

# **IMMERSION/EMERSION: Presence in hybrid environments**

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## **Summary**

Technical problems are supposed to attract attention to the infrastructure of the virtual environment and then engender the user's emersion from the simulation. For these reasons, efforts are devoted to hide any trace of the medium from the interface on the one side and to measure presence as the sense of exclusive involvement into the virtual environment, on the other. We wanted to check the soundness of these assumptions by observing what actually takes place right after a technical dysfunction. We considered 5 minutes- sessions, in which students explore a virtual environment in individual, immersive modality, and collected a corpus of 15 episodes where a technical dysfunction occurs. We used discursive and interaction analysis to examine what happens from the manifestation of the dysfunction onwards. A sudden emersion from the virtual environment seems to be a rather inappropriate way to describe what happens. Participants remain focused on the navigation in the virtual environment, even though the environment they address with their actions is an expanded one. Hence we propose hybridity of virtual environments as a crucial aspect in their design and evaluation, for presence is distributed over settings that are conventionally considered as separate.

## **1 Visibility of the technical medium and emersion**

Technical dysfunctions occurring while navigating in a virtual environment are usually believed to stop the sense of presence in the simulation and mark a return to reality. Like the noise of a smashed door, which corrupts the vividness of our daydreaming, a technical dysfunction would reveal the simulation as a fake and deliver the user immediately to reality. This seems like a good example of the loss of transparency of the medium, an argument proposed by Winograd and Flores a decade ago, adapting

Heideggers' philosophical speculations to the interaction with computers (Winograd, Flores, 1986). According to this argument, we usually pay attention to the activity to perform and not to the tool used to perform it, unless a problem arises. Problems neutralize the transparency of a tool, in our case the technical architecture underlying the simulation, and make it visible; it is common assumption that in case of virtual environments the visibility of the technical infrastructure would spoil the sense of presence and make the user 'emerge'. This is the reason why designers of virtual systems try to hide the medium, by concealing any trace of the digital infrastructure, by making the interactive device as analogous with the action to perform as possible, by isolating the user from external interruptions, let alone preventing technical flows from breaking into the virtual experience.

The fate of presence when a breakdown occurs, though, is still poorly investigated. The difference between being immersed and having the illusion of immersion broken is simply taken as a primary, straightforward one. The user would be snapped out of the simulation into reality with such a clarity that she can self-report on her emersion right away (Slater and Wilbur, 1997; Held, Durlach, 1992). But does it really happen this way?

It is our suspect that a technical problem is not enough to push the participant abruptly off the simulation, since people do not respond to purely technical features but to complex symbolic events bearing on their current actions (see the studies on scientific perception Goodwin, 1999; 2000, Jordan, Lynch, 1993; paranormal phenomena, Wooffitt, 1992, mystic dimension, Hanks 1990). The psychological literature is adding more and more evidence to the fact that we can be engaged in different settings at the same time, and perform multiple actions simultaneously (from the early studies on divided attention to the current studies on multilayered situations). Some authors have already started to venture on this road; partitioning have been proposed among simple, cybernetic and experiential presence (Draper et al., 1998) or personal, social and environmental presence (Cuddihy, Walters, 2000) or according to the task performed (Schlörb, 1995). Some have addressed the alternation of emersion and immersion during a virtual session (Waterworth, Waterworth, 2001, Slater, Steed, 2000), the blurring distinction between person and environment (Zahoric, Jenison, 1998; Sheridan, 1999, Flach, Holden, 1998; Mallon, Webb, 2000), the distinction among focus, locus and sensus (Waterworth, Waterworth, 2001). So chances are that presence after a breakdown is not easy to be located within either the virtual or the real environment.

During the breakdown the participant is still operating in the simulation, so she has to be present there somehow. Even when the user starts talking with the researcher in the lab it is not sure whether she necessarily stops feeling present in the virtual environment. Our interest here is to study what happens

after a technical dysfunction occurs by observing actions and conversations taking place immediately after it. The goal is to test the enduring image of a sudden shift from virtuality to reality and suggest an explanation that accounts for the issues mentioned above.

## **2 Data and method**

We collected 15 episodes in which technical dysfunctions spontaneously occurred during the exploration of a virtual environment. All episodes were extracted from 24 sessions of immersive interaction with a virtual library. Users were mostly students in Psychology, both male and female, usually unfamiliar with immersive technologies; their orientation in the virtual library was facilitated by its close resemblance to a real library they used to attend. The virtual library allowed forward, backward, and diagonal movements, plus simple interactions with a small set of objects (doors, taps, ...). View was egocentric, meaning that participants could see the environment as if standing there and change their vista on the x- and y-axes. Each action was executed by pushing dedicated buttons on a joystick and by head rotation. All sessions were individual, 5-minutes sessions, where the participant was wearing the helmet and operating on the joystick, standing within a small space delimited by a safety fence. One of the researchers was always present during the session.

