Communications Through Virtual Technology:
Identity Community and Technology in the Internet Age
Edited by *G. Riva* and *F. Davide*, IOS Press: Amsterdam, 2001 - © 2001, 2002, 2003

6 Virtual Reality as communicative medium between patient and therapist

Giuseppe RIVA, Enrico MOLINARI, Francesco VINCELLI

Abstract: The great potential offered by VR to clinical psychologists derives prevalently from the central role, in psychotherapy, occupied by the imagination and by memory. These two elements, which are fundamental in our life, present absolute and relative limits to the individual potential. Using VR as an advanced imaginal system - an experience that is able to reduce the gap existing between imagination and reality - it is possible to transcend these limits.
In this sense VR can improve the efficacy of a psychological therapy for its capability of reducing the distinction between the computer's reality and the conventional reality.
Two are the core characteristics of this synthetic imaginal experience: the perceptual illusion of nonmediation and the possibility of building and sharing a common ground. In this sense, experiencing presence in a clinical VE - such as a shared virtual hospital - requires more than reproduction of the physical features of external reality. It requires the creation and sharing of the cultural web that makes meaningful - and therefore visible - both people and objects populating the environment.

Contents

6.1 Introduction

The diffusion of Virtual Reality (VR) in clinical psychology is constantly increasing. Hodges et al. [1] used virtual environments (VEs) to provide acrophobic patients with fear-producing experiences of heights in a safe situation. A similar approach was used by Lamson [2] to treat 44 subjects with acrophobia.

In a more recent work Hodges and colleagues [3] verified the possibility of using a virtual reality airplane for exposure therapy in the treatment of fear of flying. North and his team [4], too, presented a case study of a 42 yr old male with a fear of flying who was recruited for virtual reality therapy. Using a helicopter simulation, the authors exposed the patient to anxiety producing stimuli in progressively challenging situations.

North and colleagues [5] also verified the possibility of using VEs in the treatment of agoraphobia. In a controlled study the experimental group exposed to VR therapy reported significant improvement [5]. A similar approach is used by Botella group [6] in the treatment of claustrophobia and by the North team in the treatment of public speaking disorder [7].

VR exposure is also used as an alternative to typical imaginal exposure treatment for Vietnam combat veterans with posttraumatic stress disorder (PTSD). Rothbaum and colleagues [8] esposed a Vietnam combat veteran with PTSD to two virtual environments, a virtual Huey helicopter flying over a virtual Vietnam and a clearing surrounded by jungle. The patient experienced a 34% decrease on clinician-rated PTSD and a 45% decrease on self-rated PTSD. Treatment gains were maintained at 6-month follow-up.

Riva and colleagues [9, 10, the paper in this special issue] are using the Experiential Cognitive Therapy (ECT) an integrated approach ranging from cognitive-behavioral therapy to virtual reality (VR) sessions in the treatment of eating disorders and obesity. In particular, using VR, ECT seems to be able to address both body experience disturbances and motivation for change.

Optale and his team [11, 12, the paper in this special issue] used virtual reality as a new mean of treating male erectile disorders. The obtained results show that VR seems to hasten the healing process and reduce drop-outs, suggesting that this method opens or consolidates new or rarely used brain pathways, facilitating the flow of new mnemonic associations that promote the satisfaction of natural drives.

In a recent case report Hoffman and colleagues [13] provided the first evidence that entering an immersive virtual environment can serve as a powerful adjunctive, nonpharmacologic analgesic: two patients received VR to distract them from high levels of pain during wound care. The preliminary results suggest that immersive VR merits more attention as a potentially viable form of treatment for acute pain.

In general, using VR software, it is possible to re-create, together with the subject undergoing treatment, a hierarchy of situations corresponding to reality, which he may experience in an authentic way thanks to the involvement of all his sensorimotor channels [5, 14]. The experience of the virtual environments enables the interacting individual to immerse himself in a dimension of real presence that can play an important role in therapy.

As noted by Glantz *et al.* [15]: “One reason it is so difficult to get people to update their assumptions is that change often requires a prior step - recognising 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.” (p. 96). Using the sense of presence, the therapist can actually demonstrate to the patient that

what looks like a perception doesn't really exist. Once this has been understood, individual maladaptive assumptions can then be challenged more easily.

Even if the number of reported application is constantly increasing, as reported by the contents of this special issue, understanding how to use immersive virtual reality (VR) to support clinical practice presents a substantial challenge for the designers and users of this emerging technology [16]. As noted by Banos and colleagues [17] VR has two opposite faces. On one side it can be used by clinicians as a “setting lab where to study anomalous behaviors, emotions and beliefs” (p.284). On the other side, “VR can be also seen as a creator of psychopathology” (p. 288) for its potential of inducing reality judgement and identity problems. Moreover, it is well known that this tool can induce important side effects such as cybersickness and aftereffects [18], forcing the clinician to a clear planning of his approach to lessen the probability of inducing harmful consequences for the patients.

