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Do you feel as if you are there? Measuring presence in cybertherapy

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Abstract

The present paper examines previously published research addressing users' sensations of presence in virtual environments designed to support psychological therapy. A set of 47 papers reporting empirical studies is examined to single out the way in which presence is approached. This examination highlights the key role attributed to presence in cybertherapy as well as a number of recurrent assumptions of the way in which it operates to affect the patient's experience. It also reveals a lack of efforts in investigating the nature of this experience from a qualitative point of view.

Keywords---**presence, cybertherapy**

1. Introduction

Cyberpsychology is psychological therapy carried out in a virtual environment, for a wide range of problems, including anxiety disorders, eating disorders, autism, phobias, and for the reduction of the pain perceived during medical treatments. This area is both an application and a research field. In this field, presence measurements are often included among the data collection techniques deployed (see [1]). This paper reports the ways in which presence is currently dealt with in cybertherapy research. Works published till 2010 and having both „presence“ and „therapy“ in their text were sought in scientific databases (PsycInfo and PubMed), scientific journals (Presence: teleoperators and virtual environments, Cyberpsychology and behavior, PsychNology Journal, Annual Review of CyberTherapy and Telemedicine, Journal of CyberTherapy and Rehabilitation), and in the proceedings of The Annual International Workshop on Presence. A set of 47 papers (listed in the Appendix) remained after discarding papers that were actually not related to the selected topic or did not report any empirical results. These papers were then examined to identify the functions that are implicitly or explicitly attributed to the concept of presence in cybertherapy. The results are reported in the

following sections: Section 2 illustrated the available techniques to investigate presence and then identifies the techniques used in cybertherapy studies; Section 3 examines the role attributed to presence in these studies and Section 4 dwells on one underlying assumption, i.e., that presence is as distraction from the real world. Some recommendations are made in the conclusions.

2. Available and adopted techniques to measure presence

In social science, a psychological experience can be investigated with methods that can be roughly characterized as quantitative or qualitative. In the case of presence, a quantitative approach would measure the level of presence experienced by the person in a mediated environment; a qualitative approach would describe the nature of the presence experience. This categorization crosses another distinction, the difference between direct and indirect methods, depending on the access to the phenomenon under investigation. The rest of this section shows that all these types of investigation techniques are already available in presence studies and then concludes by showing which kind of technique is primarily used when presence is addressed in cybertherapy studies.

2.1. Available techniques: Quantitative...

2.1.1. Indirect. In social science self-report is the most common data collection technique. Similarly, the vast majority of data collected about sensations of presence is post-exposure self-report. In most cases participants respond to Likert-type scales inquiring about how they felt during the media exposure. Participants are asked to answer questions such as “How immersed did you feel during the media experience” and “How completely were all your senses engaged?” These types of measures are highly subjective and rely on the participants' ability to recall their emotion and cognitions during the media experience. While this is the current norm in presence research various researchers have

questioned whether this methodology is best providing evidence about presence sensations [[2] - [3].

Other researchers have used continuous measurement techniques such as dials [[4] - [5] and sliders [6] these types of measurement techniques allow participants to rate their emotions and sensations of presence during the actual media or virtual experience. One concern is whether participants in a high presence state will remember to turn the dial.

Additionally, secondary task reaction time (STRT) has been employed in several studies. STRT is a continuous measure that assesses the level of attention a participant is giving a particular task by measuring the duration of time it takes for a participant to respond to either an audio and/or visual cue provided during a media or virtual experience [7]. Prior research has documented that STRT is highly correlated with psychophysiological measures of attention.

2.1.2. Direct. Objective measures, such as psychophysiology and other continuous measurement have been used periodically to test existence of presence sensations. The most commonly used psychophysiological measures are EKG (i.e., heart rate) and Galvanic Skin Response (GSR). These two measures have been documented as having a direct relationship to attention. Several researchers have attempted to use attention as measurement of presence [5] 6, 8-9] with mixed results.

