

# Presence and Relaxation: A Preliminary Controlled Study

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## ABSTRACT

Technologies such as Virtual Reality (VR) that induce presence in a virtual, but still external, perceived world, have great power to evoke emotional experiences that can lead to psychotherapeutically valuable changes in the individual. This reflects the power of presence – seen as the feeling of being located in a perceived, external world – in developing and affecting psychological wellbeing.

Until today Virtual reality Environments (VEs) have been incorporated into a variety of clinical and everyday settings to improve mental health. Nevertheless many areas in the health field can be still explored by using this innovative technology. One example is represented by stress management area, one of the leading mental health problems of western societies linked to several pathologies.

Following this trend our proposal is to investigate with a non clinical sample the efficacy of a relaxing narrative through a virtual experience. In a controlled study we compared three different media: Immersive VR, DVD and Audio speaker, by using the same therapeutic narrative and protocol. A control group without treatment was also included in the study.

The sample included 60 university students, randomly divided in four experimental conditions.

Non parametric test and correlation were used to analyse self-reports and physiological parameters. Within groups analysis - in both VR and DVD conditions - showed a significant improvement of the emotional state and significative physiological changes. Furthermore, regression analysis showed that a relationship exists between the sense of presence and the outcome achieved by the mediated experience. However, the absence of significant differences from the analysis between groups suggests that the principal determinant of presence might be the content proposed within the mediated experience.

Further reflections about sense of presence in relaxing virtual environments will be discussed.

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## **1. Introduction**

Looking at the technologies used until now to induce relaxation, we observed that some tools already exist. CDs of calming music have shown positive effects on stress reduction and relaxation and combined with relaxation techniques these CDs strengthened the positive effect of calm and sedative music. To increase effectiveness, commercial relaxation DVDs have also integrated visual stimuli to support the process of relaxation by creating an isolated context.

Virtual Reality (VR) represents a further advance. It provides such a convincing interface that users believe they are actually present in a three dimensional world and they navigate and interact with it in real time while their actions and reactions are experienced in the present moment (Wiederhold & Wiederhold, 2005). In fact, the key feature of VR which differentiates it from other media, is the sense of presence (Riva, Davide, & Ijsselstein, 2003; Ijsselstein, 2003).

Our proposal is to take advantage of the potentiality of this technological tool, by enhancing the quality of the experience through the elicitation of the sense of presence. Thanks to the sense of presence experienced through this tool, it could be possible to enhance the quality of the relaxing experience.

Considering the strong potentiality of VR in clinical psychology, we can recognize two different approaches. On one side, VR has been traditionally used to deliver graded exposure, as an adjunct to cognitive-behavioral therapy (CBT) (Moore, Wiederhold, Wiederhold, & Riva, 2002; Riva, 2005) to treat pathologies such as phobias, post-traumatic stress disorder (PTSD), and other disorders related to anxious stimuli management (Riva, Wiederhold, & Molinari, 1998; Pull, 2005). The principal disadvantage of this approach is that it is content specific: a new virtual environment has to be developed for each particular context. So it is hardly applicable to some conditions, like stress and general negative emotionality, not strongly related to a specific scenario.

On the other side, other researchers have used VR to enhance well being by using a different approach. We propose that this approach could offer a series of advantages in relaxation too. A virtual environment including positive visual and auditory stimulation could be used to produce an optimal experience. Within the environment, it could be important to include contextual sensorial cues (Morie, 2002) to enhance the realism and the sense of presence experienced by the participants. For example Plante and colleagues have recently observed (Plante et al., 2003; Plante, Cage, Clements, &

Stover, 2006) that individuals who interact in an enriched environment with a variety of positive visual and auditory stimulation report greater improvement in self-efficacy and mood (McAuley, Talbot, & Martinez, 1999; Turner, Rejeski, & Brawley, 1997). This suggests that it is possible to use VR to manipulate experience-related self-efficacy and mood.

