Virtual Cultural Experiences: The Drivers of Satisfaction

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Abstract

This article presents the results of an interdisciplinary research work on the emergence and impact of virtual technologies on the valorization of cultural experience. Our analysis focuses on the drivers of the users' satisfaction through a three-step research path. The results of this study give evidence to the link between immersion and emotion and emphasize the essential mediating role of social interaction. These conclusions are consistent with present technological and market trends, concerning the integration of virtual reality and social networks.

Keywords: Cultural Experience; Virtual Environment; Immersion; Social Interaction; Global Markets

1. Cultural Experiences in the Digital Age

In the digital age cultural experiences are increasingly re-created thanks to creative applications of new technologies. The expressions "Virtual reality" (VR) or, more appropriately, "Virtual Environments" (VE) identify "a complex technology which exploits more low-level technologies (such as computer science, 3D graphics, robotics etc.) in order to create a digital environment which users feel completely immersed inside, and which they may interact with". Cultural institutions, such as museums, are at the forefront of the experimentation of these technologies especially in the area of education, cultural dissemination and storytelling, "as information is not mediated by linguistic codes but conveyed mostly by sensorial feedback (images, sounds, etc.) and therefore easily understood even by non-specialized users" (Carrozzino and Bergamasco 2010). The importance of VR in facilitating and "democratizing" access to culture is commonly acknowledged and significant technological developments are underway in this direction. This trend is strengthened by the crucial role that such technology-led "democratization" have in upgrading the impact of cultural experiences within "experience and sensation" tourism packages (Brondoni, 2016; Guerra et al. 2015).

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Through an original, interdisciplinary cooperation between engineers and marketing scholars this paper intends to advance in the understanding of the actual drivers of the user's satisfaction within a cultural experience, focusing on the following drivers: immersion, emotions and social interaction.

2.The Theoretical Framework

2.1 The Technology

Virtual Environments are nowadays a mature technology, used in many sectors (industry, medicine, design), and subject to an accelerated development, leading to a constant fall in prices and to a parallel widening of the market. The power of the VE technology is due to its unique characteristics of immersion and interaction. Immersion is defined as the physical sensation of being inside a virtual space. This is achieved through sensory interfaces, which "accompany" the user throughout the experience. Interaction is related to the user's ability to interact with the virtual environment in an active and reciprocal way. Immersion and interaction contribute to achieving one of the main objectives of the virtual experience, i.e. to trigger a high sense of presence among the public during the lived experience (belief to be present in the virtual space), so as to develop the same reactions and emotions as those felt during a real experience (Schuemie et al. 2001; Carrozzino and Bergamasco 2010).

This approach seems very relevant in the case of strong emotional experiences, related to hedonism and pleasure, such as those related to art and culture. This is why, in recent years, virtual technologies have aroused great interest in the field of cultural heritage. Digital tools, manipulated in an interactive way, plunge users into a totally new world in a real context (Guerra et al. 2015). VE technologies allow users to approach artworks in ways that are often complementary to or "digital reflections" (Styliani et al. 2009) of the "real" experience. However, while "augmented reality" visualizations normally suppose the physical presence in the place where the artwork is located, VE technologies break the link with the actual location. The user can be transported in different times, like with many innovative applications to experiential archeology (Ch'ng 2009), and/or in different (virtual) places, where, e.g., physically distant artworks can be recomposed within a virtual exhibition.

A serious limitation of VE is the difficulty of realizing a social interaction with other users. The lack of social interactions originates a sense of isolation of the user within the perceived virtual world. This contrasts with the rapid widening of the technical possibilities to share a cultural experience not just with those physically present at the same time and place, but, often instantly, with the whole range of one's social networks, both in words and with images. On the contrary, although technically possible, the interaction with other connected individuals within the VE (either though avatars or real-time 3D images) is severely constrained by the availability of sufficient bandwidth.