Other less common methods include Electroencephalography (i.e., EEG) or the measurement of brain waves using sensors on the forehead and scalp, Functional magnetic resonance imaging (i.e., fMRI) measuring blood flow in the brain to indicate which parts of the brain are being used to process information, Electromyography (i.e., EMG) to measure muscle movement (most often facial muscles) and ocular measures (e.g, eye movement). While still relatively uncommon the cost of these measurement techniques has lessened and they are being employed more often.

The extent to which presence is experienced can be measured also with a direct observation of some users' behaviors – either real or virtual. For instance, a real behavior is ducking if an object is looming to the users [10] or rotating the shoulders to pass through a tight door entrance [11]. This approach implies some assumptions about the kind of behavior that reveals presence or an experiment demonstrating that a certain behavior can be considered as a measure of presence. In many cases, the possible degrees of presence are 0/1, namely either a person is present in the environment where the behavior is expected (be it virtual, real or mixed) or s/he is not. A

different kind of behavioral measure is based on virtual actions undertaken by the user, to obtain the measure of his/her behavioral involvement with the virtual environments or the other users. This can be most proficiently used via automatic detection by the virtual reality environment itself, which records each time a certain operation on the interface is performed and can return a richer measure than 0/1 [12].

2.2. ... and qualitative

Most common qualitative methods to investigate presence are interviews and the observation of the users' actions. Interviews can be grouped into two categories, individual interviews and group interviews (or focus groups). The interview method requires participants to respond to a question verbally. In the case of in-depth interviews participants talk with the interviewer and the data collection can appear to be conversation-like. The use of in-depth interviews in presence research has been limited and was by-passed with quick introduction of self-report measures in the early 1990s. Group interviews or focus groups rely on the interaction of the participants to reveal key aspects of the research questions. Again, the use with-in presence research has been limited.

A different qualitative method to study presence is the analysis of the verbal and nonverbal interaction of the user with other users or the virtual environment, in order to discover the structure of the interaction and its relation with the affordances of the medium [13] -[15] . The research questions in this case do not regard the extent to which a person is present in a certain environment but the configuration of the users' presence in the mediated environment. The nature of the environment itself and its composition become an object of investigation, to study its extension with respect to the users' actions or in the users' phenomenological experience.

2.3. Techniques adopted in cybertherapy

The most adopted technique to investigate sensations of presence in the cybertherapy studies examined was self-report questionnaire (Table 1).

The scales and questionnaires treat presence as an internal state, which depends on the personality of the individual; they also treat the virtual environment as a pre-defined space, opposite to the real environment (i.e., 0/1). However, presence can be treated as a consequence of the users' action in the environment. While in the first case the notion of presence and environment is taken for granted, in the second case it is investigated to understand

Table 1. Presence questionnaires adopted by at least two studies and number of studies adopting them.

Questionnaire	Adoption
Presence Questionnaire, PQ [16]	19
International Test Commission-Sense of Presence Inventory, ITC-SOPI [17]	6
Immersive Tendency Questionnaire [16] ,	6
Slater-Usoh and Steed questionnaire, SUS [18]	6
Igroup presence questionnaire [19] ,	3
Presence and Reality judgment questionnaire [20]	2

its specific meaning. The researcher investigates what kind of presence the user experiences and what subjective perception of the surrounding is coupled with that experience.

This second approach to presence seems to be a better fit for psychotherapy application, where the subjective experience and the meaning attributed to the environment in which it takes place are the central focus. However, the vast majority of the published studies does not take this perspective and explore the configuration of the users' sensation of presence. This preference for quantitative, indirect data collection techniques reveals that a large terrain is still unexplored. It also reflects the role that is attributed to presence in cybertherapy studies, which is the subject of the next section.

3. Role of presence in cybertherapy

In the cybertherapy studies considered here, three possible roles for presence are outlined: an absolute index of validity of the therapeutic virtual environment; relating with other psychological dimensions characterizing the treatment; or being predicted by personality differences.