These opposite faces are resulting from the peculiar characteristics of VR. As we have seen in Chapter 3, this tool is not simply a particular collection of technological hardware, but can be considered as a new *medium* defined in terms of its effect on both basic and major psychological processes [19-21]. According to Bricken [22] the essence of VR is the inclusive relationship between the participant and the virtual environment, where direct experience of the immersive environment constitutes communication. In this sense, VR can be considered as the leading edge of a general evolution of present communication interfaces like television, computer and telephone [23]. Main characteristic of this evolution is the full immersion of the human sensorimotor channels into a vivid and global communication experience [24].

Following this approach, it is also possible to define VR in terms of human experience [25]: "a real or simulated environment in which a perceiver experiences telepresence," where telepresence can be described as the "experience of presence in an environment by means of a communication medium" (pp.78-80).

Starting from these definitions, in the next paragraphs we will try to outline a theoretical framework for supporting the development and tuning of clinical oriented VR systems.

6.2 From imagination to Virtual Reality

6.2.1 Mind and images

The use of mental images in psychotherapy has distant origins. Already the first “explorers” of the human psyche attributed to *oneiric* images and *conscious* images an enormous therapeutic value. Freud [26] defined them as the “highway that leads to the unconscious”; Jung [27] considered them as the only means to gain access to the collective unconscious; Adler [28] emphasized the marked correspondence between the world of dreams and the world of imagination.

From the birth of clinical psychology to the present day, the majority of psychotherapeutic techniques that have been developed and consolidated over time have been based on the analysis and modification of mental images. Starting from the interpretation of dreams up to the most up-to-date procedures of cognitive restructuring, the common goal has been to intervene on the internal representations of reality that prove to be non-functional with respect to the required adaptation to the environment.

The images of the mind constitute the result of the operation of psychological processes and describe to us three aspects of extreme importance for assessment of, and intervention on, the individual - the representations of self, the representations of the world, and the representations of the future - which are characteristic for every subject and, in certain

cases, may be associated to precise psychopathological types. The assessment of possible dysfunctions and the subsequent treatment cannot therefore disregard the examination of processes of perception, thought and attribution of meaning through the involvement of the verbalized images.

In the seventies, Beck [29] in describing some of the more frequent behavioral syndromes, defined anxiety disorder as the result of the visualization of oppressive images regarding the theme of danger. Some time later, Arieti [30] added that it is precisely the presence and persistence of such images that favor the maintenance of the emotional behavior even in the absence of the anxiety-provoking stimulus.

The power of imagination on human behavior has been demonstrated experimentally through research work carried out in the psycho-physiological disciplines. In these studies, the subjects stimulated to produce certain mental images manifested a series of corresponding physiological modifications. Increase in heart rate, modification in pupil size, inhibition of gastro-intestinal activity, increase in the level of glucose in the blood, modifications in muscular tension, and alterations in skin temperature are some of the somatic reactions identified as a direct consequence of precise imaginative processes [31].

The fact that mental representations have the power to determine changes in the balance of organic functioning explains the importance of the cognitive factor as a determining element in the genesis of psychopathological disorders. But if imagination pays a role of such importance in aetiopathogenetic processes of human behavior, the modification and substitution of images associated to these dysfunctions represent indispensable elements in the complex process of diagnosis and care of psychological distress.

In the sixties, experimental neurophysiology gave a strong impetus to the development of rehabilitation procedures based on the utilization of mental images in clinical psychology. In 1963, Penfield showed that the cerebral location of imaginative excitation is exactly in the area of the cortex delegated to sensorial functions [32]. A few years later, other authors, developing this same vein of research, confirmed that experiences of imagination and perception may be difficult to distinguish, not only from the neurophysiological standpoint, but also from the experiential-qualitative standpoint [33].

The identification of the common location in the brain and the demonstration that images have a strong power of producing precise emotional responses explain the reason why experiencing something in the imagination is equivalent, in certain circumstances, to having experiences in reality. In more recent times, Klinger [34] has described the imaginative system as the core of our psychic apparatus, on which are based mechanisms of recovery, elaboration and response to external stimuli.

6.2.2 The role of imagination in therapy

On such grounds, moreover confirmed by subsequent research, there has been witnessed in the last few years a significant increase in therapeutic techniques based on the use of imagination.

In the sixties Lazarus [35] developed the “technique of projection in time”. Born in the wake of the techniques devised by Beck [36] for the treatment of patients with depressive disorders, this approach has the aim of modifying the pessimistic vision associated to alterations in the mood tone, by means of guided induction of positive and realistic images regarding the subject’s own future. This technique, which in some cases is used as part of a wider therapeutic process of cognitive restructuring, is sometimes administered by resorting to the use of symbolic images, through which is facilitated the replacement of maladaptive fantasies with other, more functional, forms of imagination.

Another typical element of cognitive therapy is the technique of “de-catastrophization of the image”. This technique, used prevalently in phobic disorders, consists in identifying the catastrophic images associated with the fear-generating element and in modifying them thanks to a process of de-dramatization.

A therapeutic technique frequently employed in anxiety disorders is the one called “image modeling and substitution”. By means of this procedure, the therapist teaches the subject to use a strategy of thought interruption, when the thought regards markedly anxiety-provoking images, and then stimulates the subject to produce pleasant and relaxing mental images, so as to reduce psycho-physiological arousal.

