regarding a problematic body part, stage performance, or psychodrama.[34,35]

Unfortunately, both approaches, even if effective in the long term, require a strong involvement of the patient and many months of treatment.

The use of VR offers two key advantages. First, it is possible to integrate all different methods (cognitive, behavioral, and experiential) commonly used in the treatment of body experience disturbances

TABLE 1. APPLICATIONS OF VIRTUAL REALITY IN PSYCHOTHERAPY: CONTROLLED TRIALS WITH 10 OR MORE PATIENTS
RESEARCH AS OF MARCH 9, 2004. SOURCES: PSYCINFO AND MEDLINE.

Authors	Paper	Approach	Sample
Emmelkamp, P.M.G., Bruynzeel, M., Drost, L. & van der Mast, C.A.P.G.	(2001). Virtual reality treatment in acrophobia: , a comparison with exposure *in vivo*. *CyberPsychology & Behavior*, 4:335–339.	Cognitive-behavioral	10 acrophobia patients
Emmelkamp, P.M.G., Krijn, M., Hulsbosch, A.M., de Vries, S., Schuemie, M.J., & van der Mast, C.A.P.G.	(2002). Virtual reality treatment versus exposure in vivo: a comparative evaluation in acrophobia. *Behavior Research and Therapy* 40:509–516.	Cognitive-behavioral	33 acrophobia patients
Garcia-Palacios, A., Hoffman, H., Carlin, A., Furness, T.A., III, & Botella, C.	(2002). Virtual reality the treatment of spider phobia: a controlled study. *Behavior Research and Therapy,* 40:983–993.	Cognitive-behavioral	23 phobics
Maltby, N., Kirsch, I., Mayers, M., & Allen, G.	(2002) Virtual reality exposure therapy for the treatment of fear of flying: a controlled investigation. *Journal of Consulting & Clinical Psychology,* 70: 1112–1118.	Cognitive-behavioral	45 phobics
Optale, G., Munari, A., Nasta, A., Pianon, C., Baldaro Verde, J., & Viggiano, G.	(1997). Multimedia and virtual reality techniques in the treatment of male erectile disorders. *International Journal of Impotence Research* 9:197–203.	Psycho-dynamic	60 patients of male erectile disorders
Riva, G., Bacchetta, M., Baruffi, M., & Molinari, E.	(2001). Virtual reality–based multidimensional therapy for the treatment of body image disturbances in obesity: controlled study. *CyberPsychology & Behavior* 4:511–526.	Experiential-cognitive	28 obese patients
Riva, G., Bacchetta, M., Baruffi, M., & Molinari, E.	Virtual reality–based multidimensional therapy for the treatment of body image disturbances in binge eating disorders: a preliminary controlled study *IEEE Transactions on Information Technology in Biomedicine,* 6:224–234.	Experiential-cognitive	20 binge eating patients

TABLE 1. APPLICATIONS OF VIRTUAL REALITY IN PSYCHOTHERAPY: CONTROLLED TRIALS WITH 10 OR MORE PATIENTS RESEARCH AS OF MARCH 9, 2004. SOURCES: PSYCINFO AND MEDLINE. (*CONTINUED*)

Authors	Paper	Approach	Sample
Riva, G., Bacchetta, M., Cesa, G., Conti, S., & Molinari, E.	(2003). Six-month follow-up of in-patient Experiential-Cognitive Therapy for binge eating disorders. *CyberPsychology & Behavior* 6:251–258.	Experiential-cognitive	36 binge eating patients
Rothbaum, B.O., Hodges, L.F., Kooper, R., Opdyke, D., et al.	(1995). Effectiveness of computer-generated (virtual reality) graded exposure in the treatment of acrophobia. *American Journal of Psychiatry* 152:626–628.	Cognitive-behavioral	17 college students
Rothbaum, B.O., Hodges, L., Smith, S., Lee, J.H., & Price, L.	(2000). A controlled study of virtual reality exposure therapy for the fear of flying. *Journal of Consulting and Clinical Psychology* 68:1020–1026.	Cognitive-behavioral	49 fear of flying patients
Rothbaum, B.O., Hodges, L., Anderson, P.L., Price, L., & Smith, S.	(2002). Twelve-month follow-up of virtual reality and standard exposure therapies for the fear of flying. *Journal of Consulting and Clinical Psychology* 70:428–432.		
Vincelli, F., Anolli, L., Bouchard, S., Wiederhold, B.K., Zurloni, V., & Riva, G.	(2003). Experiential cognitive therapy in the treatment of panic disorders with agoraphobia: a controlled study. *CyberPsychology & Behavior* 6:312–318.	Experiential-cognitive	12 panic disorders with agoraphobia patients
Wiederhold, B.K., Jang, D.P., Kim, S.I., & Wiederhold, M.D.	(2002). Physiological monitoring as an objective tool in virtual reality therapy. *CyberPsychology & Behavior* 5:77–82.	Cognitive-behavioral	36 fear of flying patients, 22 non-phobics
Wiederhold, B.K., Jang, D.P., Kim, S.I., & Wiederhold, M.D.	(2002). A controlled trial comparing physiologicalresponses during virtual reality exposure and imaginal exposure in flight phobics. *IEEE Transactions on Information Technology in Biomedicine* 6:218–223.	Cognitive-behavioral	30 fear of flying patients

within a single virtual experience. Second, VR can be used to induce the patient in a controlled sensory rearrangement that unconsciously modifies his or her bodily awareness (body schema). When we use a VR system, we feel our self-image projected onto the image of the visual cues (i.e., a certain figure or an abstract point, such as a cursors, which moves in accordance with the movement of our own hand) appearing in the video monitor, as a part of or an extension of our own hands.[36] As noted by Iriki and colleagues,[37] "Essential elements of such an image of our own body should be comprised of neural representations about the dimension, posture and movement of the corresponding body parts in relation to the environmental space. Thus, its production requires integration of somatosensory (intrinsic) and visual (extrinsic) information of our own body in space." When this occurs, the information itself becomes accessible at a conscious level[38] and can be modified more easily.

In a case study, a 22-year-old female university student diagnosed with anorexia nervosa was submitted to ECT treatment.[39] At the end of the inpatient treatment, the patient increased her bodily awareness, at the same time reducing her level of body dissatisfaction. Moreover, the patient presented a high degree of motivation to change. Expanding these results, the researchers carried out different clinical trials on female patients[40–43]; 25 patients suffering from binge-eating disorders were included in the first study, 20 in the second, and 18 with obesity in the third. At the end of the inpatient treatments, the patients from each sample significantly modified their bodily awareness. This modification was associated with a reduction in problematic eating and social behaviors.

Optale et al.[44,45] used immersive VR to improve the efficacy of a psychodynamic approach in treating male erectile disorders. In the VE, four different expandable pathways open up through a forest, bringing the patients back into their childhood, adolescence, and teens, when they started to get interested in the opposite sex. Different situations are presented with obstacles that the patient has to overcome to proceed. VR environments are here used as a form of controlled dreams allowing the patient to express in a non-verbal way transference reactions and free associations related to his sexual experience. General principles of psychological dynamisms, such as the difficulty with separations and ambivalent attachments, are used to inform interpretive efforts.

The obtained results—30 out of 36 patients with psychological erectile dysfunction and 28 out of 37 patients with premature ejaculation maintained partial or complete positive response after 6-month follow up—show that VR hastens the healing process and reduces dropouts. Moreover, Optale et al. used positron emission tomography (PET) scans to analyze regional brain metabolism changes from baseline to follow-up in patients treated with VR.[46] The analysis of the scans showed different metabolic changes in specific areas of the brain connected with the erection mechanism.

WHAT IS VR?

As we have just seen, the rationales behind the use of VR in psychotherapy are very different. What is the common link between them, and what is the future of VR in psychotherapy? Our attempt to identify a possible answer starts from a broader question: what is VR?

Since 1986, when Jaron Lamier used the term for the first time, VR has been usually described as a collection of technological devices: a computer capable of interactive three-dimensional (3D) visualization, a head-mounted display, and data gloves equipped with one or more position trackers. The trackers sense the position and orientation of the user, and report that information to the computer that updates (in real time) the images for display.

For instance, Rubino et al.,[47] McCloy and Stone,[48] and Székely and Satava,[49] in their reviews about the use of VR in health care, share this vision: "VR is a collection of technologies that allow people to interact efficiently with 3D computerized databases in real time using their natural senses and skills."[48]

However, when we shift our attention to behavioral sciences, we find a different vision: VR is described as "an advanced form of human–computer interface that allows the user to interact with and become immersed in a computer-generated environment in a naturalistic fashion."[50]

In fact, psychologists use specialized technologies—head-mounted displays, tracking systems, earphones, gloves, and sometimes haptic feedback—to provide a new human–computer interaction paradigm. In VR, users are no longer simply external observers of images on a computer screen, but are active participants within a computer-generated 3D virtual world.[51]

Bricken[52] identifies the core characteristic of VR in the inclusive relationship between the participant and the virtual environment, where direct experience of the immersive environment constitutes communication. According to this position, VR can be considered as the leading edge of a general evolution of present communication interfaces such as

television, computer, and telephone,[53,54] whose ultimate goal is the full immersion of the human sensorimotor channels into a vivid and global communication experience.[55]

This position better clarifies the actual role of VR in psychotherapy and the common link between the different clinical applications presented: VR is an advanced communication interface based on interactive 3D visualization, able to collect and integrate different inputs and data sets in a single real-like experience.