A further advance in this direction has already been tested by Freeman and colleagues (Freeman, 2003; Freeman, Lessiter, Keogh, Bond, & Chapman, 2004; Freeman, Lessiter, Pugh, & Keogh, 2005) too, that consider VR as useful to support relaxation. In this case, an important role was also played by an audio narrative that supported each phase of the experience, both guiding participants in the navigation and helping them to perform the cognitive and relaxation exercises.

As we already stated, the principal feature of VR, that distinguishes it from other media, is the sense of presence.

To define presence is not an easy task and it is possible to recognize two different perspectives. The rationalist point of view considers a VR system as a collection of specific machines with the necessity of inclusion of the concept of presence. The researchers agreeing with this approach describe the sense of presence as a function of our experience of a given medium (*Media Presence*). The main result of this approach is the definition of presence as the *perceptual illusion of non mediation* produced by means of the disappearance of the medium from the conscious attention of the subject. Within this approach, Slater and colleagues (1994) listed the technological and participant factors that contribute to presence by presenting three aspects: the sense of being in the environment; the tendency of users to respond to events in the VE rather than in the real world; the memory of the experience, after the VE session, of such as having visited a place, rather than just having seen images generated by a computer. However, the technological definitions of VR do not deny the existence of the psychological component offered by the VR systems, it is simply not included in the definition. At the other extreme there is the psychological or ecological perspective (*Inner Presence*). Within this perspective, the feeling of presence is seen as a common experience among different types of human experiences independent of any technology.

Aiming to take in consideration both perspectives, we can state that the experience of presence is a complex, multidimensional perception, formed through an interplay of raw (multi) sensory data and various cognitive processes (Ijsselsteijn & Riva, 2003). Ijsselsteijn, de Ridder, Freeman, and Avons (2000) suggest a vision that aims to

overcome the debate related to the determinants of sense of presence and they suggest a wide categorization of variables that can determine a user's presence. These authors propose two general categories: media characteristics and user characteristics. Media characteristics category can be subdivided into aspects of "media form" and "media content". "Media form" refers to physical, objective properties of a display medium, covering the means by which an image is represented (for example photo-realistic video or animated computer graphics). "Media content" includes the theme, narrative or story represented by the medium.

Is presence related to the efficacy of the experience?

Until now the relationship between the sense of presence and treatment outcomes has been explored but it didn't result in a final conclusion. In fact, in the anxiety treatment, that generally involves specific VEs and a graded exposure therapy, presence presumably contributes to the amount of anxiety felt during an exposure to a feared virtual stimulus. Recently, results found by Price and Anderson (2007) considered presence as a factor that contributes to the experience of anxiety in the virtual environment. These authors considered also a relation between presence and phobic elements, but they did not support a relation between presence and treatment outcome. The authors suggest that feeling present during exposure may be necessary but not sufficient to achieve benefit from VR exposure.

The goal of the study of Freeman and colleagues (2004) was different. It was focused on relaxation and in particular it aimed to test the effect of a relaxing narrative through the comparison between a narrative only condition (eyes-closed) and a narrative plus the visual and background audio stimuli of the Relaxation VE. Results showed that the presentation of the narrative within the audio visual VE resulted in significantly greater increases in relaxation in relation with the presentation of the narrative alone. Furthermore, presence ratings were higher for the VR condition than for the Audio one. To sum up, the authors suggest good potentiality for the use of VEs as devices to improve relaxation. Unfortunately, probably due to the low statistical power derived from the small sample size, the relationship found between presence and relaxation was not consistent.

In summary, results from empirical works on the relation between presence and treatment efficacy have been inconclusive.

The specific goal of the present study was to investigate with a non clinical sample the efficacy of a relaxing narrative through a virtual experience. After analyzing the literature in this field we decided to use different techniques to induce relaxation,

involving Autogenic training (Schultz & Luthe, 1969), Progressive Muscular Relaxation - PMR - (Jacobson, 1938), and breathing techniques.

We were interested in verifying the efficacy of the relaxing therapeutic narrative ("media content"), by manipulating the "media form" variables, according to Freeman and colleagues categorization (Freeman, 2003; Ijsselstein et al., 2000). For this reason we compared three different media: Immersive VR, DVD and AUDIO tape. We also included in the study a control group without treatment.