2.2 The Experience of Cultural Consumption and the Drivers of Satisfaction

The experience of cultural consumption has already been the subject of numerous studies in both marketing and, most notably, contemporary museography (Holbrook and Hirschman 1982; Bourgeon et Filser 1995; Filser 2002; Roederer 2008; Walls et al. 2011). This stream of literature emphasizes the unique, subjective and personal nature of the experience, where the consumer is physically, emotionally and intellectually involved. In this respect, the level of consumer satisfaction depends on the originality of the experience and the commitment of the individual (Cova and Cova 2004). Further work has focused on the impact of new technologies, with reference to a variety of devices, e.g. mobile, and alternative representations of the digital content, such as augmented reality vs. VR (Ben Nasr et al. 2017; Buonincontri and Marasco, 2017; Evrard and Kreps 2017; Petr and N'Gary 2014; Pallud and Monod 2010; Chang et al. 2014; Pujol and Economou 2009). More specifically the phenomena of immersion and interaction have been analyzed (Jarrier 2015; Jarrier and Bourgeon 2014; Courvoisier and Jaquet 2010), questioning the role of interactive mediation in enhancing cultural experience. Dierking and Falk (2000) propose, in this respect, a conceptualization of the lived interactive museum experience and consider that learning is the result of a threefold (personal, physical and socio-cultural) interaction. This interaction takes on three forms: the interpersonal interaction, the symbolic interaction with the content and the physical and spatial interaction with the interface.) In a nutshell, interaction generates "a range of experiences that fully engage visitors, personally, physically, and emotionally" (Adams et al. 2004).

Each experience of cultural consumption is unique and generates particular emotions and interactions, which are constructed by a combination of personal, physical and social context. In this specific setting, professionals try to take the visitor in unforgettable immersive experiences (Bourgeon-Renault 2009), by plunging them directly (either immediately or more gradually) into the environment and cutting them off from the everyday world. This mechanism encourages the visitor to be absorbed, involved and fully engaged in the lived experience (Lombard and Ditton 1997). The sense of immersion refers to an intense experience characterized by an increase in emotion and a decrease in critical distance (Grau 2003).

The intensity of this experience depends on its ordinary or extraordinary dimension (Caru and Cova 2003). According to Arnould et al. (2002), the most intense interactive experiments will trigger a flow phenomenon, characterized by a complete concentration on the activity and by an enjoyment, which can be shared with others. It has been noticed that visitors actually spend more time at exhibitions or cultural events when they can engage in discussions with other visitors (Courvoisier and Jaquet 2010).

Fornerino et al. (2008) indicate that the degree of immersion has an impact on public satisfaction through the emotions and social interactions generated. Tested in the specific environment of cinema (that presents several similarities with a VE, although with no interaction), these authors demonstrate that the results obtained depend on the type of film proposed and the context (horror film, classical comedy or dramatic comedy). In the case of a high degree of immersion (horror film and dramatic comedy), there is a positive link between emotions and social interactions.

Similarly, the intensity of immersion has an impact on the intensity of interaction with others and the intensity of this interaction with others varies during the experience according to the emotions felt (Luminet et al. 2000).

3. Research Methodology

3.1 From the Exploratory Study to the Setting of Hypotheses

Our research path was structured in different phases. We first conducted an exploratory study to obtain an initial overview of the users' reactions to VE technologies and to allow us a possibly original approach to the issue. The results of this phase were summarized in an earlier publication (Bellini et al. 2015). The engineer members of our team selected three recent experiences realized and tested by their laboratory with the general public:

- the digitalized presentation of a major pictorial work of art to substitute for the original that needed to be removed for restoration purposes: the experimentation implied an immersive and interactive information system that allowed an unprecedented exploration of the painting along custom-tailored paths;
- the integration of digitalized sculptures into a highly immersive VE, where haptic interface technologies allowed to simulate the tactile contact with the artwork: this is not only a substitute for the visually impaired, but a kind of perception that is normally impossible in a "real" museum and therefore new for all museum visitors;
- the digital reconstruction of a historical opera performance, made possible by the availability of all the sketches used at the time and the use of holographic representations of singers: this allowed a unique experience (as visual components were significantly different than the contemporary ones) and one that, while non-interactive, was highly immersive thanks to the importance of the sound dimension.

All of these experiences concerned cultural experiences with significant emotional and educational components and they all derived from the same research program with a consistent focus on natural interaction between man and his technological environment (perceptual robotics). The technologists had collected a large amount of feedback information from participants, based on observations, questionnaires and individual interviews. Although no systematic "customer satisfaction" studies was carried out and the recorded feedback mainly focused on technical performance, the collected information included a large number of very revealing, personal and spontaneous evaluations. In particular, the playful and multi-sensory aspects and the sense of novelty of the lived experience were very often linked with a willingness to share and exchange with other participants and non-participants, in a way that was often conflicting with the limits imposed by immersion. In other words, there was a tension between the memorable character of the experience and the isolation of the individual emotions in the VE.