What distinguishes VR from other media or communication systems is the sense of *presence*.[56] What is presence? Even if usually presence is defined as the "sense of being there"[57] or as the "feeling of being in a world that exists outside of the self,"[58] it is now widely acknowledged that presence should be treated as a neuropsychological phenomenon.[54,56,59–65] In particular, Riva and Waterworth described presence as a defining feature of self, related to the evolution of a key feature of any central nervous system[58]: the embedding of sensory-referred properties into an internal functional space. More specifically, without the emergence of the sense of presence, it is impossible for the nervous system to differentiate between an external world and the internal one. If, in simple organisms, this differentiation involves only a correct coupling between perceptions and movements, in humans it also requires the shift from meaning-as-comprehensibility to meaning-as-significance.

Meaning-as-comprehensibility refers to the extent to which the event fits with our view of the world (e.g., as just, controllable, and nonrandom), whereas meaning-as-significance refers to the value or worth of the event for us.[66] Following this point, contributions to the intensity of the sense of presence come from three layers of the self recently defined by Damasio[67]: proto self, core self, and autobiographical self. The more the three layers are integrated (focused on the same events), the stronger the intensity of the presence feeling. This means that, between two equally stimulating virtual environments, humans are more present in the one more relevant to their own goals.

VR IN PSYCHOTHERAPY: THE NEXT STEPS

How is it possible to change a patient? Even if this question has many possible answers according to the specific psychotherapeutic approach, in general change comes through an intense focus on a particular instance or experience[68]: by exploring it

as much as possible, the patient can relive all of the significant elements associated with it (i.e., conceptual, emotional, motivational, and behavioral) and make them available for a reorganization of his or her perspective.

Within this general model, we have the insight-based approach of psychoanalysis, the schema-reorganization goals of cognitive therapy, the functional analysis of behavioral activation, the interpersonal relationship focus of interpersonal therapy, or the enhancement of experience awareness in experiential therapies.

What are the differences between them? According to Safran and Greenberg,[69] behind the specific therapeutic approach we can find two different models of change: bottom-up and top-down. Bottom-up processing begins with a specific emotional experience and leads eventually to change at the behavioral and conceptual level, whereas top-down change usually involves exploring and challenging tacit rules and beliefs that guide the processing of emotional experience and behavioral planning. These two models of change are focused on two different cognitive systems, one for information transmission (top-down) and one for conscious experience (bottom-up), both of which may process sensory input.[70] The existence of two different cognitive systems is clearly shown by the dissociation between verbal knowledge and task performance: people learn to control dynamic systems without being able to specify the nature of the relations within the system, and they can sometimes describe the rules by which the system operates without being able to put them into practice.

Even if many therapeutic approaches are based on just one of the two change models, a therapist usually requires both.[68] Some patients seem to operate primarily by means of top-down information processing, which may then prime the way for corrective emotional experiences. For others, the appropriate access point is the intensification of their emotional experience and their awareness of both it and related behaviors. Finally, different patients who initially engage therapeutic work only through top-down processing may be able, later in the therapy, to make use of bottom-up emotional processing.

In this situation, a critical advantage can be provided by the sense of presence provided by VR. As we have seen before, the sense of presence is strictly related to all the three layers of self recently identified by Damasio.[67] Using it accordingly, it is possible to target a specific cognitive system without any significant change in the therapeutic approach. For instance, behavioral therapists may use a virtual environment for activating

the fear structure in a phobic patient through confrontation with the feared stimuli; a cognitive therapist may use VR situations to assess situational memories or disrupt habitual patterns of selective attention; experiential therapists may use VR to isolate the patient from the external world and help him or her in practicing the right actions; psychodynamic therapists may use virtual environments as complex symbolic systems for evoking and releasing affect.

In fact, VR can also be described as an advanced imaginal system: an experiential form of imagery that is as effective as reality in inducing emotional responses.[71–73] As outlined by Baños et al.,[74] the VR experience can help the course of the therapy for "its capability of reducing the distinction between the computer's reality and the conventional reality." In fact, "VR can be used for experiencing different identities and . . . even other forms of self, as well." The possibility of structuring a large amount of real-like or imaginary controlled stimuli and, simultaneously, of monitoring the possible responses generated by the user of the virtual world offers a considerable increase in the likelihood of therapeutic effectiveness, as compared to traditional procedures.[54] As noted by Glantz et al.[75]: "One reason it is so difficult to get people to update their assumptions is that change often requires a prior step—recognizing the distinction between an assumption and a perception. Until revealed to be fallacious, assumptions constitute the world; they seem like perceptions, and as long as they do, they are resistant to change." Using the sense of presence induced by VR, it is easier for the therapist to develop real-like experiences demonstrating to the patient that what looks like a perception (e.g., the body image distortion) is produced by his or her mind. Once this has been understood, individual maladaptive assumptions can then be challenged more easily.

Moreover, patients usually accept very well the use of VR. In a recent study, Garcia-Palacios et al. compared the acceptance of one-session and multi-session *in vivo* exposure versus multi-session VR exposure therapy.[76] More than 80% of the sample preferred VR to *in vivo* exposure.

Finally, VR can play an important role in psychotherapy as a particular form of supportive technique, contributing to the therapist–patient relationship as well as enhancing the therapeutic environment for the patient. Even if supportive techniques are more common in psychodynamic approaches, they are widely used in different treatments.[77] In general, they are considered as supportive as the following techniques[77,78]:

- Demonstration of support, acceptance, and affection toward the patient
- Emphasis on working together with the patient to achieve results
- Communication of a hopeful attitude that the goals will be achieved
- Respect of the patient's defenses
- Focus on the patient's strengths and acknowledgment of the growing ability of the patient to accomplish results without the therapist's help

Using VR, it is possible for the patient to manage successfully a problematic situation related to his or her disturbance. By creating a synthetic environment in which the patient is likely to feel more secure, VR may enable the patient to express thoughts and feelings that are otherwise too difficult to discuss, thereby increasing the degree of closeness between the patient and therapist. Using VR in this way, the patient is more likely not only to gain an awareness of his or her need to do something to create change but also to experience a greater sense of personal efficacy.

VR can be employed as a supportive technique at the onset of treatment to create an atmosphere in which the patient feels stable, which in turn allows treatment to progress. Alternatively, it may be used in the course of treatment should a crisis occur, enabling the patient to overcome the situation responsible for halting further improvement. In general, VR can be used throughout treatment to foster a positive therapeutic alliance and as a trigger for a broader empowerment process. In psychological literature, empowerment is considered a multifaceted construct reflecting the different dimensions of being psychologically enabled, and is conceived of as a positive additive function of the following three dimensions[79]:

- *Perceived control*: This includes beliefs about authority, decision-making skills, availability of resources, and autonomy in the scheduling and performance of work.
- *Perceived competence*: This reflects role-mastery, which, besides requiring the skillful accomplishment of one or more assigned tasks, also requires successful coping with non-routine role-related situations.
- *Goal internalization*: This dimension captures the energizing property of a worthy cause or exciting vision provided by the organizational leadership.

VR is a special, sheltered setting where patients can start to explore and act without feeling threat-

ened. In this sense, the virtual experience is an "empowering environment" that therapy provides for patients. As noted by Botella and colleagues,[80] nothing the patient fears can "really" happen to them in VR. With such assurance, they can freely explore, experiment, feel, live, and experience feelings and/or thoughts. VR thus becomes a very useful intermediate step between the therapist's office and the real world.

CONCLUSION

As we have seen, in the last 5 years there has been a steady growth in the use of VR in clinical psychology due to advances in information technology and a decline in costs.[2] 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.[81] To date, very few of the various VR systems available are interoperable. This makes their use difficult in contexts other than those in which they were developed.

The second is the lack of standardized protocols that can be shared by the community of researchers. If we check the two clinical databases, we can find only five published clinical protocols: for the treatment of eating disorders,[24] fear of flying,[82,83] fear of public speaking,[84] and panic disorders.[16]

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 force 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 a proprietary hardware and software, which have been tuned by a process of trial and error. According to the European funded project VEPSY Updated,[85] the cost required for designing a clinical VR application from scratch and testing it on clinical patients using controlled trials may range between 150,000 and 200,000 US$. Finally, the introduction of patients and clinicians to virtual environments raises particular safety and ethical issues.[86] In fact, despite developments in VR technology, some users still experience health and safety problems associated with VR use. It is however true that, for a large proportion of VR users, these effects are mild and subside quickly.[87]

Significant efforts are still required to move VR into commercial success and therefore routine clinical use. It is clear that building new and additional virtual environments is important so that therapists will continue to investigate applying these tools in their day-to-day clinical practice.[88] In fact, in most circumstances, the clinical skills of the therapist remain the key factor in the successful use of VR systems. Here, VR can have a role both as supportive technique and for targeting a specific cognitive system without any significant change in the therapeutic approach.