Other techniques that resort to mental images are those proposed by Cautela, a psychologist of the behaviorist school. Starting from the theoretical assumption of social learning and operative learning, Cautela [37] has developed the techniques of “covert conditioning”. In comparison with the corresponding traditional techniques, such as extinction, positive reinforcement, negative reinforcement, modeling, etc., covert techniques are administered by resorting to the systematic use of images.

Authors who have given a strong impetus to the development of psychotherapy and “in imagination” techniques are Meichenbaum [38], who has structured “stress-inoculation training”, “self-instructional training”, and “coping imagery”, and Goldfried [39] who introduced “systematic rational restructuring”. In these procedures, the role played by the induction of mental images is a central one.

Also the elective techniques of cognitive-behavioral therapy have recourse to the patient’s capacity for producing mental images. Procedures of “implosion”, “flooding”, “gradual exposure”, and “systematic de-sensitization” may be used both “in imagination” and “in vivo” [40].

Klinger [34] has described the imaginative system as the core of our psychic apparatus, on which are based mechanisms of recovery, elaboration and response to external stimuli. On such grounds, moreover confirmed by subsequent research, there has been witnessed in the last few years a significant increase in therapeutic techniques based on the use of imagination. From psycho-analytical psychotherapies, to hypnosis, to systemic, humanistic and cognitive-behavioral psychotherapies, the analysis of images associated to psychological dysfunctions and the intervention on these images via a modification of the maladaptive ones, constitute central elements of a large number of therapeutic strategies. “In imagination” techniques are innumerable. We shall take, as an example, one of the historic techniques of cognitive-behavioral therapy, namely, systematic de-sensitization (SD).

Developed by Wolpe in the sixties, this procedure of behavioral treatment is based on the principle of “reciprocal inhibition” [41]. The repeated association of a state of relaxation with an anxiety-provoking stimulus creates inhibition of the anxiety response. The aim is to stabilize an adaptive response - the antagonist of anxiety - as a consequence of the administration of the stimuli that initially generated the dysfunction. The phases in which SD is structured comprise the definition of a hierarchy of anxiety-provoking stimuli set in ascending order of intensity, the transfer to the patient of the skills necessary for obtaining a profound state of psycho-physical relaxation, the display of the least anxiety-provoking stimulus in the state of relaxation until the inhibition of the anxiety response is achieved, and the passage to the next stimulus in the hierarchy.

Traditionally, this treatment is carried out “in imagination” or “*in vivo*”. In the first case, the subject is trained to produce the anxiety-provoking stimuli through mental images; in the second case, the subject actually experiences these stimuli in semi-structured situations. Both of these methods present advantages and limitations as regards the cost-benefit ratio. In the first case, the prevalent difficulty is represented by teaching

the subject to produce the images that regard experiences associated to anxiety: the majority of failures linked to this therapy regards those subjects who present particular difficulties in visualizing scenes of real life.

The cost of the application, however, is minimal, because the therapy is administered in the physician's office, thus avoiding situations that might be embarrassing for the patient and safeguarding his privacy. In the second case, the difficulty lies in structuring, in reality, experiences regarding the hierarchically ordered anxiety-provoking stimuli, with the result that the cost in terms of time, money and emotions is high. At the same time, the advantage of contending with real contexts increases the likelihood of effectiveness of the "*in vivo*" procedure.

6.2.3 Virtual reality as advanced imaginal system

In this context, VR takes its place as *advanced imaginal system*: an experience that is able to reduce the gap existing between imagination and reality [4, 42]. According to Banos and colleagues [17], VR can affect cognitive development for "its capability of reducing the distinction between the computer's reality and the conventional reality." Moreover, "VR can be used for experiencing different identities and… even other forms of self, as well" (p. 289). As noted by Vincelli [42] this experience can induce in the patient the awareness of being more skilled in the difficult operations of recovery of past experiences, through the memory, and of foreseeing of future experiences, through the imagination. But can VR be considered an experience?

As discussed in Chapter 3, for many researchers VR is first of all a technology. Since 1986, when Jaron Lamier conied the term, VR has been usually described as a collection of technological devices: a computer capable of 3D real-time animation, a head-mounted display, data gloves equipped with one or more position trackers. For instance, Heim [43] recently described VR as "a technology" (p. 6) and a similar position can be found in many recent books and papers.

This vision is also well reflected in the growing research work concerned with virtual environments (VE). Most of it has addressed more the development of new rendering technologies than the highly interactive and dynamic nature of user-system interaction that VR supports.

However, this focus on technology is somewhat disappointing [21]. As noted by Steuer [25] this approach "fails to provide any insight into the processes or effects of using these systems, fails to provide a conceptual framework from which to make regulatory decisions and fails to provide an aesthetic from which to create media products" (p. 73).

VR constitutes a three-dimensional interface that puts the interacting subject in a condition of active exchange with a world re-created via the computer. The possibility of not limiting the paradigm of interaction in a unidirectional sense represents the strong point of the new technology: man is not simply an external observer of pictures or one who passively experiences the reality created by the computer, but on the contrary may actively modify the three-dimensional world in which he is acting, in a condition of complete sensorial immersion [44, 45].