In the second phase, we decided to focus on immersion, emotions and social interaction as the three potentially critical drivers of the users' satisfaction. Our hypothesis is that immersion allows for the creation of a subjective experience, relative to the implementation of a mechanism of self-appropriation and personal identification, that is interactively shared with other individuals (Caru and Cova 2006; Fornerino et al. 2008).

We propose then the following initial hypotheses as part of our research:

H1. In a virtual cultural experience, the state of immersion generates emotions.

H2. In the virtual cultural experience, the emotions generate social interaction.

H3. In a virtual cultural experience, the state of immersion engenders social interaction through the emotions.

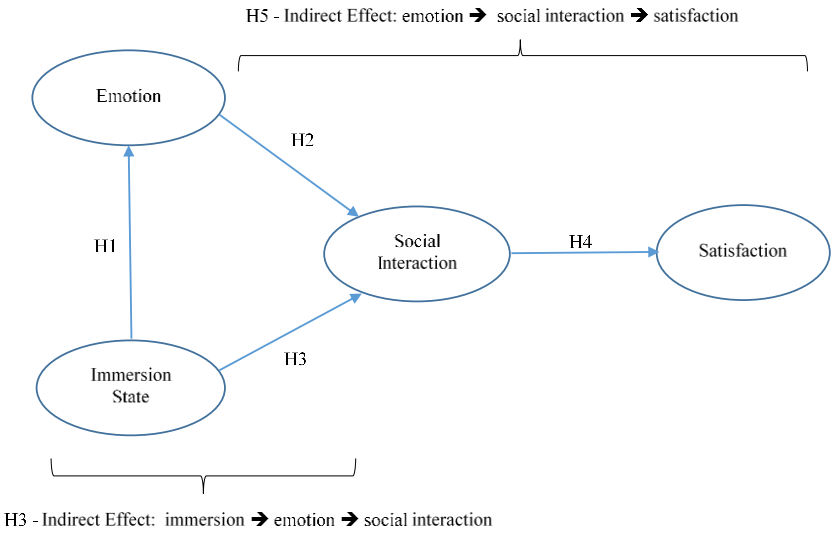
The following hypotheses aim at deepening our understanding of the link between satisfaction and social interaction:

H4. In a virtual cultural experience, social interaction has a positive impact on audience satisfaction.

H5. In a virtual cultural experience, emotion has a positive impact on audience satisfaction through social interaction.

The figure 1 summarizes the theoretical model and the proposed hypotheses.

Figure 1: *Theoretical Model and Hypotheses*



Source: own elaboration.

3.2 The Quantitative Study

In the third phase we realized a quantitative study, by selecting (this time, "ex ante") a new case, concerning an intangible cultural asset. It focused on an immersive VR reality system, developed within a project called AMICA (standing for "AMbienti virtuali Immersivi per la Comunicazione delle maestrie dell'Artigianato", i.e. Virtual Environments for the Communication of Handicraft). The project aims at conserving and disseminating the artisans' intangible heritage through "edutainment" applications based on immersive VE (Carrozzino et al. 2016).

This technical choice is highly consistent with the cultural objective of the project. In fact, handicraft skills are typically made of non-codified, tacit knowledge that must be acquired mostly through socialization within a master-apprentice shared experience (Nonaka and Takeuchi 1995). The system was then designed to simulate the learner's presence in a reconstructed artisan workshop populated by virtual humans performing engraving. The virtual tour is built around

a storyboard touching the most significant steps required to produce an artistic print. Immersion was achieved using an Oculus Rift headset, and interaction was made possible by means of a Leap Motion camera able to dynamically acquire the user's hands motion and to enable a Natural User Interface with the virtual environment.

This system was demonstrated in May-June 2016 at the Modern and Contemporary Art Gallery in Viareggio (Italy), a museum hosting an important collection of printmaking artworks. The test was performed with students from a number of the region's high schools. After their experiences students were asked to fill a questionnaire, that had been constructed around scales of immersion, emotion and social interaction, which already exist in the literature (text in annex). 104 questionnaires were submitted in total.

We assessed participants' immersion in the virtual experience, emotions, social interaction and satisfaction reported after the experiment using the items from Fornerino et al. (2008). As these items have been developed in English, we developed a translation process to Italian, followed by a validation step of translated items. As advised for multicultural and international research by Douglas and Craig (2007), we performed a collaborative and iterative approach. We first carried out a traditional back-translation with iteration among scholars participating to the study, taking into account the various linguistic and semantic knowledge and subtleties related to the different disciplines related to our research.