Finally, communication networks have the potential to transform virtual environments into shared worlds in which individuals, objects, and processes interact without regard to their location. In the future, such networks will probably merge VR and telemedicine applications, allowing us to use VR for such purposes as distance learning and e-therapy.

ACKNOWLEDGMENTS

REFERENCES

1. Norcross, J.C., Hedges, M., & Prochaska, J.O. (2002). The face of 2010: a Delphi poll on the future of psychotherapy. *Professional Psychology: Research and Practice* 33:316–322.
2. Riva, G. (2002). Virtual reality for health care: the status of research. *CyberPsychology & Behavior* 5:219–225.
3. Rizzo, A.A., Wiederhold, B., Riva, G., et al. (1998). A bibliography of articles relevant to the application of virtual reality in the mental health field. *CyberPsychology & Behavior* 1:411–425.
4. Hodges, L.F., Rothbaum, B.O., Kooper, R., et al. (1995). Virtual environments for treating the fear of heights. *IEEE Computer* 28:27–34.
5. Hodges, L.F., Bolter, J., Mynatt, E., et al. (1993). Virtual environments research at the Georgia Tech GVU Center. *Presence, Teleoperators, and Virtual Environments* 2:234–243.
6. Rothbaum, B.O., Hodges, L., & Kooper, R. (1997). Virtual reality exposure therapy. *Journal of Psychotherapy Practice & Research* 6:219–226.
7. Emmelkamp, P.M., Bruynzeel, M., Drost, L., et al. (2001). Virtual reality treatment in acrophobia: a comparison with exposure *in vivo*. *CyberPsychology & Behavior* 4:335–339.

8. Emmelkamp, P.M., Krijn, M., Hulsbosch, A.M., et al. (2002). Virtual reality treatment versus exposure *in vivo*: a comparative evaluation in acrophobia. *Behaviour Research & Therapy* 40:509–516.

9. Garcia-Palacios, A., Hoffman, H., Carlin, A., et al. (2002). Virtual reality in the treatment of spider phobia: a controlled study. *Behavior Research and Therapy* 40:983–993.

10. Rothbaum, B.O., Hodges, L., Smith, S., et al. (2000). A controlled study of virtual reality exposure therapy for the fear of flying. *Journal of Consulting & Clinical Psychology* 68:1020–1026.

11. Rothbaum, B.O., Hodges, L., Anderson, P.L., et al. (2002). Twelve-month follow-up of virtual reality and standard exposure therapies for the fear of flying. *Journal of Consulting & Clinical Psychology* 70: 428–432.

12. Wiederhold, B.K., Jang, D.P., Gevirtz, R.G., et al. (2002). The treatment of fear of flying: a controlled study of imaginal and virtual reality graded exposure therapy. *IEEE Transactions on Information Technology in Biomedicine* 6:218–223.

13. Maltby, N., Kirsch, I., Mayers, M., et al. (2002). Virtual Reality Exposure Therapy for the treatment of fear of flying: a controlled investigation. *Journal of Consulting & Clinical Psychology* 70:1112–1118.

14. North, M.M., North, S.M., & Coble, J.R. (1996). Effectiveness of virtual environment desensitization in the treatment of agoraphobia. *Presence, Teleoperators, and Virtual Environments* 5:127–132.

15. Botella, C., Baños, R.M., Perpiña, C., et al. (1998). Virtual reality treatment of claustrophobia: a case report. *Behaviour Research & Therapy* 36:239–246.

16. Vincelli, F., Choi, Y.H., Molinari, E., et al. (2001). A VR-based multicomponent treatment for panic disorders with agoraphobia. *Studies in Health Technology and Informatics* 81:544–550.

17. Vincelli, F., Choi, Y.H., Molinari, E., et al. (2000). Experiential cognitive therapy for the treatment of panic disorder with agoraphobia: definition of a clinical protocol. *CyberPsychology & Behavior* 3:375–385.

18. Vincelli, F., Anolli, L., Bouchard, S., et al. (2003). Experiential cognitive therapy in the treatment of panic disorders with agoraphobia: a controlled study. *CyberPsychology & Behavior* 6:312–318.

19. North, M.M., North, S.M., & Coble, J.R. (1998). Virtual reality therapy: an effective treatment for phobias. *Studies in Health Technology and Informatics* 58: 112–119.

20. Lee, L.M., Ku, J.H., Jang, D.P., et al. (2002). Virtual reality system for treatment of the fear of public speaking using image-based rendering and moving pictures. *CyberPsychology & Behavior* 5:191–195.

21. Rothbaum, B.O., Hodges, L., Alarcon, R., et al. (1999). Virtual reality exposure therapy for PTSD Vietnam Veterans: a case study. *Journal of Traumatic Stress* 12:263–271.

22. Rothbaum, B.O., Hodges, L.F., Ready, D., et al. (2001). Virtual reality exposure therapy for Vietnam veterans with posttraumatic stress disorder. *Journal of Clinical Psychiatry* 62:617–622.

23. Riva, G., Bacchetta, M., Baruffi, M., et al. (1998). Experiential cognitive therapy: a VR-based approach for the assessment and treatment of eating disorders. In: Riva, G., Wiederhold, B., & Molinari, E. (eds.), *Virtual environments in clinical psychology and neuroscience: methods and techniques in advanced patient–therapist interaction*. Amsterdam: IOS Press, pp. 120–135.

24. Riva, G., Bacchetta, M., Cesa, G., et al. (2001). Virtual reality and telemedicine based experiential cognitive therapy: rationale and clinical protocol. In: Riva, G., Galimberti, C. (eds.), *Towards CyberPsychology: mind, cognition and society in the Internet age*. Amsterdam: IOS Press, pp. 273–308.

25. Riva, G., Bacchetta, M., Cesa, G., et al. (2003). Six-month follow-up of in-patient experiential-cognitive therapy for binge eating disorders. *CyberPsychology & Behavior* 6:251–258.

26. Williamson, D.A. (1996). Body image disturbance in eating disorders: a form of cognitive bias. *Eating Disorders* 4:47–58.

27. Thompson, J.K., Heinberg, L.J., Altabe, M., et al. (1999). *Exacting beauty: theory, assessment and treatment of body image disturbance*. Washington, DC: American Psychological Association.

28. Vitousek, K.B., & Orimoto, L. (1993). Cognitive-behavioral models of anorexia nervosa, bulimia nervosa, and obesity. In: Dobson, K.S., & Kendall, P.C. (eds.), *Psychopathology and cognition*. San Diego: Academic Press, pp. 191–243.

29. Vitousek, K.B., Watson, S., & Wilson, G.T. (1998). Enhancing motivation for change in treatment-resistant eating disorders. *Clinical Psychology Review* 18:391–420.

30. Cash, T.F. (1995). *What do you see when you look in the mirror? Helping yourself to a positive body image*. New York: Bantam Books.

31. Cash, T.F. (1997). *The body image workbook: an eight-step program for learning to like your looks*. Oakland, CA: New Harbinger.

32. Rosen, J.C. (1996). Improving body image in obesity. In: Thompson, J.K., (ed.), *Body image, eating disorders and obesity*. Washington, DC: American Psychological Association, pp. 425–440.

33. Wooley, S.C., & Wooley, O.W. (1985). Intensive outpatient and residential tratment for bulimia. In: Garner, D.M., & Garfinkel, P.E., (eds.), *Handbook of psychotherapy for anorexia and bulimia*. New York: Guilford, pp. 120–132.

34. Wooley, S.C. (1995). Feminist influences on the treatment of eating disorders. In: Brownell, K.D., & Fairburn, C.G. (eds.), *Eating disorders and obesity: a comprehensive handbook*. New York: Guilford, pp. 294–298.

35. Kearney-Cooke, A., & Striegel-Moore, R. (1994). Treatment of childhood sexual abuse in anorexia nervosa and bulimia nervosa: a feminist psychodynamic approach. *International Journal of Eating Disorders* 15:305–319.

36. James, K.H., Humphrey, G.K., & Goodale, M.A. (2001). Manipulating and recognizing virtual objects: where the action is. *Canadian Journal of Experimental Psychology* 55:111–120.

37. Iriki, A., Tanaka, M., Obayashi, S., et al. (2001). Self-images in the video monitor coded by monkey intraparietal neurons. *Neuroscience Research* 40:163–173.

38. Baars, B.J. (1988). *A cognitive theory of consciousness*. New York: Cambridge University Press.

39. Riva, G., Bacchetta, M., Baruffi, M., et al. (1999). Virtual reality based experiential cognitive treatment of anorexia nervosa. *Journal of Behavioral Therapy and Experimental Psychiatry* 30:221–230.

40. Riva, G., Bacchetta, M., Baruffi, M., et al. (2000). Virtual reality–based experiential cognitive treatment of obesity and binge-eating disorders. *Clinical Psychology and Psychotherapy* 7:209–219.

41. Riva, G., Bacchetta, M., Baruffi, M., et al. (2000). Virtual reality environment for body image modification: a multidimensional therapy for the treatment of body image in obesity and related pathologies. *CyberPsychology & Behavior* 3:421–431.