For these characteristics VR can be considered as the leading edge of a general evolution of present communication interfaces [21, 46]. But, what is a communication interface?

Biocca & Delaney [24] defined a communication interface as "the interaction of the physical media, codes and information with the sensorimotor channels of the user" (p. 59). Designers play a key role in defining the characteristics of this advanced communication interface. In order for a virtual environment to work the user has to have some idea about

what the virtual reality system expects and can handle, and the environment has to incorporate some information about what the person's goals and behaviors are likely to be [47]. These two aspects, the user's "mental model" of the virtual reality system and the designer's "understanding" of the user, are just as much a part of the interface as its physical and sensory manifestations [48, 49].

In Chapter 3 we reported the following example that can be used to understand better this point:

When a user is trying to touch a spider (task) in the virtual environment using a dataglove, he/she manipulates an iconic representation of both the hand and the spider that are designed to stand for the real objects in his/her internal model of what he/she is doing. For most users, moving the hand in the virtual environment to touch the spider is a quite straightforward action, analogous to moving the "real" hand on his/her "real" environment [46].

In this sense, the role of the designer is to make the user believe that what he/she does when he/she moves the hand is an analog to moving the “real” hand [47].

6.3 Presence in a clinical oriented virtual environment

6.3.1 The perceptual illusion of nonmediation

As introduced in Chapter 3 the possible use of a virtual environement as an advanced imaginal system is based on a key idea: the perceptual illusion of nonmediation. Following Lombard & Ditton [50] the term *perceptual* shows that the illusion "involves continuous (real time) responses of the human sensory, cognitive, and affective processing systems to objects and entities in a person's environment." And, what's more, a subject experience an *illusion of nonmediation* when "fails to perceive or acknowledge the existence of a medium in his/her communication environment and responds as he/she would if the medium were not there".

So, a key issue for developing satisfying virtual environments for the clinical use is the *disappearance of mediation*, a level of experience where the VR system and the external physical environment disappear from the user's phenomenal awareness. When this happens, the difference between “in imagination” and “in vivo” treatments disappears too.

But how can we obtain this result? Most of the work in this area tries to reach the disappearance of mediation by providing to the user a more “realistic” experience, such as adding physical qualities to virtual objects. For instance, Hoffman and colleagues [51] published in the “Virtual Reality” journal the results of two experiments in which they tried to verify if adding olfactory cues and tactile feedback to a VE may improve its sense of presence.

But is it really so important, this focus on the physical characteristics of a VE? As suggested in the paper published in the “Virtual Reality” journal just after the one of Hoffman et al., more than the richness of available images, the sensation of presence depends on the level of interaction/interactivity which actors have in both “real” and simulated environments [52]. According to the two authors a VE, particularly when it is used for real world applications, is effective when “the user is able to navigate, select, pick, move and manipulate an object much more naturally (pp.235). In this sense, emphasis shifts from quality of image to freedom of movement, from the graphic perfection of the system to the actions of actors in the environment: "Experience of space will depend more

on the mode of locomotion than on the visual and acoustic images. The reality of a surface will be in its implications for action (e.g., does it impede locomotion) rather than in its appearance (e.g., does it look like a wall). In this approach, the reality of experience is defined relative to functionality, rather than to appearances" [53].

6.3.2 A cultural approach to presence

If we recall the definition of telepresence presented by Steuer in the Introduction, we can verify the strict link between this definition and the perceptual illusion of nonmediation: only with this illusion is possible being present in an environment by means of a communication medium.

Even if these definitions seem intuitive to us, their effects are not. In fact, there continues to be contention and general disagreement over the role of presence and telepresence in a VE [54].

The research on telepresence emerged with teleoperators, robots that are controlled by human's perceptual and motor skills instead of by the central processing unit of a computer. The following definition of telepresence was adapted from Sheridan [55]: telepresence is the ideal of sensing sufficient information about the teleoperator and task environment and communicating this to the human operator in a sufficient natural way, so that the operator feels physically present at the remote site. In this vision physical presence accompanies subjective presence, consisting of the perception of being located in the same physical space in which a certain event happens, a certain process takes place, or a certain person stands [56-58].

This vision is also shared by many VR researchers. For Slater [59, 60] the notion of presence includes three aspects [59]:

- "the sense of being there in the environment depicted by the VE";
- "the extent to which the VE becomes the dominant one, i.e., that participants will tend to respond to events in the VE rather than in the real world";
- "the extent to which participants, after the VE experience, remember it as having visited a place rather than just having seen images generated by a computer" (pp.560-561).

Following this approach, the key difference between presence and telepresence is that the former is a "natural" fact, whereas the latter is a fact produced by technology, an artifact. This difference also occurs in the definition of Slater & Wilbur [60] according to whom presence "...is both a subjective and objective description of a person's state with respect to an environment" (p. 606). Particularly, *objective description* is defined as "...an observable behavioral phenomenon, the extent to which individuals behave in a VE similar to the way they would behave in analogous circumstances in everyday reality" (p. 606).