A second step assessed the quality and reliability of the translated items on participants experiencing a virtual reality experiment (N = 92). We used SPSS 19.0 and Lavaan 0.5-23 package (Rosseel 2012) in R statistical environment (R Development Core Team 2008), relying on Beaujean (2014) recommendations. As our results revealed that some items did not load properly on their factor, we relied on Costello and Osborne (2005) recommendations and removed them from the scales prior to analysis. The final solution is a 5 items scale for immersion, a 4 items scale for emotion and a 4 items scale for interaction (Appendix 1). To assess scales reliability, we relied mainly on Nunnally (1978), Churchill and Peter (1984) and Nunnally and Bernstein (1994) for inter-item correlation (Table 1). Post experiment satisfaction has been assessed by a single item, following Fuchs and Diamantopoulos (2009) recommendation regarding mono-item instrument use. Although the use of single item scales has been judged controversial, research shows that mono-item instruments can also increase the quality of a psychological variable assessment (Evrard 1993; Fornerino et al. 2008 ; Fuchs and Diamantopoulos 2009).

Table 1: *Reliability of Measurement Scales*

		Immersion	**Emotion**	**Social Interaction**
		5 items	4 items	4 items
PCA	Variance	22,06%	17,97%	16,87%
Reliability	Cronbach α	0,712	0,802	0,731
Corrected Item-Total Correlation (Nunnally and Bernstein, 1994)		> 0,3	> 0,3	> 0,3

Source: Own elaboration.

Our theoretical model and hypotheses have been tested on a sample (N = 104; 51,1% males) of young Italians (Mean age = 18,26) who underwent the virtual reality experiment as described earlier. The constitution of this sample allowed us to eliminate any possible distortion related to the lack of familiarity with new technologies and virtual contexts (a problem which concerns more particularly the older generations and that does not affect generations born in numerical epoch). All the participants declared to be enthralled of video games, which introduces many similarities with virtual reality.

Regarding the modest sample size used in this study, data analysis classic methods such as maximum likelihood estimation would obviously not be appropriate. Fortunately, specific methods aim at analyzing relatively small samples. For instance, bootstrapping procedures appear to work well with small samples (Hoyle 1999; Fok et al. 2015), providing more accurate inferences when the sample size is small, using preferably, as indicated by Hayes (2013), a percentile bootstrap confidence interval. Nevertheless, literature highlights that, additionally to bootstrap methods, the most appropriate procedure for small samples remains Bayesian methods (Koopman et al. 2015; van de Schoot et al. 2015).

4. Data Analysis

To test the model and the causal and indirect effects hypothesized, we first used Latent Variables Analysis Lavaan 0.5-23 (Rosseel 2012) under R environment (R Development Core Team 2008), relying on Beaujean's recommendations in terms of structural equation modelling bootstrap analysis (Beaujean 2014). To strengthen our analysis, and as recommended in small samples, a second step consisted in testing our model using Bayesian structural equation modelling with R Blavaan (Bayesian Latent Variables Analysis) 0.2-4 (Merkle and Rosseel 2018). In that latest procedure, as no previous information is available on that particular model, we decided to use default priors (also known as Jeffreys priors) with 1000 adaptation iterations, 4000 burn-in iterations and 10000 sample iterations (Merkle and Rosseel 2016).

Results of the first procedure using 95% percentile bootstrap confidence interval show that the theoretical model fits well with the data (Table 2). Analysis reveals a positive significant effect of immersion state on emotion (Regression Coeff. = 0,587; $p < 0,01$), which confirms hypothesis H1. Moreover, we notice that emotion felt during experience predicts social interaction (Regression Coeff. = 0,569; $p < 0,01$), which confirms hypothesis H2. As hypothesized, analysis shows the existence of an indirect effect of immersion on social interaction across emotion (Regression Coeff. = 0,334; $p < 0,05$), with a significant 95% bootstrap confidence interval (Shrout and Bolger 2002; Cheung and Lau 2007; Hayes 2013), thus supporting hypothesis H3. Moreover, as postulated in hypothesis H4, social interaction has a positive impact on satisfaction (Regression Coeff. = 0,497; $p < 0,01$), and satisfaction is also explained by the positive indirect impact of emotion through social interaction (Regression Coeff. = 0,283; $p < 0,05$), which supports hypothesis H5. Results are displayed in Table 2.