42. Riva, G., Bacchetta, M., Baruffi, M., et al. (2001). Virtual reality–based multidimensional therapy for the treatment of body image disturbances in obesity: a controlled study. *CyberPsychology & Behavior* 4:511–526.

43. Riva, G., Bacchetta, M., Baruffi, M., et al. (2002). Virtual-reality–based multidimensional therapy for the treatment of body image disturbances in binge eating disorders: a preliminary controlled study. *IEEE Transactions on Information Technology in Biomedicine* 6:224–234.

44. Optale, G., Munari, A., Nasta, A., et al. (1997). Multimedia and virtual reality techniques in the treatment of male erectile disorders. *International Journal of Impotence Research* 9:197–203.

45. Optale, G., Chierichetti, F., Munari, A., et al. (1999). PET supports the hypothesized existence of a male sexual brain algorithm which may respond to treatment combining psychotherapy with virtual reality. *Studies in Health Technology and Informatics* 62:249–251.

46. Optale, G., Chierichetti, F., Munari, A., et al. (1998). Brain PET confirms the effectiveness of virtual reality treatment of impotence. *International Journal of Impotence Research* 10:suppl. 1, 45.

47. Rubino, F., Soler, L., Marescaux, J., et al. (2002). Advances in virtual reality are wide ranging. *British Medical Journal* 324:612.

48. McCloy, R., & Stone, R. (2001). Science, medicine, and the future. Virtual reality in surgery. *British Medical Journal*. 323:912–915.

49. Székely, G., & Satava, R.M. (1999). Virtual reality in medicine. *BMJ* 319:1305.

50. Schultheis, M.T., & Rizzo, A. A. (2001). The application of virtual reality technology in rehabilitation. *Rehabilitation Psychology* 46:296–311.

51. Riva, G., Molinari, E., & Vincelli, F. (2002). Interaction and presence in the clinical relationship: virtual reality (VR) as communicative medium between patient and therapist. *IEEE Transactions on Information Technology in Biomedicine* 6:198–205.

52. Bricken, W. (1990). *Virtual reality: directions of growth* (HITL Technical Report No. R-90-1). Seattle: University of Washington.

53. Riva, G., & Mantovani, G. (2000). The need for a socio-cultural perspective in the implementation of virtual environments. *Virtual Reality* 3:32–38.

54. Riva, G., & Davide, F. (eds.). (2001). *Communications through virtual technologies: identity, community and technology in the communication age*. Amsterdam: IOS Press. Available: <www.emergingcommunication. com/ volume1.html>.

55. Biocca, F., & Levy, M.R. (eds.). (1995). *Communication in the age of virtual reality*. Hillsdale, NJ: Lawrence Erlbaum Associates.

56. Riva, G., Davide, F., & IJsselsteijn, W.A. (eds.). (2003). *Being there: concepts, effects and measurements of user presence in synthetic environments*. Amsterdam: IOS Press. Available: <www.emergingcommunication.com/ volume5.html>.

57. Steuer, J.S. (1992). Defining virtual reality: dimensions determining telepresence. *Journal of Communication* 42:73–93.

58. Riva, G., & Waterworth, J.A. (2003). Presence and the self: a cognitive neuroscience approach. *Presence-Connect* [On-line]. Available: <http://presence. cs.ucl. ac.uk/presenceconnect/articles/Apr2003/jwworth Apr72003114532/jwworthApr.html>.

59. Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): speculations on the role of presence in virtual environments. *Presence* 6:603–617.

60. Slater, M. (2002). *Siggraph 2002 course notes on understanding virtual environments: immersion, presence and performance*. San Antonio, TX: ACM–Siggraph.

61. Waterworth, J.A., & Waterworth, E.L. (2001). Focus, locus, and sensus: the three dimensions of virtual experience. *CyberPsychology & Behavior* 4:203–213.

62. Mantovani, G., & Riva, G. (1999). "Real" presence: how different ontologies generate different criteria for presence, telepresence, and virtual presence. *Presence, Teleoperators, and Virtual Environments* 8:538–548.

63. Schubert, T., Friedman, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic insights. *Presence: Teleoperators, and Virtual Environments* 10:266–281.

64. Zahoric, P., & Jenison, R. L. (1998). Presence as being-in-the-world. *Presence, Teleoperators, and Virtual Environments* 7:78–89.

65. Waterworth, J.A., & Waterworth, E.L. (2003). The meaning of presence. *Presence-Connect* [On-line]. <http://presence.cs.ucl.ac.uk/presenceconnect/articles/Feb2003/jwworthFeb1020031217/jwworthFeb. html>.

66. Janoff-Bulman, R., & Frantz, C.M. (1997). The impact of trauma on meaning: From meaningless world to meaningful life. In: Power, M., & Brewin, C.R. (eds.), *The transformation of meaning in psychological therapies*. New York: Wiley, pp. 91–106.

67. Damasio, A. (1999). *The feeling of what happens: body, emotion and the making of consciousness*. San Diego: Harcourt Brace.

68. Wolfe, B.E. (2002). The role of lived experience in self- and relational observation: a commentary on Horowitz. *Journal of Psychotherapy Integration* 12:147–153.

69. Safran, J.D., & Greenberg, L.S. (1991). *Emotion, psychotherapy, and change*. New York: Guilford.

70. Brewin, C.R. (1989). Cognitive change processes in psychotherapy. *Psychological Review* 96:379–394.

71. North, M.M., North, S.M., & Coble, J.R. (1997). Virtual reality therapy for fear of flying. *American Journal of Psychiatry* 154:130.

72. Vincelli, F. (1999). From imagination to virtual reality: the future of clinical psychology. *CyberPsychology & Behavior* 2:241–248.

73. Vincelli, F., Molinari, E., & Riva, G. (2001). Virtual reality as clinical tool: immersion and three-dimensionality in the relationship between patient and therapist. *Studies in Health Technology and Informatics* 81:551–553.

74. Baños, R.M., Botella, C., & Perpiña, C. (1999). Virtual reality and psychopathology. *CyberPsychology & Behavior* 2:283–292.

75. Glantz, K., Durlach, N.I., Barnett, R.C., et al. (1997). Virtual reality (VR) and psychotherapy: opportunities and challenges. *Presence, Teleoperators, and Virtual Environments* 6:87–105.

76. Garcia-Palacios, A., Hoffman, H.G., See, S.K., et al. (2001). Redefining therapeutic success with virtual reality exposure therapy. *CyberPsychology & Behavior* 4:341–348.

77. Barber, J.P., Stratt, R., Halpering, G., et al. (2001). Supportive techniques: are they found in different therapies? *Journal of Psychotherapy Practice & Research* 10:165–172.

78. Luborsky, L. (1984). *Principles of psychoanalitic psychotherapy*. New York: Basic Books.

79. Menon, S.T. (1999). Psychological empowerment: definition, measurement, and validation. *Canadian Journal of Behavioural Science* 31:161–164.

80. Botella, C., Perpiña, C., Baños, R.M., et al. (1998). Virtual reality: a new clinical setting lab. *Studies in Health Technology and Informatics* 58:73–81.

81. Riva, G. (ed.). (1997). *Virtual reality in neuro-psychophysiology: cognitive, clinical and methodological issues in assessment and rehabilitation*. Amsterdam: IOS Press. Available: <http://www.cybertherapy.info/pages/book1.htm>.

82. Klein, R.A. (1999) Treating fear of flying with virtual reality exposure therapy. In: VandeCreek, L., & Jackson, T. L., (ed.), *Innovations in clinical practice: A source book, Vol. 17.* Sarasota: Florida, U.S., pp. 449–465.

83. Rothbaum, B.O., Hodges, L., & Smith, S. (1999). Virtual reality exposure therapy abbreviated treatment manual: Fear of flying application. *Cognitive & Behavioral Practice*. 6:234–244.

84. Botella, C., Baños, R.M., Villa, H., et al. (2000). Telepsychology: Public speaking fear treatment on the internet. *CyberPsychology and Behavior*. 3:959–968.

85. Riva, G., Alcañiz, M., Anolli, L., et al. (2001). The VEPSY Updated project: Virtual reality in clinical psychology. *CyberPsychology and Behavior*. 4:449–455.

86. Durlach, N.I., & Mavor, A.S.E. (1995). *Virtual reality: scientific and technological challenges*. Washington, D.C.: National Academy Press. Online: http://www.nap.edu/books/0309051355/html/index.html.

87. Nichols, S., & Patel, H. (2002). Health and safety implications of virtual reality: a review of empirical evidence. *Applied Ergonomics*. 33:251–271.

88. Riva, G., Wiederhold, B., Molinari, E., (eds.). (1998). *Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction*. Amsterdam: IOS Press. Online: http://www.cybertherapy.info/pages/book2.htm.