Recently Mantovani and Riva proposed a different concept of presence [54], following the perspective of social constructionism now strongly emerging in social psychology. According to this position "reality" is not "outside", escaping social interchange and cultural mediation. On the contrary, it is continually being negotiated and filtered by artifacts, by means of which we adapt the environment to our needs and at the same time adapt ourselves to the environment in order to exploit the affordances it offers us [61]. In fact, the environment does not provide undifferentiated information, ready-made objects equal for everyone. It offers different opportunities according to the actors and their needs [62]. *Affordances* are not "things which are outside'" simply waiting for someone to come and take a photograph of them. They are resources, which are only revealed to those who seek them.

Lying at the base of this view are two elements which promise an elevated sense of presence: a *cultural framework* and the possibility of *negotiation*, both of actions and of their meaning [63].

Within this view, experiencing presence and telepresence does not depend so much on the faithfulness of the reproduction of physical aspects of "external reality" as on the capacity of the simulation to produce a context in which social actors may communicate and cooperate [64].

A study analyzed a large sample of visitors to Walt Disney World's Epcot Center© to identify the aspects that lead to a more realistic experience of a VR ride [65]. The results showed that aspects of immersive interfaces, including displays, graphics and control device quality were not as important to the users as the "physics fidelity" (e.g. motion) of the rides, their background stories and goals.

As noted by Draper and colleagues [66] the ability of a VE to create a rich computer-mediated world does not annul the responsibility of designers to tailor interfaces to meet the task-dependant needs of the user. It is true that rich and immersive interfaces can display much more information and in a more compelling way than was possible with non-immersive technology. However, it is also true that "in some cases, simple map reading has been more effective in imparting knowledge about an environment than experience in a virtual representation of that environment" [66, p. 361].

According to Ellis [67] the key questions for a VR designer are: "Can the users accomplish the tasks they accept? Can they acquire the necessary information? Do they have the necessary control authority? Can they correctly sequence their subtasks?" (p.258). In fact, the successful implementation of virtual environment simulations will directly depend on the answers to these types of questions.

6.3.3 Building and sharing a common ground

It is well known that a core feature of any form of psychological therapy is the relationship between client and therapist. However, understanding how to use VR to support this relationship presents a substantial challenge for the designers and users of clinical oriented VEs. This challenge is even more demanding when multi-user VEs are considered.

First, VEs are designed to serve a purpose, so must be designed with intended users' tasks and goals explicitly considered [68]. Moreover, during the VR experience the knowledge relevant to the goal should be distributed, and actions should be coordinated. Particularly, to support collaborative activities VEs should provide task appropriate information representation and communication tools embedded in the environment in which activities happen [69].

Second, as we have seen before, the possibility of negotiation, both of actions and of their meaning, has a key role in providing a satisfactory sense of presence. This is even truer for clinical oriented VEs where empathy and communication are the key features of the experience. However, subjects vary tremendously in their negotiation strategies as well as in their task accomplishment process [69]. The difficulty of managing negotiation has two consequences for the design of clinical oriented VEs [20].

- the only way to understand negotiation is by analyzing the subjects involved in the environment in which they operate. This means that the social context in which the VR experience occurs plays a crucial role;
- new processes and activities will develop during interactions which challenge and change the initial relationship between subject and context. So clinical oriented VEs have to be flexible enough to handle these changes without imposing constraints to the interaction.

Churchill & Snowdon [69] recently identified a series of key issues a VE developer has to face for supporting the negotiation process (pp. 5-7):

1. *The transition between shared and individual activities*. Actors should know what is currently being done and what has been done in the context of the task goals.
2. *Flexible and multiple viewpoints and representations*. Tasks often need use of multiple representations each tailored to a different point of view and different subtasks.
3. *A shared context*. The shared context is composed of symbolic references which allow actors to orient and coordinate themselves. It includes the shared knowledge of each others' current activities, shared knowledge of each others' past activities, shared artifacts and shared environment.
4. *The awareness of others*. This awareness includes both the knowledge of shared task related activities and the sense of co-presence.
5. *The support to communication activities*. Negotiation through face-to-face talks is important for collaboration. In fact, conversation analytic studies of negotiation at work have detailed how subtle verbal and non verbal contribute to such negotiation.

However, this is more difficult in VR than in other computer-based activities. As noted by Oravec [70], VR forces individuals "to deal with such issues of image manipulation and distortion on an immediate and personal basis, as participant immersed in fast-moving interaction" (p.51). This adds layers of complexity to an already-overwhelming set of social constructs.

As we have already seen in Chapter 3, to overcome this problem, VR designers usually use some tricks. For instance, more of the effort of the design of multi-user VR is focused toward developing tools for the creation of faces. This choice reflects the considerable societal attention on the face as medium for expression and information display. Generally, development of multi-user VR systems calls for conceptual mechanisms with which groups can be constructed and vehicles through which groups can express themselves [70].

Many developers of multi-user VR systems are aware of this and are conscious of the need to "create community" in the context of their efforts [70]. Even if many traditional means for creating community are not available, a great effort is given to the creation of virtual town squares or meeting rooms. According to Coate [71] the work of maintaining virtual communities is similar to the one of an innkeeper: facilitating interaction and keeping order among patrons. In fact, if multi-user VR has to serve as community for its users, it has to embody, or replace with adequate substitutes, some functions of community life that parallel those commonly provided by "traditional" communities. This is even truer for the development of clinical oriented multi-user VR systems, where the sense of community could be an important boost of therapy.