In particular, this study was conducted to test to the following hypotheses:

*Hypothesis 1:* There is a significant emotional modification within groups. In particular we expected an increase of relaxation and a decrease of anxiety;

*Hypothesis 2:* There is a significant difference between the conditions in terms of efficacy. In particular, we expected an increase of relaxation and positive emotions higher in VR condition than in the other groups;

*Hypothesis 3:* A relationship exists between the sense of presence and increase of relaxation and positive emotions. This relationship is also related to the medium used.

## **2. Method**

### **2.1 Participants and Design**

We recruited sixty participants (30 female and 30 male students), aged 21 to 28 years ( $M=24.52$ ,  $SD=1.75$ ) for the study from the Catholic University of Milan. We randomly allocated groups of 15 participants to each of the four experimental conditions by a true random number service (Haahr, 1998). They voluntarily participated to the experiment after having subscribed the informed consent.

In order to study the efficacy of different technologies on relaxation, we carried out a mixed design. We developed a relaxing narrative ("media content") that involved different relaxation techniques and we manipulated the "media form" variable, comparing three different media: Immersive VR, DVD and AUDIO tape. In particular the design involved 3 experimental conditions and repeated measurements (pre and post-treatment).

All participants in the VR, DVD and AUDIO conditions listened to the same narrative and followed the same exercises, based on Progressive Muscular Relaxation - PMR - (Jacobson, 1938), Autogenic Training (Schultz & Luthe, 1969), and deep breathing techniques.

Let's see more in depth each condition:

- VR: An immersive virtual reality environment, the Relaxation Island (experienced with a head mounted display, head tracking and joystick). Participants moved through different relaxation experiences, exploring the environment and watching waves lapping gently on a shore, or sitting near a waterfall and watching leaves float down a stream into the surrounding ocean. Each experience was supported by a relaxing narrative.
- DVD: A commercial DVD (experienced on the Computer screen with relaxing tropical videos). Participants moved through different relaxation scenes, watching water at beach levels. Each experience was supported by the same relaxing narrative.
- AUDIO: An audio-tape was used with the same relaxing narrative. In this condition participants were required to use their imagination skills to visualize the tropical scenario.

Furthermore we compared these conditions with a control group (composed by 15 participants too) without treatment.

Participants sat in a swivel armchair in front of a computer and were tested once per session. At the beginning of the sessions, they provided their informed consent and received a set of instructions about the experiment. The experiment consisted of 2 sessions carried out on two different days within the same week.

Participants in the control condition did not receive the treatments, but they were only assessed on two days within the same week.

## **2.2 Measures**

To test the dependent variables - the emotional response (with special focus on relaxation) and the sense of presence - we considered that emotions are complex phenomena that comprise multiple components ranging from the purely subjective to the purely physiological. No single method of emotion assessment can possibly capture the richness of emotional phenomena, and a complete evaluation of emotion phenomena can only be gained through multiple-method investigations.

Therefore, we decided to use an Integrated Multimodal Assessment - combining self-reports and objectives measures. In particular for the emotional evaluation we used:

- The *State Trait Anxiety Inventory* (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) to assess state anxiety levels. Respondents indicate how much each statement reflects how they feel on a 0-3 scale. It has two versions, asking

participants “how they feel right now” (state version) and “how they generally feel” (trait version).

- The *Positive and Negative Affect Schedule* (PANAS) (Watson, Clark, & Tellegen, 1988) to measure the positive and negative affects through 10 positive and 10 negative moods/emotion adjectives. The PANAS allows to indicate the time frame when considering the experience of the affect items (i.e., ranging from “current states” to “general feelings”). We decided to examine the “current state” of the participants.
- The *Visual Analogue Scale* (VAS) (Gross & Levenson, 1995) to describe different emotions using 8 adjectives. Participants are required to indicate how they feel at a specific moment in time with reference to each of the eight visual analogue scales measuring: happiness, sadness, anger, surprise, disgust, anxiety, quietness, and wrath.
- The *Coping Orientation to Problems Experienced Questionnaire* (COPE) *Questionnaire* (Sica, Novara, Dorz, & Sanavio, 1997) assessed the different strategies commonly activated in daily problem solving, focusing on three categories: problem, emotive expression and maladaptive mechanisms.