Commentary on Riva, G., Virtual Reality in Psychotherapy: Review

ACCORDING TO RIVA, as virtual reality (VR) is set to enter mainstream psychotherapy delivery, it could be part of clinical psychology's future. For the appropriate development of VR applications to be guaranteed, Riva argues that VR should be defined, and that the opportunities and the challenges it may provide to professional practice be understood. When outlining the current state of relevant clinical research to the development of VR in psychotherapy use, Riva observes that, since the early 1990s, virtual environments have been used as a medium for exposure in phobias.[1,2] He notes that VR exposure therapy (VRE) has been shown to be as effective as *"in vivo"* exposure in the treatment of specific phobias (e.g., acrophobia,[3,4] spider phobia,[5] fear of flying[6]). Its clinical application to more complex disorders (e.g., agoraphobia,[7] claustrophobia,[8] panic disorder,[9] public speaking disorder,[10] eating disorders[11]) is currently being examined. He describes how VRE has also been used as an alternative to "imagery" exposure treatment with post-traumatic stress disorder.[12]

Riva identifies several advantages of VRE when compared to *"in vivo"* or "imagery" exposure. VRE can be administered in traditional therapeutic settings (hence can be more controlled and possibly more cost effective); it can provide stimuli for individuals who have difficulty in imaging scenes; it can provide opportunities for those individuals who are too phobic to experience real situations; and it can generate stimuli of greater magnitude than other more standard techniques (it can therefore produce alternative and fantastic worlds). According to Riva, it is these advantages that arguably position VR as an "intermediate step between the therapist's office and the real world."

Nevertheless, before it becomes part of mainstream use, Riva also identifies several technological, practical, procedural, and ethical barriers still remaining for VR. VR devices, software, and protocols lack standardization, and only a few of the VR systems available are interoperable, rendering most systems only useful in the contexts in which they were developed. As noted by Riva, the above issues force most researchers to spend a lot of time and money designing and developing "one-off" VR creations. These barriers, when added to the particular safety and ethical issues associated with using virtual environments, lead Riva to conclude that much effort will be needed to move VR to commercial success and therefore to become part of routine clinical use.

Riva offers a thoughtful and stimulating commentary on VR in psychotherapy. However, in addition to the ideas provided by Riva and in line with the statement of the nature, purpose, and characteristics of clinical psychology offered by the British Psychological Society's (BPS) Division of Clinical Psychology's (DCP),[13] it is the author's contention that clinical psychology is more than psychotherapy for those of working age. "Clinical psychologists can work with individuals, couples, families, groups (therapeutic, staff), and at the organizational level (e.g., hospital wards, day centres, Community Mental Health Teams, National Health Service Trusts). They also work with all age groups from very young children to older people. They work with people with mild, moderate, and severe mental health problems, people with learning disabilities, people with physical and sensory handicaps, people with brain injury, people who have alcohol and other drug problems, and people with a range of physical health problems."[13]

When considering the assertion above, it may be argued that the above-mentioned benefits of using virtual environments may be extended to other clinical psychologists working in a variety of user group settings. Indeed, there are already examples of the use of VR in the field of neuropsychology rehabilitation,[14–18] in older adult psychology services,[17,19] and in pediatric services.[20] Their use within learning difficulties services has also been discussed.[21]

REFERENCES

1. Hodges, L.F., Rothbaum, B.O., Keeper, R., et al. (1995). Virtual environments for treating the fear of heights. *IEEE Computer* 28:27–34.
2. Hodges, L.F., Bolter, J., Mynatt, E., et al. (1993). Virtual environments research at the Georgia Tech GVU Center. *Presence, Teleoperators, and Virtual Environments* 2:234–243.
3. Emmelkamp, P.M., Bruynzeel, M., Drost, L., et al. (2001). Virtual reality treatment in acrophobia: a comparison with exposure *in vivo*. *CyberPsychology & Behavior* 4:335–339.
4. Emmelkamp, P.M., Krijn, M., Hulbosch, A.M., et al. (2002). Virtual reality treatment versus exposure *in vivo*: a comparative evaluation in acrophobia. *Behaviour Research & The*rapy 40:509–516.
5. Garcia-Palacios, A., Hoffman, H., Carlin, A., et al. (2002). Virtual reality in the treatment of spider phobia: a controlled study. *Behaviour Research & Therapy* 40:983–993.
6. Maltby, N., Kirsch, I., Mayers, M., et al. (2002). Virtual reality exposure therapy for the treatment of fear of flying: a controlled investigation. *Journal of Consulting & Clinical Psychology* 70:1112–1118.
7. North, M.M., North, S.M., & Coble, J.R. (1996). Effectiveness of virtual environment desensitization in the treatment of agoraphobia. *Presence, Teleoperators and Virtual Environments* 5:127–132.
8. Botella, C., Banos, R.M., Perpina, C., et al. (1998). Virtual reality treatment of claustrophobia: a case report. *Behaviour Research & Therapy* 36:239–246.
9. Vincelli, F., Anolli, L., Bouchard. S., et al. (2003). Experiential cognitive therapy in the treatment of panic disorders with agoraphobia: a controlled study. *CyberPsychology & Behavior* 6:312–318.
10. Lee, L.M., Ku, J.H., Jang, D.P., et al. (2002). Virtual reality system for treatment of the fear of public speaking using image-based rendering and moving pictures. *CyberPsychology & Behavior.* 5:191–195.
11. Riva, G., Bacchetta, M., Cesa, G., et al. (2003). Six-month follow-up of in-patient experiential-cognitive therapy for binge eating disorders. *CyberPsychology & Behavior.* 6:251–258.
12. Rothbaum, B.O., Hodges, L., Alarcon, R., et al. (1999). Virtual reality exposure therapy for PTSD Vietnam Veterans: a case study. *Journal of Traumatic Stress* 12:263–271.
13. Harvey, P. (2001). *The core purpose and philosophy of the profession.* British Psychological Society, Division of Clinical Psychology, Leicester, UK.
14. Rose, F.D., Attree, E.A., Andrews. T.K., et al. (1997). Applications of virtual reality to brain damage rehabilitation. *Proceedings of the British Psychological Society* 4:63.
15. Rose, F.D., Johnson, D.A., Attree, E.A., et al. (1997). Virtual reality: an ecologically valid tool for assessment in neurological rehabilitation. *European Journal of Neurology* 3:131–132.
16. Rose, F.D., Johnson, D.A., Attree, E.A., et al. (1997). Virtual reality in neurological rehabilitation. *British Journal of Therapy and Rehabilitation* 3:223–228.
17. Andrews, T.K., Brooks, B.M., McNeil, J., et al. (2001). Route learning in patients with memory difficulties: limitations of training in a virtual environment. *Proceedings of the British Psychological Society* 9:9.
18. Rose, F.D., Attree, E.A., Brooks, B.M., et al. (2001). Learning and memory in virtual environments: a role in neurorehabilitation? Questions (and occasional answers) from the University of East London. *Presence* 10:345–358.
19. Brooks, B.M., Rose, F.D., Potter, J., et al. (2004). Assessing stroke patients' prospective memory using virtually reality. *Brain Injury* 18:391–401.
20. Gershon, J., Zimand, E., Lemos, R., et al. (2003). Use of virtual feality as a distracter for painful procedures in patients with paediatric cancer: a controlled study. Unpublished manuscript.
21. Attree, E.A., Brooks, B.M., Rose, F.D., et al. (1997). Memory processes and virtual environments: I can't remember what was there, but I can remember how I got there. Implications for people with disabilities. Presented at the First European Conference on Disability, Virtual Reality and the Associated Technologies, Amsterdam, Holland.

TRESA ANDREWS, Ph.D.
South London and Maudsley N.H.S. Trust, London, United Kingdom
E-mail: tresa.andrews@nhs.net

V IRTUAL REALITY (VR) is a very powerful tool that has shown its potential in many fields. Its wide range of utility was quickly evident for both basic research and applications in different scientific ambits. Clinical psychology was also very interested in the versatility of VR and its use as a therapeutic resource. More than a decade has passed since the first clinical applications—which were focused mainly on the treatment of specific phobias, that is "virtual exposure"—were brought to the attention of academic and therapeutic audiences. The application of VR to clinical psychology is expanding fast to encompass more

complex disorders, such as eating disorders, panic disorder, and post-traumatic stress disorder. It is also beginning to encompass a broader range of psychotherapeutic approaches. After more than 10 years of work on VR clinical applications, a detailed reflection about the work achieved and the work in prospect is useful. This reflection should go beyond the initial enthusiasm, pointing out the weaknesses and strengths of VR. This is the purpose of Riva's paper—to outline the current state of VR for use in psychotherapeutic contexts. If VR is expected to be an effective and efficient therapeutic tool, its utility should be extended from universities and research centers to "clinical reality." Riva's work also addresses this, and shows the opportunities and limitations of VR applications for professional practice.