6.4 Conclusions

The great potential offered by VR derives prevalently from the central role, in psychotherapy, occupied by the imagination and by memory. These two elements, which are fundamental in the life of every one of us, present absolute and relative limits to the individual potential. Using VR as an advanced imaginal system - an experience that is able to reduce the gap existing between imagination and reality - it is possible to transcend these limits.

In this sense VR can improve the efficacy of a psychological therapy for its capability of reducing the distinction between the computer's reality and the conventional reality.

This experience can induce in the patient the awareness of being more skilled in the difficult operations of recovery of past experiences, through the memory, and of foreseeing of future experiences, through the imagination.

Two are the core characteristics of this clinical experience: the perceptual illusion of nonmediation and the possibility of building and sharing a common ground. As discussed also in Chapter 3, the first characteristic of a satisfying virtual environment is the *disappearance of mediation*, a level of experience where both the VR system and the physical environment disappear from the user's phenomenal awareness. When this happens, the user is not simply an external observer of pictures or one who passively experiences the reality created by the computer, but on the contrary may actively change the three-dimensional world in which he is acting, in a condition of complete sensorial immersion. In this way the subject undergoing treatment perceives the advantage of being able to re-create and use a real experiential world within the walls of the clinical office of his own therapist.

The second characteristic of a satisfying virtual environment for clinical therapy is the possibility of building and sharing a common ground through the interaction process. Through interaction, individuals share empathy and, in multi-user VR, form groups that share interests. So, information exchange becomes the carrier for expressing self-concept and eliciting emotional support.

At the end we can propose a new definition of *presence* [54] that (a) recognizes the mediated character of every possible experience of presence; (b) always conceives experience as immersed in a social context; (c) stresses the component of ambiguity inherent in everyday situations; (d) highlights the function of confirmation which culture (artifacts and principles) plays. Breaking down this idea into formulas, we may say that [54, p. 545]:

- presence is always mediated by both physical and conceptual tools which belong to a given culture: “physical” presence in an environment is no more “real” or more true than telepresence or immersion in a simulated virtual environment;
- the criterion of the validity of presence does not consist of simply reproducing the conditions of physical presence but in constructing environments in which actors may function in an ecologically valid way: we accept the emphasis of ecological approach on the primacy of action on mere perception;
- action is not undertaken by isolated individuals but by members of a community who face ambiguous situations in a relatively coordinated way: to be able to speak of an actor’s presence in a given situation, his freedom of movement must be guaranteed, both in the physical environment (locomotion) and in the social environment, composed of other actors involved in the same situation, in whatever way and for whatever reason.

In this sense, experiencing presence in a clinical VE such as a shared virtual hospital requires more than reproduction of the physical features of external reality; it requires the creation and sharing of the cultural web that makes meaningful - and therefore visible - both people and objects populating the environment.

6.5 Acknowledgments

This chapter will be published with the title ”Interaction and presence in the clinical relationship: VR as communicative medium between patient and therapist” by the journal “Presence: Teleoperators and Virtual Environments”, 2001. Copyright MIT Press, 2001.

6.6 References

[1] L. F. Hodges, B. O. Rothbaum, R. Kooper, D. Opdyke, T. Meyer, M. North, J. J. de Graaff, and J. Williford, Virtual environments for treating the fear of heights, *IEEE Computer* **28** (1995) 27-34.

[2] R. Lamson, Virtual therapy of anxiety disorders, *CyberEdge Journal* **4** (1994) 6-8.

[3] L. F. Hodges, B. O. Rothbaum, B. Watson, G. D. Kessler, and D. Opdyke, A Virtual Airplane for Fear of Flying Therapy, presented at Virtual Reality Annual International Symposium - VRAIS '96, Los Alamitos, CA, 1996.

[4] M. M. North, S. M. North, and J. R. Coble, Virtual reality therapy for fear of flying, *American Journal of Psychiatry* **154** (1997) 130.

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

[6] C. Botella, R. M. Baños, C. Perpiña, H. Villa, M. Alcañiz, and A. Rey, Virtual reality treatment of claustrophobia: A case report, *Behaviour Research & Therapy* **36** (1998) 239-246.

[7] M. M. North, S. M. North, and J. R. Coble, Virtual reality therapy: an effective treatment for phobias, *Studies in Health Technology and Informatics* **58** (1998) 112-9.

[8] B. O. Rothbaum, L. Hodges, R. Alarcon, D. Ready, F. Shahar, K. Graap, J. Pair, P. Hebert, D. Gotz, B. Wills, and D. Baltzell, Virtual reality exposure therapy for PTSD Vietnam Veterans: a case study, *J Trauma Stress* **12** (1999) 263-71.

[9] G. Riva, M. Bacchetta, M. Baruffi, S. Rinaldi, and E. Molinari, Experiential Cognitive Therapy: a VR based approach for the assessment and treatment of eating disorders, in *Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction*, G. Riva, B. Wiederhold, and E. Molinari, Eds. Amsterdam: IOS Press, 1998, pp. 120-135.