Results of the Bayesian structural equation modelling analysis do not differ much from our bootstrap frequentist analysis results. We conclude also that immersion has a positive effect on emotion (Bayes estimate = 0,609), that emotion has also a positive effect on social interaction (Bayes estimate = 0,557), and that immersion positively affects social interaction across emotion (Bayes estimate = 0,339). We also conclude that, if interaction positively affects satisfaction (Bayes estimate = 0,506), this latest variable is also the result of the positive indirect effect of emotion across interaction (Bayes estimate = 0,282). The Bayes estimates are the median of the posterior distribution of these parameters, so they represent the most likely value of this parameter given our default priors and observed data. In this sense, the 95% credibility interval (HPD) represents the range of values that we are 95% certain contains the true parameter value. Moreover, all the Gelman-Rubin statistic, which uses multiple Markov chains Monte Carlo (MCMC) to evaluate the model convergence, is below 1,05 for all parameters, and the model posterior p-value (PPP) of 0,336 advocates for a good model fit (Muthén and Asparouhov 2011). Results are displayed in Table 2.

Table 2: *Model Fit and Test of Hypotheses Using Bootstrap and Bayesian Methods*

	Bootstrap Method Under R Lavaan		**Bayes Method Under R Blavaan**	
Test of hypotheses	**Regression Coeff. (bootstrap)**	**95% Bootstrap C.I (LL ; HL)**	**Bayesian B estimate (PSRF)**	**Bayesian HPD.025 HPD.975**
Immersion ➔ Social Interaction	0,201[+]	-0,303 ; 1,310	0,200 (1,002) [+]	-0.236 ; 0,891
Immersion ➔ Emotion	0,587**	0,554 ; 1,757	0,609 (1,004)	0.526 ; 1.694
Emotion ➔ Social Interaction	0,569**	0,199 ; 0,829	0,557 (1,001)	0.193 ; 0.782
Social Interaction ➔ Satisfaction	0,497**	0,194 ; 0,777	0,506 (1,002)	0.215 ; 0.676
Indirect effects				
Indirect 1: Immersion → Emotion → Social Interaction	0,334*	0,168 ; 1,009	0,339	0.149 ; 0.918
Indirect 2: Emotion → Social Interaction → Satisfaction	0,283*	0,058 ; 0,419	0,282	0.062 ; 0,358
Model fit (Bootstrap and Bayes)	Chi2/dll : 1,19 ; CFI : 0,958 ; GFI : 0,991 ; TLI : 0,949 ; RMSEA : 0,047		Bayes Posterior Predictive (PPP) P-value = 0,336	

Bootstrap Sample = 10000. LL = Low Level ; HL = High Level ; C.I = Confidence Interval.
PSRF: Potential Scale Reduction Factor ; HPD: Highest Posterior Density
* p < 0,05 ** p < 0,01 *** p < 0,001 + not significant

Source: Own elaboration.

5. Theoretical and Managerial Implications

The study seems to confirm the presence of emotional and social dimensions and their links during this type of experience and represents them as key factors in the lived experience and drivers of the users' satisfaction. These findings allow us to suggest some important implications for the use of virtual reality systems and their future development. In particular:

- the link between immersion and emotions remains the cornerstone of the VE experience. The immersive dimension takes on a justified priority in the choices of systems to be developed in cultural contexts;
- social interaction (i.e. the feeling of sharing the experience with other users) is an essential mediator between emotions and satisfaction and adds value to the lived experience. Of course, social interaction continues after the experience, by exchanging images, memories, and information with those who did not participate (Mencarelli and Puhl 2012). However, technological developments, which allow interaction with other participants during the experience help to develop new forms of satisfaction, as reflected by a sense of instant sharing and approval.

We believe that these observations provide food for thought to technological research on the possible meeting between VR and social networks. This is not a new issue. This perspective was realized in the past during pioneering online experiments, which mixed the playful and social dimension. In the virtual 3D-world of "Second Life" (launched in 2003) the players' avatars interact with places, objects and other avatars in a quite complex way, but without providing a feeling of immersion.