As Riva points out, at first VR was defined as a collection of machines. However, this kind of definition was too restricted, and the focus changed quickly to include the individual who uses the technology. We prefer to consider VR as a human experience, that is, an advanced communication interface that enables the user to experience "other" worlds, "other" realities. This is why VR is so useful and versatile for psychotherapy. The focus of psychological treatments lies in modifying some of the person's experiences, and it is necessary to create experiences that individuals assume as their own. As Osberg[1] claimed, VR could be considered as an alternative reality based on perception, instead of as a perception based on reality; it may not be necessary to copy physical reality exactly. A user could experience a virtual world even when the virtual environment does not provide a complete or totally precise representation of the real world. Furthermore, VR could produce alternative and fantastic worlds, which is one of its more attractive features, especially for clinical psychology because the goal is to achieve important changes in the users.[2]

We have to be aware of VR's limitations. Riva points out that some problems still remain. Some of them are mainly technological, but others are related to clinical issues. It is necessary to standardize VR devices, software, and protocols, and to take into account ethical issues. It is also necessary to continue working on VR's utility for other clinical tasks, such as assessment and research. VR can be helpful to increase the ecological validity of our assessment tools, and it can be considered as an "ecological" laboratory where behaviors, feelings, and human experiences can be studied in a controlled and rigorous way.[3] Furthermore, when VR is combined with the internet, its applications multiply.

However, many clinical psychologists still have misgivings about the use of VR. We need to keep working to offer empirical data about the efficacy of VR applications, to develop more user-friendly applications, to improve software and protocols, to individualize environments, and to decrease costs. We also need to keep working to disseminate the results of all this work. VR is a tool—only a tool—but one of the most powerful tools that the clinical community has had to date. There is general agreement that three "I's" are needed to design a VR application: Interaction, Immersion, and Imagination. Imagination is also needed to transfer VR research to day-to-day clinical practice.

REFERENCES

1. Osberg, K. (1997). *But what's behind door number 4? Ethics and virtual reality: a discussion. HITL report no. R-97-16.* Seattle: University of Washington, Human Interface Technology Laboratory.
2. Botella, C., Perpiña, C., Baños, R.M., et al. (1998). Virtual reality: a new clinical setting lab. *Studies in Health Technology and Informatics* 58:73–81.
3. Baños, R.M., Botella, C., & Perpiña, C. (1999). Virtual reality and psychopathology. *CyberPsychology & Behavior* 2:283–292.

ROSA M. BAÑOS, Ph.D.
Departamento de Personalidad, Evaluación y Tratamientos Psicológicos, Universitat de Valencia, Valencia, Spain
E-mail: Rosa.Baños@uv.es

DRAMATIC TECHNOLOGICAL ADVANCES took place in the 20th century, and we are sure that these advances will be even more dramatic and faster in the 21st century. Some aspects that still seem scientific fiction today will become part of our daily life. One of these advances has been the development of virtual reality (VR). The progress achieved from the time of Sutherland, one of the pioneers of VR, is surprising even to researchers who work in the field.[1,2]

Riva's aim is to present a state of the art review about the progress achieved in the application of VR to clinical psychology. Riva analyzes the present situation, and reviews most of the developments and clinical trials carried out for the treatment of many mental disorders. He describes in more detail the work done by his team about the use of VR for the treatment of body image disturbances in eating disorders. Then he presents his own vision of the rationale of this new technology in this field, analyzing the concept of *presence*. Finally, he presents the future of research in VR.

From Riva's review, we can conclude that VR is no longer a promise of the future, but a present reality. This new technology offers many possibilities for psychology, including assessment, treatment, and research. In the field of clinical psychology, VR is a known, accepted, and widespread tool used in exposure treatments of anxiety disorders, especially phobic disorders. Virtual exposure has many advantages compared with "*in vivo*" exposure and "imagery" exposure. VR provides stimuli for individuals who have difficulty in imagining scenes; it represents an opportunity for those individuals who are too phobic to experience real situations; it can be performed within the privacy of the consulting room; and it can generate stimuli of greater magnitude than standard techniques. Its utility and effectiveness have been demonstrated in the treatment of many disorders (e.g., flying phobia, claustrophobia, acrophobia, driving phobia). [3,4]

Furthermore, its use is being expanded, including in other anxiety disorders such as post-traumatic stress disorder and panic disorder.[5,6] The impact of VR applications is reflected in the growing number of publications, not only in specialized journals on VR (e.g., *CyberPsychology & Behavior, and Presence: Teleoperators and Virtual Environments*), but also in very prestigious classical journals in clinical psychology (e.g., *Behaviour Research and Therapy, Behaviour Therapy, Clinical Psychology and Psychotherapy, and Journal of Behaviour Therapy and Experiential Psychiatry*).

The time of expensive and big equipment is over, and we are demonstrating utility and effectiveness in several fields. Now, besides improving the VR applications, it is time to pay attention to other important tasks. It is urgent to reflect on and do research into the meaning of the increasing use of this new technology—that is, the benefits, the delimitation of parameters and variables that could be important to a good mastery of this tool, and the management of the possible negative side effects. We should not forget that VR can be understood as a *new sense* that becomes a part of our device to explore the world involving issues related to development and evolution, ontogenesis, and filogenesis.

In summary, besides progressing in the development of more powerful VR systems, we should be on the alert and reflect on the effects of VR applications. Bateson[7] stated, every intervention and each human artifact has a price, no matter how good the purpose of the agent of the intervention is. Finally, we are sure that VR will achieve important progress in the field of clinical psychology in the next few years. The efficacy of this tool in the treatment of some mental disorders has been demonstrated, and we have data that suggest that this new tool is well accepted by patients.[8] It has also been shown that VR can be effective with relatively cheap hardware. All these issues suggest that VR will become a usual tool in the work of clinical psychologists in the future.

REFERENCES

1. Botella, C., Baños, R., Perpiñá, C., et al. (1998). Realidad virtual y tratamientos psicológicos. *Análisis y Modificación de Conducta* 24:5–26.
2. Botella, C., Baños, R.M., & Perpiñá, C. (2000). Realidad virtual: nuevas tecnologías aplicadas al campo de la psicología clínica y de la salud. In: Lameiras, M., & Failde, J.M. (eds.), *La psicología clínica y de la salud en el siglo XXI: posibilidades y retos.* Madrid: Dykinson Psicología, pp. 408–419.
3. Botella, C., Perpiñá, C., Baños, R., et al. (1998). Virtual reality: a new clinical setting lab. In: Riva, G., Wiederhold, B.K., & Molinari, E. (eds.), *Virtual environments in clinical psychology and neuroscience: methods and techniques in advanced patient-therapist interaction.* Amsterdam: IOS Press, pp. 73–81.
4. Botella, C., Quero, S., Baños, R., et al. (2004). Virtual reality and psychotherapy. In: Riva, G., Botella, C., Legeron, P., et al. (eds.), *Cybertherapy, Internet and virtual reality as assessment and rehabilitation tools for clinical psychology and neuroscience.* Amsterdam: IOS Press, pp. 37–54.
5. Botella, C., Villa, H., García-Palacios, A., et al. (2004). The use of VR in the treatment of panic disorders and agoraphobia. Riva, G., Botella, C., Legeron, P., et al. (eds.), *Cybertherapy, Internet and virtual reality as assessment and rehabilitation tools for clinical psychology and neuroscience.* Amsterdam: IOS Press, pp. 73–90.

6. Botella, C., Villa, H., García-Palacios, A., et al. (2005). Virtual reality exposure in the treatment of panic disorder and agoraphobia: a comparison with *in vivo* exposure (submitted).
7. Bateson, G. (1972). *Steps to an ecology of mind.* New York: Chandler Publishing Company.
8. Garcia-Palacios, A., Hoffman, H.G., See, S.K., et al. (2001). Redefining therapeutic success with virtual reality exposure therapy. *CyberPsychology & Behavior* 4:341–348.

CRISTINA BOTELLA, Ph.D.
Departmento de Psicología Básica, Clínica y Psicobiologia, Jaume I University, Castellon, Spain
E-mail: botella@psb.uji.es

T‍HERE IS MUCH TO AGREE WITH in Riva's review, although I prefer a more down to earth approach to the promises of VR and am less optimistic about the implementation of these technologies in daily clinical practice.

IMPLEMENTATION OF VR IN ROUTINE CLINICAL PRACTICE

Currently, there are a number of technological limitations that limit the widespread clinical application of VR at this moment. Apart from these technical impediments, which may be solved by technological developments in the near future, there are other reasons not to expect that VR psychotherapies will be applied in routine clinical practice in the near future. It took decades for behavior therapy to be accepted as one of the main schools of psychotherapy, despite its being evidence-based as demonstrated in hundreds of controlled outcome studies.[1] Apparently, in the mental health field and in psychotherapy, in particular, there are other motives and arguments than an intervention's approved efficacy that determine whether an evidence-based intervention will be accepted by the larger community of professionals or not. Especially when technology is involved, there are a number of reasons that will preclude large-scale implementation within a couple of years. Among psychotherapists, the value of the therapeutic relationship is felt to be very important, and for some therapy schools, even of paramount importance. When discussing our clinical research on VR,[2,3] and our studies into psychotherapy delivered through the Internet,[4,5] we sometimes get hostile reactions by psychotherapists because they—albeit incorrectly—feel that there is no place for a therapeutic relationship. However, as in any therapy, in technology-driven therapies the therapeutic relationship is important. Further, I am afraid that we must deal with a technology phobia among psychotherapists before widespread application of VR will occur. Most current psychotherapists, who are in their forties and fifties, are not familiar with technological innovations and are anxious about using them. Finally, some therapists feel threatened that, at the end of the day, technology-driven therapies will make their work superfluous. Perhaps it is more realistic to expect that in a few years time there will be specialized centers which will provide such therapies with sufficient technical support, than that VR will be integrated into routine clinical care.