[10] G. Riva, M. Bacchetta, M. Baruffi, S. Rinaldi, F. Vincelli, and E. Molinari, Virtual reality-based experiential cognitive treatment of obesity and binge-eating disorders, *Clinical Psychology and Psychotherapy* **7** (2000) 209-219.

[11] G. Optale, A. Munari, A. Nasta, C. Pianon, J. Baldaro Verde, and G. Viggiano, Multimedia and virtual reality techniques in the treatment of male erectile disorders, *Int J Impot Res* **9** (1997) 197-203.

[12] G. Optale, F. Chierichetti, A. Munari, A. Nasta, C. Pianon, G. Viggiano, and G. Ferlin, 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** (1999) 249-251.

[13] H. G. Hoffman, J. N. Doctor, D. R. Patterson, G. J. Carrougher, and T. A. Furness, 3rd, Virtual reality as an adjunctive pain control during burn wound care in adolescent patients, *Pain* **85** (2000) 305-9.

[14] G. Riva, B. Wiederhold, and E. Molinari, Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction, . Amsterdam: IOS Press, 1998, pp. 249.

[15] K. Glantz, N. I. Durlach, R. C. Barnett, and W. A. Aviles, Virtual reality (VR) and psychotherapy: Opportunities and challenges, *Presence, Teleoperators, and Virtual Environments* **6** (1997) 87-105.

[16] G. Riva, Design of clinically oriented virtual environments: A communicative approach, *CyberPsychology & Behavior* **3** (2000) 351-358.

[17] R. M. Banos, C. Botella, and P. C., Virtual Reality and Psychopathology, *CyberPsychology & Behavior* **2** (1999) 283-292.

[18] A. Rizzo, M. Wiederhold, and J. G. Buckwalter, Basic issues in the use of virtual environments for mental health applications, in *Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction*, G. Riva, B. Wiederhold, and E. Molinari, Eds. Amsterdam: IOS Press, 1998, pp. 21-42.

[19] N. I. Durlach and A. S. E. Mavor, *Virtual reality: scientific and technological challenges*. Washington, D.C.: National Academy Press, 1995.

[20] G. Riva, From technology to communication: Psycho-social issues in developing virtual environments, *Journal of Visual Languages and Computing* **10** (1999) 87-97.

[21] G. Riva, Virtual Reality as a communication tool: a socio-cognitive analysis, *Presence, Teleoperators, and Virtual Environments* **8** (1999) 460-466.

[22] W. Bricken, Virtual reality: Directions of growth, University of Washington, Seattle, WA HITL Technical Report R-90-1, 1990.

[23] A. Kay, Computer software, *Scientific American* **251** (1984) 52-59.

[24] F. Biocca and B. Delaney, Immersive virtual reality technology, in *Communication in the age of virtual reality*, F. Biocca and M. R. Levy, Eds. Hillsdale, NJ: Lawrence Erlbaum Associates, 1995, pp. 57-124.

[25] J. S. Steuer, Defining virtual reality: Dimensions determining telepresence, *Journal of Communication* **42** (1992) 73-93.