From a physiological point of view, we considered stress to be generally accompanied by generalized activation of the nervous central system, autonomous nervous system, and neuromuscular system. This implies an increase in muscular tension, heart rate, blood pressure, palmar sweating, peripheral vasoconstriction, and rate and irregularity of respiration. For this reason we selected:

- Different physiological parameters (Respiration Rate, Respiration amplitude, Heart Rate, Heart Amplitude, Skin Conductance, Electromyography) to test the activation of the subjects in correspondence with emotional arousal at the begin and at the end of the experience.

To measure the level of subjective presence we used the ITC–Sense of Presence Inventory (ITC-SOPI) (Lessiter, Freeman, Keogh, & Davidoff, 2001) that refers to after and during the mediated experience. It considers four dimensions: Physical space (a sense of physical placement in the mediated environment, and interaction with, and control over, parts of the mediated environment); Engagement (a tendency to feel psychologically involved and to enjoy the content); Ecological Validity (a tendency to perceive the mediated environment as lifelike and real) and Negative effects (adverse physiological reactions).

### 2.3 Tools

The virtual environment used, termed the Relaxation Island, was conceived and had previously been used by Freeman and colleagues (Freeman, Lessiter, Keogh, Bond, & Chapman, 2004) within the EMMA - “Engaging Media for Mental Health” - European funded project. Exploration in the immersive VR condition involved 4 different zones related to different relaxation exercises: beach zone 1, beach zone 2, the clouds and waterfall. The zones were presented in versions both by day and by night. One example is showed in Figure 1. The DVD used was a commercial relaxation system, with the visual content similar to that of the VR condition - 4 beaches of tropical islands - supported by the same narrative. An example is showed in Figure 2.

The audio tape included only the same narrative. For this reason this condition required imagination skills by the participants.



**Figure 1.** The waterfall zone of Relaxation Island by day.



**Figure 2.** The Island DVD by day.

The computerized and Virtual Reality materials consisted of:

- a portable computer (Fujitsu Siemens AMILO Processor, Pentium 4);
- a wireless joystick (only in the VR condition): Logitech Wingman Cordless Rumblepad Gamepad;

- a Head-Mounted Display (only in the VR condition): a Sony Glastron PLM S-700 with a head-tracker: Intersense Intertrax2;
- an Audio-tape with headphones.

For the physiological measurements, in this study we also used the BioGraph Infinity Procomp.

### 3. Results

The data were not normally distributed in almost all multimodal aspects evaluated. For this reason and to avoid analyses with a low statistical power we conducted non-parametric analyses.

- First, before treatment we compared the participants in the four experimental conditions (VR, DVD, AUDIO, Control) we didn't find significant differences between groups.
- Then, we analyzed the degree of change on the dependent variables achieved with the treatment separately for each group (within groups effects).
- As a third analysis set, we focused on testing whether the degree of change was different among the four groups (between groups effects).
- A final analysis tested whether a relationship existed between the sense of presence and the efficacy of the treatment through correlation and regression analyses.

We analyzed data from the following four "moments/time points" in the treatment:

- T1: before Session 1 (pre-treatment)
- T2: after Session 1
- T3: before Session 2
- T4: after Session 2 (post-treatment)

#### 3.1 Within Groups Effects

To compare different moments of the treatment for each condition we used both the Friedman and Wilcoxon tests (paired samples), as showed in Table 1.

We found a significant reduction of anxiety measured through the STAI questionnaire in the first session both in:

- VR ( $Z=1,905$ ,  $p<.05$ ), DVD ( $Z= 2,852$ ,  $p<.01$ ), and AUDIO ( $Z=3,244$ ,  $p<.00$ ) conditions.