IS VR EVIDENCE-BASED?

But what evidence is there for the effectiveness of VR in psychotherapy? Riva reviews a number of studies into eating disorders, anxiety disorders, and sexual dysfunctions and concludes that VR is highly effective. We recently reviewed research on VR in anxiety disorders, and our conclusions are more modest.[6] Few studies have been published in which virtual reality exposure therapy (VRET) is compared to exposure *in vivo*, the golden standard for treatment of phobias to date. Promising results show that VRET is as effective as exposure *in vivo* in treating fear of heights and fear of flying, but as far as other anxiety disorders are concerned, the promise is as yet unfulfilled. With respect to the impressive series of studies into experiential cognitive therapy with a variety of eating disorders by Riva's group, results support the effectiveness of VR. It should be noted, however, that VR was integrated in a multimodal treatment

program. There is a clear need to study the effectiveness of VR treatment for eating disorders as a stand-alone treatment. The same criticism applies to the application of VR in the treatment of impotence and premature ejaculation. When VR is not studied in isolation and compared with gold standard evidence-based treatments, any conclusions on the effects of VR as a therapeutic method are precluded.

PRESENCE

The most evidence for the efficacy of VR as stand-alone treatment is provided by studies with patients with acrophobia.[3,7] However, the high dropout rates during therapy due to low levels of experienced presence temper the optimism somewhat. Some participants are not able to involve themselves in the virtual world to the extent that they experience relevant emotions, thus precluding extinction and emotional processing. Therefore, there is a clear need to study presence in more detail. There is some evidence that the quality of the system has some influence on the level of presence felt.[8] The main techniques used to immerse participants in the virtual environment are a head-mounted display (HMD) or computer automatic virtual environment (CAVE). The CAVE is a multi-user projection-based VR system. The patient is surrounded by stereoscopic computer-generated images on four to six sides (cubicle). In a recent study with patients with acrophobia,[7] we found that CAVE presentation of VR environments resulted in higher levels of presence than HMD presentation of these environments. However, this did not result in more anxiety reduction.

To date, most virtual worlds used in psychotherapy have concentrated on visual realism, but progress is limited by computer-processing power. There are some interesting developments in the area of creating emotionally evocative environments. In order to immerse patients into the virtual world, auditory and tactile stimuli may be added to virtual environments. For example, in our studies we use a railing for hold onto in a height virtual environment, and vibrations in the airplane-chair during take-off or turbulence in our flight virtual environment.

Morie et al.[10] hold that, by combinations of sensory inputs designed to trigger emotional responses, a "feels real" rather than a photo-real world can be achieved. In their VR world, they make use of visceral low-frequency sounds, which may actually be below the threshold of hearing, but still can have impact, like a musical score does in movies. Smell is now hardly used in VR but may also enhance a "feels real" experience. There is quite some research suggesting that smell is associated with memories, and an integration of smells with virtual worlds might also enhance the "feels real" experience. Clinical applications are especially worthwile in the area of cue exposure therapy for substance abuse and eating disorders, but are not restricted to these areas.

Finally, individual differences related to the experience of presence in VR need our attention. There is some evidence that such personal characteristics as degree of absorption and hypnotisability may mediate the effectiveness of VR.[10] Other possible predictor variables for presence are the propensity of participants to get involved passively in some activity (like reading a book and watching movies), the ability to concentrate, and alexithymia. Research into these moderating individual traits will be of value because it may enhance selecting patients who profit most from treatment using VR.

CONCLUDING REMARKS

In sum, given the many advantages of VR over conventional psychotherapies and the results achieved so far, further research efforts in this area are needed. But the proof of the pudding is the effectiveness of VR treatment as stand-alone intervention versus the gold-standard intervention in the respective areas. There is a clear need for further controlled randomized studies evaluating VR therapies, especially for eating disorders, sexual dysfunctions, addictions, and other anxiety disorders than acrophobia and fear of flying

ACKNOWLEDGMENT

REFERENCES

1. Emmelkamp, P.M.G. (2004). Behavior therapy with adults. In: Lambert, M. (ed.), *Handbook of psychotherapy and behavior change*, 5th ed. New York: Wiley, pp. 393–446.
2. Emmelkamp, P.M.G., Bruynzeel, M., Drost, L., et al. (2001). Virtual reality treatment in acrophobia: a comparison with exposure *in vivo*. *CyberPsychology & Behavior* 4:335–339.
3. Emmelkamp, P.M.G., Krijn, M., Hulsbosch, A.M., et al. (2002). Virtual reality treatment versus exposure *in vivo*: a comparative evaluation in acrophobia. *Behaviour Research & Therapy* 40:509–516.
4. Lange, A., Rietdijk, D., Hudcovicova, M., et al. (2003). INTERAPY. A controlled randomized trial of the standardized treatment of posttraumatic stress through the Internet. *Journal of Consulting & Clinical Psychology* 71:901–909.
5. Lange, A., van de Ven, J.-P., Schrieken, B., et al. (2001). Interapy. Treatment of posttraumatic stress through the Internet: a controlled trail. *Journal of Behavior Therapy & Experimental Psychiatry* 32:73–90.
6. Krijn, M., Emmelkamp P.M., Olafsson, R.P., et al. (2004). Virtual reality exposure therapy of anxiety disorders: a review. *Clinical Psychology Review* 24:259–281
7. Krijn, M., Emmelkamp, P.M.G., Biemond, R., et al. (2004). Treatment of acrophobia in virtual reality: the role of immersion and presence. *Behaviour, Research & Therapy* 42:229–240.
8. Schubert, T.W., Regenbrecht, H.T., & Friedman, F. (2000). Real and illusory interaction enhance presence in virtual environments. Presented at the Presence 2000 Workshop, Delft.
9. Morie, J.F., Iyer, K., Valanejad, K., et al. (2002). Emotionally evocative environments for training. Army Science Conference.
10. Wiederhold, B.K., & Wiederhold, M.D. (2000). Lessons learned from 600 virtual reality sessions. *CyberPsychology & Behavior* 3:393–400.

PAUL M.G. EMMELKAMP, Ph.D.
Department of Clinical Psychology, University of Amsterdam, Amsterdam, Holland
E-mail: P.M.G.Emmelkamp@uva.nl

As RIVA OBSERVED IN HIS REVIEW, it is not without difficulties that virtual reality (VR) has become a recognized therapy tool. Having acquired an incontestable role in telemedicine,[1] VR seems to be a promising support for psychotherapy in numerous clinical contexts. Riva's review provides a clear and effective depiction of the state of the art in psychotherapy written from an experienced author in the field who has been involved in more than one application himself, and concludes with a list of possible explanations for the limits that cybertherapy may find in its development. However, current limitations cannot only be traced back to a poor technical flexibility, scarcity of clinical protocols, and high costs. In our opinion, these aspects, although important, are a part of the problem rather than its deep cause. We would like to extend the reflection on what is slowing down, whilst not stopping, a thriving growth in this area.

VR applications to psychotherapy move on a very dangerous cliff: expectations, high in any psychotherapy, are increased by the power with which VR and new technologies are popularly entrusted. In order to meet these expectations, cybertherapy has to undergo a reinvigorating cure itself, necessarily including the development of a shared vision on interaction in a mediated world. Such a shared vision allows avoidance of practical mix-ups and conceptual confusion that would seriously interfere with the therapeutic goal. VR-supported psychotherapy is always an interdisciplinary endeavour, where "boundary objects" are necessary to allow different communities to understand each other on a common terrain.[2] The concept of presence in mediated environments could serve as an inclusive, fresh boundary object. Unfortunately, there is an abundance of independent presence definitions, almost outnumbering the amount of virtual environments, and a certain reluctance to capitalize on reflections already available in neighborhood fields on mediation, engagement, interaction, and ergonomics. These facts make presence contribution quite nebulous, and theoretical statements and individual studies difficult to translate into design guidelines for VR applications.[3] To account for the way in which people manage to be present in a cybertherapy setting, some issues should be dealt with that are currently among the crucial ones in social science and technology application.

A therapeutic setting is much more complex than those usually considered in presence models,[4] where the focus is almost exclusively on the digital simulation, and external events are considered only as a threat to a good virtual experience. These kinds of environment have a mixed (real-virtual) nature, and

existent models of presence like "Break in Presence"[5] cannot account for them.[6,7] Moreover, a therapeutic setting is relational, symbolic, and immersed in the personal history of the patient and of the therapist, as well as in the simulation, constituting what can be defined as a hybrid environment.[4] These considerations notwithstanding, the *context* in which a virtual environment is used, while at the top of the list in any other approach to human–computer interaction,[8] is completely disregarded in this field. It looks as if the excitement and the rhetoric of virtual environments as an artificial reality on its own were taken as a serious description of what actually happens during the session. Instead, the actual, sequential interaction with the system must be observed in the situated, contingent circumstances in which it takes place.[9,10]

Another necessary entry in the agenda is a deep investigation on *cultural* factors. Virtual environments for psychotherapy are often inspired by real-life environments and interspersed with symbolic implications. While designers cannot be personally aware of the extent to which their work is located in their own culture, the possibility that the intended meaning of a simulation be subverted in another community is very high,[11] along with the risk that the whole therapeutic strategy makes no sense at all in a different culture. The idea to scale e-health products for a worldwide distribution at no additional cost has then to be abandoned. A virtual environment, as many other psychological tools (e.g., questionnaires, tests), needs to be culturally adapted in order to make it compatible with the target users' experience and with the general therapeutic goal.[12] The cultural dimension also provides a framework to discuss ethical and sustainability issues that are folded into the valuable goal of alleviating people's psychic sufferance, as Riva reminds in his review.

