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How Real Is It? The State of (Tele)Presence in Therapy with Mediated Environments

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Abstract

This work is an overview of the scientific papers that have related the “sense of presence” in mediated environments to the use of these environments in psychological therapy. The majority of the works collected deal with VR applications in the assessment, therapy and rehabilitation of specific difficulties resulting from phobias, brain injury, cognitive or physical deficits and disabilities, schizophrenia, dementia, pain, eating disorder, post traumatic stress disorder, emotional and psycho-physiological stress. The techniques to measure presence have been singled out, as well as the results on the relation between presence and therapy effectiveness are briefly synthesized, and some weaknesses are commented. The “feeling of being there” is perceived as a relevant component of virtual experience, that would sometimes improve the success of the treatment, lengthen the time the patient will stay in the VR treatment, divert attention away from some aspects of the physical world, or explain for the results obtained.

1. Introduction

The goal of this poster is to present a first overview of the state of the art in the studies connecting the “sense of presence” in mediated environments to the effectiveness of these environments in psychological therapy. In order to collect the necessary material a variety of sources were examined, including journals that have dedicated several issues to presence (“Presence: teleoperators and virtual environments”, “PsychNology Journal”, “CyberPsychology & Behavior”), the proceedings of all editions of the Intl. Workshop on Presence and several scientific databases (i.e. EBSCO Communication and Mass Media, Business Source Complete, Computer Science Complete, Film and Television, Psychology and Behavioral Sciences). This search yielded a total of 69 articles mentioning both ‘presence’ and ‘therapy’. The restriction to papers that actually measured or studied presence, and that reported research or empirical studies, instead of theoretical observations or project presentations, resulted in 32 articles remaining for examination.

The overview reported here starts with a description of, the approaches to measuring presence that were followed in the works examined, and then considers the results on the relation between therapy and presence grouped by type of disease.

2. Presence measures

Since good measurement is tied to how concepts are defined, we assumed that the employed presence measures would reflect the presence definition given by the authors. Of the studies examined, there is not consensus on the definition of presence. This is not a problem confined to Cybertherapy. The International Society for Presence Research defines Presence as a psychological state or subjective perception in which even though part or all of an individual's current experience is generated by and/or filtered through human-made technology, part or all of the individual's perception fails to accurately acknowledge the role of the technology in the experience. In other words, the user feels present in an environment even though part of this environment is generated by a computer.. Besides this operational definition, the various measurement systems adopted to study presence reveal different approaches to the construct. .

In several studies presence is referred to as the sense of 'being there' experienced by users of advanced media [10, 11, 20, 23] and, as the psychological state or subjective perception in which a person has the illusion of being in a different place than the one in which she 'really' is [19, 29, 30]. When one of these definition was given, the measurement scale used most frequently was *PQ-Presence Questionnaire* [15, 20, 29]. This is also true for research conducted in the French language [16].

When presence is defined as a subjective physiological change, authors measure heart rate variability and the electrodermal response [4, 18].

Some articles defined presence as a sense of “immersion” with a heightened anxiety. In order to assess if virtual reality or computer tasks would induce a sense of presence, the authors used *Subjective Ratings of Distress (SUDs)* [1, 5, 6, 21, 26, 29] or *SUS Questionnaire* [9, 14] and presence is defined as an increase of SUDs or SUS.

Other used questionnaires were the *TC-Sense Of Presence Inventory (ITC-SOPI)* in addition to physiological measurements (heart period and skin conductance level) [18, 31]; the *APQ questionnaire* in association with the *PRCS: Personal Report of Confidence as a Public Speaker* [17]; the *Tellegen Absorption Scale (TAS)* and the *Dissociative Experiences Scale (DES)* [13]; an adapted version based on Kalawsky's *VRuse Questionnaire* [7]; the *Fear of Flying*

Inventory (FFI) and the *Questionnaire on Attitude Towards Flying (QAF)* used by Price and Anderson [29]. One study appears to have adapted the PQ for use with children and referred to the measurement scale as the “Children’s Presence Questionnaire” [26].