The same outcome was found in the second session, both in VR ( $Z= 2,923$ ,  $p<.00$ ), DVD ( $Z= 2,946$ ,  $p<.00$ ) and AUDIO ( $Z= 1,889$ ,  $p<.05$ ) conditions.

Furthermore we found significant increases in relaxation measured by the VAS questionnaire both in VR ( $Z= 2,288$ ,  $p<.05$ ) and DVD conditions ( $Z= 1,904$ ,  $p<.05$ ) in the first session and in the second session (VR:  $Z= 2,648$ ,  $p<.005$ ; DVD:  $Z= 2,138$ ,  $p<.05$ ). Reduction in sadness was found only in VR condition ( $Z= 2,232$ ,  $p<.05$ ) measured by the VAS questionnaire in the second session. No significant changes were found in Control condition.

Session	Dependent Variables	Condition	Mean	SD
1	Anxiety State (STAI)	VR	M1= 37.19 M2= 31.81	SD1= 8.84 SD2= 7.62
		DVD	M1= 34.63 M2= 29.19	SD1= 7.96 SD2= 4.42
		AUDIO	M1= 39.31 M2= 30.88	SD1= 10.43 SD2= 6.26
2	Anxiety State (STAI)	VR	M1= 37.94 M2= 32.69	SD1= 9.46 SD2= 5.84
		DVD	M1= 33.50 M2= 29.38	SD1= 6.80 SD2= 4.54
		AUDIO	M1= 37.50 M2= 34.69	SD1= 8.63 SD2= 9.06
1	Relaxation (VAS)	VR	M1= 4.13 M2= 5.06	SD1= 1.50 SD2= 1.29
		DVD	M1= 4.81 M2= 5.44	SD1= 1.17 SD2= 1.03
2	Relaxation (VAS)	VR	M1= 4.44 M2= 5.31	SD1= 1.36 SD2= 1.20
		DVD	M1= 4.31 M2= 4.81	SD1= .79 SD2= 1.11

**Table 1.** Within groups effects.

Since the time between the two sessions involved in each condition was 3-4 days, some participants started the second session with different mood and relaxation levels

in comparison to the ones achieved at the end of the first session. For this reason we considered both the whole treatment but also the outcomes obtained in each session.

Related to trait aspects, we found only significant changes in coping skills in DVD condition, in particular in Avoiding Strategies ( $Z=2,264$ ,  $p<.05$ ) and Positive Attitude ( $Z=2,741$ ,  $p<.05$ ). A probable explanation is that the length of the experiment, one week, was not a sufficient amount of time to achieve considerable trait changes.

Some interesting results were found with respect to the physiological parameters assessed. For this reason we decided to investigate only the differences within each session and not within the whole treatment.

- In VR group we found a significant reduction of Respiration rate mean both in the first ( $Z=1,939$ ,  $p<.05$ ) and in the second session ( $Z=2,329$ ,  $p<.05$ ).
- In DVD group we found a significant reduction of Heart rate mean both in the first ( $Z=2,947$ ,  $p<.005$ ) and in the second session ( $Z=2,275$ ,  $p<.05$ ) and a significant increasing of Skin conductance both in the first ( $Z=2,844$ ,  $p<.005$ ) and in the second session ( $Z=2,430$ ,  $p<.01$ ).
- In Audio group we found a significant reduction of Heart rate mean both in the first ( $Z=2,741$ ,  $p<.005$ ) and in the second session ( $Z=2,120$ ,  $p<.05$ ). A significant increase of Skin conductance was found only in the first ( $Z=2,669$ ,  $p<.005$ ) session.

### **3.2 Between Groups Effects**

We investigated whether the degrees of change in anxiety and emotional states were different among the four groups (VR, DVD, AUDIO and Control) through the Kruskal-Wallis (4 independent samples) test. No significant differences were found either in the questionnaires or in the physiological parameters. The interpretation of these results will be presented in the conclusion paragraph.