Today, however, as the accessibility of devices is rapidly increasing thanks to diminishing prices, the strategies of large international corporations are considering the development of interactive and immersive virtual collaborative environments. This is indicated, for example, by the 2014 acquisition of Oculus, a leading company in VR hardware and software, by Facebook and by the latter's heavy financial commitment in this area leading to the 2017 launch of a new low-cost device. In 2017 Microsoft acquired a start-up company called Altspace VR that had promoted the possibly most advanced experiment in "social VR" and had run into serious financial difficulties because of the slow start of the market. Companies like Google and Samsung are also heavily involved in this area of development. Furthermore, companies will be confronted with an increasing familiarity with VE thanks to applications in videogames, tourism, education etc. and with the emerging phenomenon of user-generated VR content.

It must also be added, however, that these rapid technological developments have the negative effect of an equally rapid obsolescence of the tools and systems proposed, and therefore of the investments on which museums and cultural establishments are currently committing themselves.

6. Limitations and Future Research Directions

This paper presents a number of limitations related to the methodology and to its explorative character. The four observed experiments are of different nature, although approached with a consistent technological approach. The sample of respondents to the questionnaire is also quite limited, notwithstanding the advantages of its homogeneity. Overall, any generalization should be considered with care.

Nonetheless, the convergence of our results with some trends of the industry and of the technology suggests that they are sufficiently robust to justify additional efforts on the same path. Further research could validate the model on larger and different sample of users. Experiments performed on the same or similar systems could highlight variations due to technical, social and cultural variables. This would be especially relevant with regard to the increasingly collaborative consumption that characterizes tourism (Giachino et al. 2017) and that is made possible by the new generation of technological innovations (Bellini and Brondoni 2016; Trunfio and Della Lucia 2016).

It must also be recognized that research in this area presents significant risks of rapid obsolescence as the speed of scientific production hardly matches that of technological and market development, i.e. the trend towards technically improved devices at lower prices in the hands of increasingly expert users and exploiting a growing availability of either professional or user-generated content. This recommends a special attention to the quality of data if we really want to interpret the present and not (although rigorously) the past.

Appendix: Immersion, Emotion, Social Interaction and Satisfaction Scales (Original Questionnaire in Italian and English Translation)

Immersion (Likert 5 points)

A.1) L'esperienza ha creato un nuovo mondo che alla fine è improvvisamente scomparso.

A. 1) Experience has created a new world that eventually suddenly disappeared.

A.2) A volte, non ero più consapevole dell'ambiente circostante.

A. 2) Sometimes, I was no longer aware of the surrounding environment.

A.3) Durante l'esperienza, il mio corpo era nel luogo reale, ma la mia mente era nel mondo creato dall'esperienza.

A. 3) During the experience, my body was in the real place, but my mind was in the world created by experience.

A.4) Durante l'esperienza, quello che era successo prima o ciò che sarebbe accaduto in seguito non aveva più importanza.

A. 4) During the experience, what had happened before or what would happen afterwards was no longer relevant.

A.5) L'esperienza mi ha fatto dimenticare l'ambiente che mi circondava.

A. 5) The experience made me forget the environment around me.

Emotion (Likert 5 points)

B.1) Durante l'esperienza, ho provato forti emozioni.

B. 1) During the experience, I felt strong emotions.

B.2) Durante l'esperienza, ho provato emozioni più intense di quelle che di solito provo nella vita quotidiana.

B. 2) During the experience, I felt more intense emotions than I usually feel in everyday life.

B.3) Durante l'esperienza, ho provato una serie di emozioni molto diverse tra loro.

B. 3) During the experience, I felt a number of very different emotions.

B.4) Durante l'esperienza, ho vissuto momenti di intensa emozione.

B. 4) During the experience, I experienced moments of intense emotion.
Social Interaction (Likert 5 points)
C.1) Mi sono sentito molto vicino ad altri partecipanti, anche se non li conoscevo prima.
C. 1) I felt very close to other participants, even if I didn't know them before.
C.2) Ho sentito il desiderio di condividere l'esperienza con gli altri.
C. 2) I felt the desire to share the experience with others.
C.3) Ho avuto l'impressione di condividere la mia esperienza con gli altri, anche se non li conoscevo.
C. 3) I had the impression of sharing my experience with others, even if I didn't know them.
C.4) Con il procedere dell'esperienza, mi sono sentito/a sempre più parte del gruppo dei partecipanti.
C. 4) As the experience progressed, I felt increasingly part of the group of participants.
Satisfaction (Likert 5 points)
D) In sintesi vi ritenete soddisfatti/e di questa esperienza?
D) In summary, do you feel satisfied with this experience?

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