Several studies using the same or similar definitions of presence employed multiple measurements scales. The most frequent combination are: PQ is used also in association with the *ITQ-Immersive Tendency questionnaire* [2] (and its French version [16]) and *VR Questionnaire-VRQ* [10]. Moreover, *ITQ-Immersive Tendency questionnaire* is used also with the *Telepresence in Videoconference Scale* [2]. Within the same conceptual frame, *Igroup Presence Questionnaire (IPQ)* is used alone [11, 30] or accompanied by the PQ [19, 25]. A five-item presence questionnaire based on PQ is presented by Weiss and collaborators [22].

Besides questionnaires, many authors described the use of simpler self-reported measures during the therapy session (i.e., patients reporting verbally and periodically about their level of anxiety and the level of presence they felt in the virtual environment [1, 3, 8, 12, 25]). Brooks and Petersson [3] defined presence as a state where stimulation of fantasy and imagination involves engagement and subsequent interaction with a virtual environment. Once this engagement is achieved and sustained they proposed that a higher order state is achievable through empowered activity toward a zone of optimized motivation. For these reasons they interviewed not only the participants, but also therapists and doctors who had a part in the treatment.

3. Presence and therapy: results so far

3.1. Phobias

The treatment of various phobias with mediated or virtual environments was the most common type of therapy reported. The types of phobias treated include: social phobia (fear of public speaking [17], fear of one or more social performance situations [14]); specific phobias [16] with or without panic disorder or post-traumatic stress disorder; agoraphobia [13]; acrophobia [11, 5, 9, 26, 30]; storm phobia [1]; fear of flying [29]; and driving phobia [21, 20]. The virtual environments were characterized by specific phobogenic stimuli: a fire escape with six floors in open space, a roof garden, a building site with eight floors [11, 30], a steel tower [5], a staircase [9], bridges, and balconies [26], a shopping mall and a building site [30] for acrophobia; an elevator, a supermarket, a town square, a beach [13] for agoraphobia; virtual reality driving simulators [20, 21] for driving phobia; a virtual plane for fear of flying [29]; a virtual bar with 5 virtual customers [14] and a seminar room with attending avatars [17] for the social phobias; a scenario which includes a storm of different strength [1] for storm phobia; specific phobogenic stimuli for specific phobia of either spiders, heights or enclosed spaces [16]. Most of these stimuli are presented via headmounted displays or desktop

VEs. One article presents a treatment delivered entirely via videoconference [2].

Even if patients’/participants’ personality characteristics may play a role in the presence levels [13], the majority of these studies concluded that VR is able to stimulate the same fear structure experienced in everyday environments [1, 5, 9, 11, 14, 16, 17, 29]. Robillard et coll. [16] found a linear relation between presence and anxiety supporting the hypothesis that an increased amount of presence is related to an increased amount of anxiety in individuals with a specific phobia. Elsewhere [30], there are no correlations found between feeling a sense of presence and anxiety during VR the sessions. Price and Anderson’s results [29] support presence as a factor that contributes to the experience of anxiety in the VE as well as relation between presence and the phobic elements, but do not support a relation between presence and treatment outcomes (Krijn et al. [30] note the same). They suggested that feeling a sense of presence may be a necessary but insufficient requirement to achieve benefit from VRE. Other authors reported how the sense of presence was part of the whole subjective pattern of characteristics, together with cognitive factors, which is important for the therapy outcomes [20] and for the development of a strong therapeutic bond [2]. Moreover, Walshe et al. [21] report that of all patients, 50% became immersed in the exposure. Participants who clearly improved at post-treatment showed a greater sense of presence in the virtual environment and had a lower severity of fear of driving as compared to other participants who responded more poorly [21, 22].