### **3.3 Relationship between Sense of Presence and Treatment Outcome**

To reach this aim, first we used several rho-Spearman non-parametric correlation tests. In general, the data showed a significant correlation between changes in anxiety and emotional state and some factors of presence, considering separately the first and the second session. These results indicate that the sense of presence experienced by the participants is correlated to the effectiveness of the treatment, considering both the whole group of participants and the four conditions separately.

At this point we were interested to better understand whether the sense of presence experienced by the participants was higher in VR condition. For this reason we

conducted the chi square test. Unexpectedly, DVD was the medium that showed higher sense of “ecological” presence, both in the first ( $\text{Chi}^2=5,184$ ,  $p<.05$ ) and in the second session ( $\text{Chi}^2= 7,534$ ,  $p<.01$ ).

Furthermore we were interested to investigate whether a causal relationship existed between presence factors and emotional changes. To reach this aim we carried out the linear regression analyses (Table 2).

Session	Dependent Variables	Model	Variables	t	p
1	Anxiety State (STAI)	R square=.437 F=6.796 p=.000	Ecological Validity	t= -2.415	p<.05
			Negative effect	t= 3.540	p<.005
1	Relaxation (VAS)	R square=.345 F=4.082 p<.01	Ecological Validity	t= 3.129	p<.005
2	Anxiety State (STAI)	R square=.354 F=4.791 p<.005	Physical space	t= 2.422	p<.05
			Engagement	t= -2.471	p<.005
			Negative effect	t= 2.278	p<.05
2	Anxiety State (VAS)	R square=.303 F=3.696 p<.05	Physical space	t= 2.327	p<.05
			Ecological Validity	t= -2,259	p<.05
			Negative effect	t= 2.432	p<.05

**Table 2.** Relationship between sense of presence and treatment outcome.

In particular, as showed in Table 2, from linear regression analysis we found that in the first session:

- the Anxiety state (measured by STAI) change is determined by presence, in particular by the “ecological validity” and “negative effect” scale;
- the Relaxation change (measured by VAS) is determined by presence, in particular significantly by the “ecological validity”.

In the second session:

- the Anxiety state (measured by STAI) change is determined by presence, in particular by the “sense of physical space”, “engagement” scale and the “negative effect” scale;

- the Anxiety state (measured by VAS) change is determined by presence, in particular by the “sense of physical space”, “ecological validity” scale and the “negative effect” scale.

#### **4. Conclusion**

The goal of this study was to investigate the efficacy of a relaxing narrative (“media content”) experienced through a virtual experience with a non clinical sample. For this reason we manipulated the “media form” variables and we compared three different media: Immersive VR, DVD and AUDIO tape. We also included in the study a control group without treatment.

Results show a significant reduction of anxiety and a significant improvement of positive emotional states - in particular, relaxation - measured through self-report questionnaires in all conditions. Physiological parameters showed some good changes related to respiration rate, heart rate, and skin conductance parameters, but less than expected.

The appraisal theory of Scherer (Scherer, 2001; Sander, Grandjean, & Scherer, 2005) could help us to interpret these results. In Scherer’s Component Process model, it is assumed that there are direct connections between stimulus evaluation check (SEC) units and response modalities in the neuro-endocrine system, autonomic nervous system, and somatic nervous system, independently from action tendencies. Two dimensions in particular involved in this model, “goal conduciveness” and “intrinsic pleasantness”, could have modified the expected physiological results. On one side, the goal of achieving a relaxation state might not be strictly pertinent to the participant’s interests because we did not select stressed people for this study. According with Van Reekum and colleagues (Van Reekum et al., 2004) non-pertinent goals can be related to an increase in heart rate and muscle tension. On the other side, the pleasantness of the virtual relaxation experience might predict a reduction of heart rate and skin conductance. We also have to consider that the novelty effect related to using these technologies could have caused physiological activation conflicting with relaxation.

Furthermore, we expected an increase of relaxation and positive emotions higher in VR condition than in the other ones. On the contrary we didn’t find significant differences between groups. This result could be also due to the intrinsic pleasantness

and goal conduciveness of the experience. All people, in fact, could have found positive the mediated experience: they listened to the same narrative and did the same relaxation exercises.