The involvement of the body and of the physical setting in any cybertherapy is another point to be defined. The experience with the simulation is a complex one, incorporated and *distributed* on both physical and cultural-cognitive dimensions, as mentioned above. "What people perceive, how they conceive of their activity and what they physically do develop together,"[13] says Clancey. The strict interconnection between cognitive-cultural dimension and body should be considered when planning psychotherapy using VR, because the use of the technology, the conditions during the session, and the involvement in the simulated experience rely on embodied coordinates. The moment of full presence in the simulation does not amount to a disappearance of the real environment, but to its reconfiguration with respect to the virtual action. A good model would admit that different configurations are possible and that selecting one as desirable is a choice.

The ultimate issue of any psychotherapy is the way in which the experience in the clinical setting relates with the real one. A general, flexible model that connects the virtual "experience" to a broader cultural, physical, and cognitive context may help understand the possible consequences of cybertherapy in everyday life.

REFERENCES

1. Riva, G., & Gamberini, L. (2000). Virtual reality as telemedicine tool: technology, ergonomics and actual applications. *Technology and Health Care* 8:1–15.
2. Star, S., & Griesemer, J. (1989). Institutional ecology, "translations" and boundary objects: amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907–1939, *Social Studies of Science* 19**:**387–420.
3. Sadowski, W., & Stanney, K. (2002). Presence in virtual environments. In: Stanney, K.M. (ed.), *Handbook of virtual environments: design, implementation, and applications*. Mahwah, NJ: Lawrence Erlbaum Associates, pp. 791–806.
4. Spagnolli, A., Gamberini, L., Cottone, P., et al. (2003). Ergonomics of virtual environments for clinical applications. In: Riva, G., Botella, C., Legeron, P., et al. (eds.), *Cybertherapy: Internet and virtual reality as assessment and rehabilitation tools for clinical psychology and neuroscience*. Amsterdam: IOS Press, pp. 217–230.
5. Slater, M., & Steed, A. (2000). A virtual presence counter. *Presence: Teleoperators and Virtual Environments* 9:413–434.
6. Spagnolli, A., & Gamberini, L. (2002). IMMERSION/EMERSION. Presence in hybrid environments. Presented at the 5th International Workshop on Presence, Porto, Portugal.
7. Slater, M., Brogni, A., & Steed, A. (2003). Physiological responses to breaks in presence: a pilot study. Presented at the 6th International Workshop on Presence, Aalborg, Denmark.
8. Rosson, M.B., & Carroll, J.M. (2002). *Usability engineering. Scenario-based development of human–computer interaction*. Morgan Kaufmann, San Francisco, CA.
9. Gamberini, L., & Spagnolli, A. (2002). On the relationship between presence and usability in virtual environments: a situated, action-based approach. In: Riva, G., & Davide, F. (eds.), *Being there: concepts, effects and measurements of user presence in synthetic environments,* Amsterdam: IOS Press, pp. 97–108.
10. Spagnolli, A., Varotto, D., & Mantovani, G. (2003). An ethnographic, action-based approach to human experience in virtual environments. *International Journal of Human Computer Studies* 59:797–822.

11. Mantovani, G. (2000). *Exploring borders. Understanding culture and psychology*. London: Routledge.
12. Scribner, S. (1975). Situating the experiment in cross-cultural research. In: Riegel, K.F., & Meacham, J.A. (eds.), *The developing individual in a changing world: historical and cultural issues*. The Hague: Mouton.
13. Clancey, W.J. (1997). *Situated cognition*. Cambridge: Cambridge University Press.

LUCIANO GAMBERINI, Ph.D. and ANNA SPAGNOLLI, Ph.D.
Human Technology Laboratories, Department of General Psychology, University of Padova, Padova, Italy
E-mail: luciano.gamberini@unipd.it

Giuseppe Riva is a leader in the field of the application of virtual reality (VR) to the therapeutic arena, and I am honored to be asked to comment on his review paper. I agree with many of Riva's conclusions, in particular that, "VR thus becomes a very useful intermediate step between the therapist's office and the real world."

I would like to emphasize that VR is a *tool* to be used in therapy, not a replacement for any of the essential elements in therapy. To paraphrase poorly, bad therapy with VR is still just bad therapy. We have tried to emphasize this point from the beginning, and it has been stressed in every treatment manual we have written since the early 1990s. I believe the ultimate goal of any therapy is to decrease the patient's functional impairment. For most, and with my cognitive behavioral theoretical orientation, this translates into some needed change in *behavior*.

Therefore, our use of VR-assisted therapy grew out of (1) my theoretical orientation (i.e., cognitive behavioral therapy [CBT] and information processing); (2) the needs of the patients we see (i.e., patients with anxiety disorders who generally require exposure therapy); (3) the obstacles to standard CBT therapy, especially exposure therapy (e.g., actually having to travel to the airport and an airplane, finding an audience); and (4) our desire to improve existing therapies or make them more accessible to therapists and patients or more efficient to implement. We don't create new virtual applications and environments because we can or because it is popular; we have attempted to only create new applications where some advance is needed. As Riva points out, one of the obstacles to VR therapy is the expense, especially of creating the virtual environment, so the incremental advantage must justify the incremental cost. This is also exactly why VR therapies have required more empirical validation than existing therapies. There must be empirical evidence of the efficacy of VR therapies to justify their use. The same standards have not been applied to many existing therapies (e.g., psychoanalysis).

I would like to emphasize here also that the power of the virtual experience also requires extra sensitivity to ethical considerations. Elsewhere, we have discussed ethical issues in VR applications.[1] Here, I'd like to emphasize three important points. One, therapists should use VR to enhance therapy rather than substitute for it. VR should be approached as a tool to be used by clinicians experienced with the types of patient problems and treatment they are treating. It is not meant to be a convenient way of attracting new patients or of administering a new type of therapy that they are not qualified to provide. Two, there is a different therapist–patient dynamic in VR therapy that must be taken into account. As in any social interaction, non-verbal communication is of paramount importance in the therapist/patient dyad. Much of this non-verbal communication comes from facial expression, body posture, hand gestures, and intonations. If patients are wearing head-mounted displays, they cannot see the therapist and therefore lose all of the non-verbal communication absorbed visually. Three, what is considered unethical in standard therapy would still be considered unethical in VR therapy. Variations on sex therapy have been held up as prime examples of this warning, but there are certainly others.

In closing, I think that VR-assisted therapy has great potential. We now have the ability to bring the real world into the therapist's office in more than a verbal or imagined representation. Current projects in the Virtually Better laboratory not mentioned in Riva's review include several studies with the fear of public speaking using virtual audiences,[2] including in a self-help format, a current study of the virtual relaxation chamber with patients with chronic pain, a study examining the ability of VR to distract pediatric cancer patients during painful medical procedures,[3] a larger controlled study of the virtual airplane for the fear of flying with 75 treatment completers,[4] the use of VR exposure therapy combined with medication,[5] and current studies applying VR to addictions with a virtual party for smokers and a virtual crack house for

crack cocaine addicts. These are but a few of the potential applications of VR in therapy, and I encourage the development and testing of more applications.

REFERENCES

1. Rizzo, A.A., Schultheis, M.T., & Rothbaum, B.O. (2003). Ethical issues for the use of virtual reality in the psychological sciences. In: Drexler, M., & Bush, S. (eds.), *Ethical issues in clinical neuropsychology*. Lisse, NL: Swets & Zeitlinger, pp. 243–280.
2. Anderson, P., Rothbaum, B., Zimand, E., et al. (2005).Treating social anxiety using virtual reality exposure: an open clinical trial (unpublished manuscript).
3. Gershon, J., Zimand, E., Lemos, R., et al. (2003). Use of virtual reality as a distractor for painful procedures in patients with pediatric cancer: a controlled study. *CyberPsychology and Behavior* 6:657–661.
4. Rothbaum, B.O., Hodges, L., Anderson, P., et al. (2005). Virtual reality exposure therapy and standard (In Vivo) exposure therapy in the treatment of fear of flying. *Behavior Therapy* Feb (in press).
5. Ressler, K.J., Rothbaum, B.O., Tannenbaum, L., et al. (2004). Facilitation of psychotherapy with D-cycloserine, a putative cognitive enhancer. *Archives of General Psychiatry* 61:1136–1144.

BARBARA O. ROTHBAUM, Ph.D.
Emory University School of Medicine, Atlanta, Georgia
E-mail: brothba@emory.edu