3.2. Rehabilitation

Four articles concerned rehabilitation: the first one [4] assesses on healthy people a rehabilitation program oriented to patients with upper extremities motor deficits following brain injury. Participants sat facing a computer screen showing a virtual scenario with spheres moving towards virtual arms onto which the motion of the participant was mapped. The system monitors the patients’ physiological responses during the game; the idea is to play the game using a bio-feedback system allowing the participants to regulate the game parameters and their own state (including sense of presence).

The second article [3] reports an experimental design thought for physical and cognitive load in a daily physical training regime. The task within a computer game is to keep a virtual football, with animated real world physical properties, “up” within a virtual environment. Authors redefine presence in terms of an ‘Aesthetic Resonance’ state, namely a state where “the response to intent is so immediate and aesthetically pleasing as to make one forget the physical movement involved in the conveying of the intention and is in line with” [3. p. 1]. Presence is judged here by the ‘face of the children’ and implicitly from other aspects of enjoyment and motivation. [3].

The third study [15] focuses on a rehabilitation program for patients with neurological deficits resulting from stroke, head trauma, spinal cord injury, or degenerative diseases such

as multiple sclerosis. The program foresees the use of a two platforms computer game with three possible environments (snowboarding, football game and a task where they had to keep virtual spheres) forcing the user to practice balance, body movement and visual search ability. The sense of presence is treated here as a dependent variable, to check which factors influenced its level: the attributes of the VR platform, the features of the virtual environment (type of the games, extent of functionality), the characteristics of the individual user (e.g., age) and the task itself (canning and movement) [15].

The last study also focuses on neurological rehabilitation from stroke and paraplegic spinal cord injury. It tests an adapted VividGroup's Gesture Xtreme scenario. The participants use the equipment to see themselves projected onto a screen. Their movements are seen in real time and the projected self can interact with the virtual environment in activities such as playing soccer, snowboarding, and street crossing. A few clinical studies are reported, whose results were interpreted in terms of usability and effectiveness of the system in inducing a sense of presence in the virtual scenarios.

3.3. Schizophrenia

Three articles were about presence and schizophrenia. In the first one [10], the PC generated real-time images shown to participants, and meant to be used as a tool to assess social perception. In the second study authors described an environment to train people with schizophrenia to develop conversational skills (with avatars) [12]. The third presents a program that takes the user for a walk through a hospital psychiatric ward during which a number of audio and visual hallucinations repeatedly appear and disappear, to serve within an exposure therapy [19].

Results show that the VR exposure program successfully made users feel they were "present" [12, 19], and that some presence measure correlated with some treatment outputs [12]. It has to be taken into account that patients with severe schizophrenic symptoms are less able to recognize emotions than a healthy person [10].

3.4. Other psychological diseases

Among the remaining articles, Flynn and coll. [7] presented a study to assess presence in people with dementia (PWD) exposed to a virtual environment projected on a screen, and representing a park. The data from the VR use questionnaire showed that to some extent PWD experienced presence, perceived that objects were realistic and moved naturally, feeling generally in control of the interaction.

Hofmann and coll. [8] explored whether immersive virtual reality can serve as an effective non-pharmacologic analgesic for pain during dental treatment. They used an immersive, three dimensional interactive environment where patients had the illusion of flying over a pre-defined path through a landscape with canyon and water, and compared it to watching a movie. The virtual environment was tested with two patients

experiencing both conditions; the virtual environment condition was rated more realistic by participants, who also declared to have experienced a higher sense of presence than participants in the movie condition.

A second study exploring the impact of a VE on pain used a head-mounted display during an interavenous administration of medicine IV to children [28]. The authors report that the children who declared the highest levels of presence also declared the lowest levels of pain and the highest levels of satisfaction with pain management.

To explore ways in which virtual reality can provide positive and enjoyable leisure experiences to people with physical and cognitive disabilities, Weiss et al. [22] use the same virtual environment used by Rand and coll. [15]. According to the authors, participants' responses showed a high level of presence and a remarkable enthusiasm during VR experience.