This result seems strictly related to the one found about sense of presence. First, between subjects analyses showed that DVD is higher in “ecological validity” than VR. The explanation is clear: ecological validity is the tendency to perceive the mediated environment as lifelike and real and DVD showed images coming from reality.

Nevertheless, correlations exist between the sense of presence and the increase of relaxation and positive emotions, both considering the whole group and the separated conditions. People felt generally involved in the mediated experiences proposed.

According to a study by Baños and colleagues (Baños et al., 2004), presence is not a direct function of immersion and interaction. In agreement with Ijsselstein (2003), to induce an emotionally mediated experience, it is important to focus on the content and the emotions that are being communicated. Moreover, presence might not be only influenced by the environment’s graphic realism, immersion, and other technological features, but even more by other characteristics of the experience, including the emotional ones, provided by technology.

Results suggest us that it is possible that the predominant effect was played by the relaxing content of the experience, using different techniques in a quiet multi-sensorial scenario, while the technologies used didn’t show different effects.

As third we were interested to investigate whether a relationship exists between presence and treatment outcomes. In this study, our proposal was to take advantage of the potential of this technological tool, by enhancing the quality of the experience through the elicitation of the sense of presence. We hypothesized that, thanks to sense of presence experienced through this tool, it could be possible to enhance the quality of the relaxing experience.

We found several significant correlations between Presence and the emotional change of the participants. Furthermore, as showed by the regression analysis, participants felt engaged in the mediated experience and at the end we found an increase of relaxation and a reduction of anxiety.

How can we interpret this relationship? According to our hypotheses, results confirm the role of the sense of presence as a mediating variable between the mediated experiences and the induced emotions, but some limitations didn’t allow us to consider VR the better tool to achieve relaxation outcomes.

It is not possible to clarify which aspects of the “media form” manipulated (the interaction, the immersion or the visual cues) have had a stronger impact on the sense of presence. In fact, DVD showed real images and was higher in “ecological validity”. Probably, in DVD a key function was played by the visual cues proposed that attracted the user’s attention, while in VR the sense of presence could be enhanced by the interaction and the immersion. The consequence was that participants of both groups generally felt involved in the mediated experiences proposed.

Furthermore, as also showed by the analysis between subjects, we think that in this study the principal determinant of presence is the content proposed within the mediated experience. As we stated at the beginning, we didn’t manipulated the “media content” variable: all people lived an equal positive experience based on the same relaxing exercises. For this reason we found that there were no differences related to the outcomes between groups and that the sense of presence, enhanced by the content, was related to the outcome achieved in DVD and in VR groups.

When considering presence it is also important to consider its opposite, “absence” (Waterworth & Waterworth, 2001), the feeling of being absorbed in an internally generated world of thought and imagination. According to the bio-cultural model of presence (Riva, Waterworth, & Waterworth, 2004), the overall presence level depends on how well integrated the cognitive system is to focus on the environment around the individual. In this study we could consider that virtual relaxation may have reduced the attention to the environment, producing a high degree of absence, in which participants were focused on some cognitive activity related to their Self and not related to directly perceiving the environment.

Despite these limitations, the goal of this study was to test the efficacy of VR as a tool to support the relaxation process. We believe that the use of immersive VR in this non-traditional way could represent a further approach to promote relaxation. What is important is to work on the specific content and the emotions that are being communicated. The novelty of combining different methodologies, quantitative and qualitative, for integrated multimodal assessment is also an important aspect to take in consideration. It is convenient to use more advanced technology, such as VR, whether or not it is possible to use all the potentialities and affordances that such strategies could offer to therapy.

This is a preliminary study in this field. Limitations due to the rather small sample size lead us to view the obtained results with caution. Nevertheless, important clinical applications suggested by these results include the possibility that people might learn

relaxation strategies within controllable mediated experiences. Certainly significant efforts are still required to move VR into routine clinical use in relaxation strategies. Controlled clinical trials are needed in order to compare the efficacy of the proposed VR approach with competing methods. Furthermore it will be interesting to integrate relaxation in a more complete emotional management protocol supported by different strategies.

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