3.1. A validation of the therapeutic environment

Presence is adopted as a criterion that, alone, can establish the effectiveness of the virtual environment in providing a vivid experience. For instance Malbos, Mestre, Note, Gellato tested nine immersive environments for claustrophobia by administering PQ and SUS after the immersion [21] . Sometimes, scholars use this approach preliminarily, to select the medium through which their specific environment will be experienced. They vary the

equipment, and compare the level of presence experienced in each of them. This was attempted by Kim et al. [22] for an environment on compulsive obsessive disorder, or by Quero, Salvador, Baños, García- Palacios, Botella and Serrano [23] who compared an environment was offered via helmet or CAVE.

3.2. Related with other relevant psychological dimensions of the treatment

While presence is one way to capture the experience of being in a virtual environment, other psychological dimensions of this experience are relevant to cybertherapy, especially those that are targeted by the treatment or are likely to moderate its success. The studies considered in the previous section assume that a connection between presence and these other dimensions exists, some authors try to check its existence directly.

3.2.1. During immersion. Meyerbroker and Emmelkamp investigated the relationship between presence ratings obtained by administering IPQ and therapeutic alliance in case of fear of flight or acrophobia, but they did not find any significant correlation between them [24] . Ku et al. [25] designed an environment for the treatment of schizophrenia, and investigated the relationship between presence, co- presence and several conversational behaviors such as emotional withdrawal or silence.

One key dimensions investigated in this manner is anxiety, probably because several applications of cybertherapy are directed to the treatment of phobias (e.g., [26]). The picture is complicated by the fact that presence and anxiety can affect each other. For example, anxiety can derive from being immersed in an unfamiliar experience rather than on the phobic nature of the virtual environment, and, conversely, presence can be more intense because the virtual environment triggers phobic reactions [27] .

3.2.2. After immersion. Other studies relate presence experienced during the immersion with the treatment results. For instance, Villani and Riva tested a relaxation environment and demonstrated that high levels of presence are predictive of success in the treatment of patients with a high level of distress [28] . Similarly, Hoffman, Patterson, Seibel, Soltani, Jewett-Leahy, and Sharar, while studying a virtual environment to distract 11 patients from the pain during medical treatment, found that if the level of presence was above the average pain

rating, then pain unpleasantness, and time spent thinking about pain were significantly reduced [29].

3.3. Subject to individual differences

Finally, researchers have raised the issue regarding individual differences. Several studies have reported that individual differences appear to impact the extent to which it is possible to feel “present” in a mediated environment and that these differences might be related to other personality dimensions. For instance, Wallach and her colleagues related immersive tendencies with empathy, imagination, dissociation tendencies and locus of control [30] and attachment [31]. The implication of measuring individual differences is to identify which patients are not likely to feel present in the virtual environment and should then be directed to other treatment modalities than cybertherapy.

4. Presence as distraction

Underlying the three possible roles of presence described above is the assumption that if the person feels highly present in the simulated world where the treatment is administered, then the symbols and events mobilized by the simulation will be more deeply experienced by the patient with beneficial implications for the treatment. In a specific application area, pain treatment, a high level of presence is a crucial pre-condition to the success of the therapy. There appears to be an additional underlying assumption, namely that being present in one environment distracts from being present in another environment (i.e., the real world).

4.1. Distraction from pain

The use of virtual environments has proven highly effective for reducing pain [29]. A few studies have used the term “distraction” as a way to explain the how cybertherapy reduces pain levels in patients. For example, Schneider and Hood [32] identified virtual environments as an application of cognitive distraction. Prior research on cognitive distraction, including mediation and relaxation have had mixed results [[33] 34]. It is worth noting that many studies using cybertherapy as a distraction do not measure presence but assume it occurs.