Another study [18] investigates the importance of presence in restorative environments, namely environments that can help restore directed attention or reduce emotional and psycho-physiological stress. The procedure involved the exposition to a film after a stress-inducing task. Authors manipulated presence by varying the screen size, and then checked the effect of this manipulation by administering the ITC-Sense Of Presence Inventory (ITC-SOPI). The hypothesized effect, however, was not found.

An experiment manipulating low and high calorie food was conducted with eating disorder patients. Thirty women with eating disorders were exposed to six virtual environments. Four of the environments contained a manipulation of the presentation of food: A kitchen with low-calorie or high-calorie food or a restaurant with low-calorie or high-calorie food. After being in either the kitchen or restaurant, the participants went to a pool where they had to wear a bathing suit in front of other avatars in bathing suits. The participants reported higher anxiety when presented with the high-calorie food and the swimming pool. A relationship was found between the participants reporting a sense of presence and having a stronger emotional response to the VE. [26].

Difede and Hoffman' article [6] concerns post traumatic stress disorder: virtual planes flying over the World Trade Center, jets crashing, animated explosions and sound effects, tower collapsing and dust clouds are part of the virtual environment. Authors explored whether immersive VR could be used to facilitate the patient's emotional engagement. The SUD scale was used to check stress levels, defining presence as an increase in the stress levels. The study showed that a graded VR exposure therapy facilitates emotional processing of memories associated with the traumatic event, and is accompanied by an increase in the stress level (presence).

The last article [31] combines self-reports and objective measures to evaluate the emotional response and the sense of presence and to verify the efficacy of the relaxing therapeutic narrative (even if they used a non clinical sample). The study explores stress management area, "one of the leading mental health problems of western societies linked to several

pathologies”(p. 7) [31]. Results show a significant correlation between changes in anxiety and emotional state and some factors of presence. participants felt engaged in the mediated experiences, an increase of relaxation and a reduction of anxiety.

Conclusion

Some researchers exploring cybertherapy have considered presence in their studies on the assumption that the “feeling of being there” is a relevant component of the virtual experience, and would either accompany [1, 2, 7, 9, 22] or a measure of [6] the treatment effectiveness. There has been some investigation of personal characteristics [17], or personal motivation [3], that might influence levels of presence experienced [5], on the effect of order and treatment [11, 19, 20], of features of virtual environment and task [15, 18, 31], as well as studies where presence is treated as a discriminating factor or as a pre-condition in using the VR exposure therapy [21, 13]. In most of the studies when participants report a sense of presence, it appears to improve the success of the treatment [12, 31]. In some cases presence appears to lengthen the time the patient stays in the VR treatment and in others it appears to divert attention away from some aspects of the physical world [8, 24, 28].

From this brief overview, some contradictions emerged as well. (e.g., some studies found a linear relationship between presence and anxiety [16, 29] but others did not [17, 26, 30]). Some researchers reported negative evidence (presence being not directly related to the treatment outcome [29, 30]), while other found more positive relationships. One of the most frustrating findings is the occasional cursory treatment of the concept. Sometimes, the investigation of presence is announced as a part of the study, but the results are not reported in the paper [5, 10] or are not discussed [14, 27], other times the role of presence is mentioned just as a possible explanation for the results obtained [3, 4]. The way in which presence is operationalized is not always clearly accounted for [1, 6], sometimes it is assumed to correspond to other variables such as stress [26] or heart rate [17], without accounting for these presuppositions. Regarding the measurement tool, in the vast majority of the cases considered here, presence is measured via questionnaires [2, 7, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 23, 29, 30, 31].

Overall, it appears that sensations of presence are of interest to Cybertherapy practitioners and researchers. This area of presence research has similar strengths and weaknesses in working with the concept of presence as other disciplines.

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