[26] S. Freud, *The interpretation of dreams*. London: Hogart Press, 1899.
[27] C. G. Jung, *The psychology of the unconscious*. London: Collected Works, 1926.
[28] A. Adler, *Praxis und theorie der individualpsychologie*. Monaco: Bergman, 1920.
[29] A. T. Beck and G. Emery, *Anxiety disorders and phobias*. New York: Basic Books, 1985.
[30] S. Arieti, *Creativity: The magic sinthesis*. New York: Basic Books, 1976.
[31] T. X. Barber, H. M. Chauncey, and R. A. Winer, The effect of hypnotic suggestions on parotid gland response to gustatori stimuli, *Psychosomatic Medicine* **26** (1964) 374-380.
[32] W. Penfield, The brains record of auditory and visual experience, *Brain* **86** (1963) 595-696.
[33] E. R. John, *Mechanism of memory*. New York: Academic Press, 1976.
[34] E. Klinger, *The structure and function of fantasy*. New York: Wiley, 1971.
[35] A. A. Lazarus, Learning theory and the treatment of depression, *Behavior Research and Therapy* **6** (1968) 83-89.
[36] A. T. Beck, *Depression: Clinical, Experimental, and Theoretical Aspects*. New York: Harper e Row, 1967.
[37] J. R. Cautela, Covert conditioning: assumption and procedures, *Journal of Mental Imagery* **1** (1977) 53-64.
[38] D. Meichenbaum, *Cognitive behavior modification*. New York: Plenum Press, 1977.
[39] M. Goldfried and A. Goldfried, *Helping people change*. New York: Pergamon Press, 1975.
[40] T. Stampyl and D. Levis, Essential of therapy: A learning theory based psychodinamic behavioral therapy, *Journal of Abnormal Psychology* **72** (1967) 496-503.
[41] J. Wolpe, *The practice of behavior therapy*. New York: Pergamon Press, 1969.
[42] F. Vincelli, From imagination to virtual reality: the future of clinical psychology, *CyberPsychology & Behavior* **2** (1999) 241-248.
[43] M. Heim, *Virtual Realism*. New York: Oxford University Press, 1998.
[44] G. Riva, Virtual reality as assessment tool in psychology, in *Virtual reality in neuro-psycho-physiology: Cognitive, clinical and methodological issues in assessment and rehabilitation*, G. Riva, Ed. Amsterdam: IOS Press, 1997, pp. 95-112.
[45] F. Vincelli and E. Molinari, Virtual reality and imaginative techniques in clinical psychology, in *Virtual environments in clinical psychology and neuroscience: Methods and techniques in advanced patient-therapist interaction*, G. Riva, B. Wiederhold, and E. Molinari, Eds. Amsterdam: IOS Press, 1998, pp. 67-72.
[46] G. Riva and G. Mantovani, The ergonomics of virtual reality: Human factors in developing clinical-oriented virtual environments, in *Medicine meets virtual reality. The convergence of physical & informational technologies: Options for a new era in healthcare*, J. D. Westwood, H. H. Hoffman, R. A. Robb, and D. Stredney, Eds. Amsterdam: IOS Press, 1999, pp. 278-284.
[47] T. Bardini, Bridging the Gulfs: From Hypertext to Cyberspace, *Journal of Computer Mediated-Communication [On-line]* **3** (1997) Available: http://www.ascusc.org/jcmc/vol3/issue2/bardini.html.
[48] B. Laurel, Interface agents: Metaphors with character, in *The art of human computer interface design*, B. Laurel, Ed. Reading, MA: Addison-Wesley, 1990, pp. 355-365.
[49] B. Laurel, *Computers as theater*. Reading, MA: Addison-Wesley, 1991.
[50] M. Lombard and T. Ditton, At the heart of it all: The concept of presence, *Journal of Computer Mediated-Communication [On-line]* **3** (1997) Available: http://www.ascusc.org/jcmc/vol3/issue2/lombard.html.
[51] H. G. Hoffman, A. Hollander, K. Schroder, S. Rousseau, and T. Furness III, Physically touching and tasting virtual objects enhances the realism of virtual experiences, *Virtual Reality* **3** (1998) 226-234.
[52] L. Sastry and D. R. S. Boyd, Virtual environments for engineering applications, *Virtual Reality: Research, development and applications* **3** (1998) 235-244.
[53] J. M. Flach and J. G. Holden, The reality of experience, *Presence, Teleoperators, and Virtual Environments* **7** (1998) 90-95.
[54] G. Mantovani and G. Riva, "Real" presence: How different ontologies generate different criteria for presence, telepresence, and virtual presence, *Presence, Teleoperators, and Virtual Environments* **8** (1999) 538-548.
[55] T. B. Sheridan, Telerobotics, *Automatica* **25** (1989) 487-507.
[56] T. B. Sheridan, Musing on telepresence and virtual presence, *Presence, Teleoperators, and Virtual Environments* **1** (1992) 120-125.
[57] T. B. Sheridan and D. Zeltzer, Virtual environments, *MD Comput* **11** (1994) 307-10.
[58] T. B. Sheridan, Further musing on the psychophysics of presence, *Presence, Teleoperators, and Virtual Environments* **5** (1996) 241-246.
[59] M. Slater, Measuring presence: a response to the Witmer and Singer Presence Questionnaire, *Presence: Teleoperators and Virtual Environments* **8** (1999) 560-565.

[60] M. Slater and S. Wilbur, A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments, *Presence: Teleoperators and Virtual Environments* **6** (1997) 603-616.
[61] J. J. Gibson, *The ecological approach to visual perception*. Hillsdale, NJ: Erlbaum, 1979.
[62] P. Zahoric and R. L. Jenison, Presence as being-in-the-world, *Presence, Teleoperators, and Virtual Environments* **7** (1998) 78-89.
[63] K. J. Gergen, *Toward transformation in social knowledge*. New York: Springer, 1982.
[64] G. Mantovani, *New communication environments: from everyday to virtual*. London: Taylor & Francis, 1996.
[65] R. Pausch, J. Snoody, R. Taylor, S. Watson, and E. Haseltine, Disney's Alladin. First steps toward storytelling in virtual reality, presented at 23rd Annual Conference on Computer Graphics, New York, 1996.
[66] J. V. Draper, D. B. Kaber, and J. M. Usher, Speculations on the value of telepresence, *CyberPsychology & Behavior* **2** (1999) 349-362.
[67] N. Ellis, Presence of mind: a reaction to Thomas Sheridan's "Further musings on the psychophysics of presence", *Presence, Teleoperators, and Virtual Environments* **5** (1996) 247-259.
[68] T. Rodden, J. Mariani, and G. Blair, Supporting cooperative applications, *International Journal of Computer Supported Cooperative Work* **1** (1992) 1-2.
[69] E. F. Churchill and D. Snowdon, Collaborative virtual environments: an introductory review of issues and systems, *Virtual Reality* **3** (1998) 3-15.
[70] J. A. Oravec, *Virtual individuals, virtual groups: Human dimension of Groupware and Computer Networking*. Cambridge, UK: Cambridge University Press, 1996.
[71] J. Coate, *Innkeeping in Cyberspace. Proceedings of Directions and Implications of Advanced Computing*. Palo Alto, CA: Computer Professional for Social Responsibility, 1992.