4.2. Distraction from the real world

The use of cybertherapy as distraction is largely atheoretical. We feel it is connected to the arrival –

departure model first put forth by Kim and Biocca [35]. In this conceptualization, sensations of presence participants experience a sensation of “being there” or “being in” the mediated environment. This description is very similar to the definitions provided in numerous studies in our sample. For example, “the feeling of being in an environment even if one is not physically present” [26]. In our sample, presence as being in or being out (i.e., 0/1) there is most common definition. If we look at Kim and Biocca’s terms we see arrival is defined as “being there’ in the virtual environment” and departure refers to “not being” in the physical environment. Further, Kim and Biocca argue that

The user may be maintaining two separate but partial models of both the physical environment and virtual environment, so that he/she might feel present in the virtual environment, but not completely removed from the physical environment. It may also be that the user’s phenomenal sense of presence oscillates between the virtual, physical, and imaginal environments (in discussion section, para 6)

This explanation seems to fit with what cybertherapy researchers are assuming is happening and yet extends the 0/1 model to be more of a continuum. It is still unclear if arrival (e.g., “being there”) or departure (e.g., “not being” in the physical environment”) leads to more successful distraction, treatment and/or reduction in symptoms.

Conclusions

In most cybertherapy studies, researchers assume that participants are experiencing sensations of presence, and that it affects the treatment; in fact, the relationship between presence and the effectiveness of the treatment has often been documented [36]. The vast majority of researchers use post-exposure self-report questionnaires that assume an oppositional relation between being present in the real world and in the virtual environment of the therapy. Although this can be instrumental to specific treatments such as pain distraction, other treatments such as phobias could benefit from a qualitative exploration of the subjective meaning attributed by the patient to the virtual environment and its relationship to the real environment. Not only would this support the choice of measuring presence as a validation of the virtual environment effectiveness, but also expand the scientific knowledge of the nature of the virtual experience.

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http://www.temple.edu/ispr/prev_conferences/proceedings/2008/tona.pdf

Appendix: The list of articles reviewed in this work

- 1 **2010** J. Gutierrez-Maldonado, O. Gutierrez-Martinez, D. Loreto, C. Penalzoa, & R. Nieto . Presence, Involvement and Efficacy of a
Virtual Reality Intervention on Pain. *Annual Review of CyberTherapy & Telemedicine*
- 2 S. D.Miyahira, R. a. Folen, M. Stetz, A. Rizzo, & M. M. Kawasaki. Use of Immersive Virtual Reality for Treating Anger. *Annual
Review of CyberTherapy & Telemedicine.*
- 3 H. S. Wallach, M. Safir, & R. Samana. Personality Variables and Presence. *Virtual Reality.*
- 4 **2009** H. S. Wallach, M. P. Safir, & I. Almog. Attachment and Sense of Presence in a Virtual Environment. *Virtual Reality.*
- 5 R. Wender, H.G. Hoffman, H.H. Hunner, E. J. Seibel, D. R. Patterson, & S. R. Sharar. Interactivity Influences the Magnitude of
Virtual Reality Analgesia. *Journal of CyberTherapy & Rehabilitation.*
- 6 A. Aimé, K. Cotton, & S. Bouchard. Reactivity to Virtual Reality Immersions in a Subclinical Sample of Women Concerned
with their Weight and Shape. *Journal of CyberTherapy & Rehabilitation.*
- 7 P. Gamito, J. Oliveira, D. Morais, S. Oliveira, N. Duarte, T. Saraiva, M. Pombal, & P. Rosa. Virtual Reality Therapy Controlled
Study for War Veterans with PTSD. Preliminary Results. *Annual Review of CyberTherapy & Telemedicine.*
- 8 B. Girard, V. Turcotte, S. Bouchard, & B. Girard. Crushing Virtual Cigarettes Reduces Tobacco Addiction and Treatment
Discontinuation. *CyberPsychology & Behavior.a*
- 9 A. Grassi, A. Gaggioli, & G. Riva. The Green Valley: The Use of Mobile Narratives for Reducing Stress in Commuters.
CyberPsychology & Behavior.
- 10 M. C. Juan, & D. Pérez. Comparison of the Levels of Presence and Anxiety in an Acrophobic Environment Viewed via HMD or
CAVE. *Presence: Teleoperators and Virtual Environments.*
- 11 E. Lallart, X. Lallart, & R. Jouvent. Agency, the Sense of Presence, and Schizophrenia. *CyberPsychology and Behavior.*
- 12 **2008** P. S. Bordnick, A. Traylor, H. L. Copp, K. M. Graap, B. Carter, M. Ferrer, & A. P. Walton. Assessing reactivity to virtual reality
alcohol based cues. *Addictive Behaviors.*
- 13 S. Bouchard, J. St-Jacques, G. Robillard, & P. Renaud. Anxiety Increases the Feeling of Presence in Virtual Reality. *Presence:
Teleoperators and Virtual Environments.*
- 14 M. Fornells-Ambrojo, C. Barker, D. Swapp, M. Slater, A. Antley , & D. Freeman. Virtual reality and persecutory delusions:
Safety and feasibility. *Schizophrenia Research.*
- 15 M. J. A. Jannink, G. J. Van der Wilden, D. W. Navis, G. Vissen, J. Gussinklo, & M. Ijzerman. A Low-Cost Video Game Applied
for Training of Upper Extremity Function in Children with Cerebral Palsy: A Pilot Study. *CyberPsychology & Behavior.*
- 16 K. Kim, C. Kim, K. R. Cha, J. Park, K. Han, Y. K. Kim, J. Kim, I. Y. Kim & S. I. Kim. Anxiety Provocation and Measurement
Using Virtual Reality in Patients with Obsessive-Compulsive Disorder. *CyberPsychology & Behavior.*
- 17 E. Malbos, D.R. Mestre, I.D. Note, & C. Gellato. Virtual Reality and Claustrophobia: Multiple Components Therapy Involving
Game Editor Virtual Environment Exposure. *CyberPsychology & Behavior.*
- 18 K. Meyerbroker, & Paul M. G. Emmelkamp. Therapeutic Processes in Virtual Reality Exposure Therapy: The Role of Cognitions
and the Therapeutic Alliance. *Journal of CyberTherapy and Rehabilitation.*
- 19 S. Quero, S. Salvador, R. M. Baños, A. Garcia-Palacios, C. Botella, & B. Serrano. Components of Presence and Reality
Judgment as Predictors of Treatment Efficacy. *Proceedings of the Annual International Workshop on Presence..*
- 20 G. Riva, M. Manzoni, D. Villani, A. Gaggioli, & E. Molinari. Why You Really Eat? Virtual Reality in the Treatment of Obese
Emotional Eaters. *Studies in Health Technology and Informatics.*
- 21 D. Villani, & G. Riva The Role of Media in Supporting a Stress Management Protocol: an Experimental Study. *Journal of
CyberTherapy & Rehabilitation.*
- 22 S. Yalon-Chamovitz, & P. L. (Tamar) Weiss. Virtual reality as a leisure activity for young adults with physical and intellectual
disabilities. *Research in Developmental Disabilities.*
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Burn Wound Debridement in the Hydrotank. *Clinical Journal of Pain.*

- 24 **2007** S. Bouchard, G. Robillard, A. Marchand, P. Renaud, & G. Riva. Presence and the Bond Between Patients and their Psychotherapists in the Cognitive-Behavior Therapy of Panic Disorder with Agoraphobia Delivered in Videoconference. Proceedings of the Annual International Workshop on Presence.
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- 27 M. Krijn, P. M. G. Emmelkamp, R. P. Olafsson, M. J. Schuemie, & Charles A. P. G. van der Mast.. Do Self-Statements Enhance the Effectiveness of Virtual Reality Exposure Therapy? A Comparative Evaluation in Acrophobia. *Cyberpsychology and Behavior*.
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