To shed some light on how the emersion worked, we applied a qualitative methodology. A subjective approach to presence has been adopted before in this field to investigate the relationship of presence with place (Murray et al., 2000), the different conversational patterns used (Bowers, et al., 1996), the effect of different embodiments (Benford et al., 1995). Instead of producing snapshot measurements, this approach allows a more inclusive view on presence, examining its coordinates and dynamics. The qualitative methodology we chose was interaction analysis (Goodwin, 2000; Jordan, Henderson, 1995, Fisher, Sanderson, 1996), which focuses on the sequence of verbal and non-verbal actions performed by the participants to the session, namely the user wearing the immersive devices and the researcher present in the laboratory. Interaction analysis allows to study presence from the point of view of participants' action and to examine the resources and circumstances that are taken into account to perform them. The analysis was carried out on the videorecordings of the session, produced with the split-screen technique (Mantovani et al, 2001; Gamberini et al. submitted), where two videos were running in parallel on the screen, one showing the virtual environment and the other the participant in the laboratory.

### 3 Making sense of the technical anomaly

A technical problem coming up and hampering somehow the course of participant's action looks like a splendid condition for the participant's emersion from the simulation, because of the sudden appearance of the otherwise disguised technical medium. For the sake of clarity, let's distinguish among cases where the exit from the breakdown was readily found from cases where it needed to be sorted out.

#### 3.1 Ready solutions

In our corpus, this condition occurred when a cable went into the participant's way or pulled slightly the wearable equipment (8 episodes). Each time, the attention to the technical medium was inserted smoothly into the flow of navigation, the participants took care of the problem and then resumed the navigation readily. Sometimes they stopped their movement in the virtual library to disentangle themselves from the wires, sometimes they used just the movements in the library in order to do that; for instance, in the sequence below, the user turns to the right, then realizes that she's getting embroiled in the wire so she reverses the movement in order to disentangle herself (see Appendix for the transcription code).

Extract 1 (session 1, blue).

```
1   P: ((he turns to the right; stops;))  
  
2   [((turns to the left and tries to move the wire off him))  
  
3   [uh:: ↑I'm getting stoucko,  
    eh:: mi sto incastroandoo.
```

Adjustments were sometimes carried out without even interrupting the navigation, like in the extract below.

Extract 2 (session 7, blue)

- 1 P: ((the participant is turning to the right; PICTURE?  
he lifts the wire of the joystick while turning))

We can explain those episodes by saying that users resorted to reality for a while until the problem was taken care of. Or we can acknowledge that their physical body and equipment *are* actually involved in the navigation. Participants try not to lose balance, keep contact with the fence, operate on the joystick, wear the helmet while exploring the virtual environment: their physical body is involved in the action in the virtual library, part and parcel of their presence there. When accidents occur, they become the focus for a while, causing a re-arrangement of the setting: the body position is given more attention, the disentanglement becomes a main concern, the researcher may be addressed for requests or explanations:

Extract 3 (session 2, blue)

- 1 P: ((she turns to the right, then she moves shortly forward))
- 2 ((she makes a [complete turn to the left))
- 3 |I'm: making a mess with these wires, ((ironic))  
*m:i\_sto: in:casinando con i fili,*
- 4 ((she moves forward))

This change of focus does not amount necessarily to an emersion from the virtual environment, whose resources get instead re-arranged by putting more emphasis on the organization of the equipment. This is to say that the virtual environment is not to be strictly conceived as the digital simulation alone; its confines include more variegated resources concurring to generate the action.

### 3.2 Laborious diagnosis

This condition is represented in our collection by the cases in which the technical anomaly takes a while to be fixed or diagnosed (6 episodes). After the problem comes up, a series of attempts is produced and their aftermath checked on.

Extract 4 (session 3, blu)

- 1 P: ((turns towards the main aisle, stops, turns to the left))

2 It is not going forward anymore.  
*Non va più avanti.*

3 ((he turns to [the right, to the left]) {2.7})

4 R: [it doesn't go forward anymore?  
*Non va più avanti ?*

5 P: n[o.  
*no*

6 R: [go backward a little,  
*torna n attimo indietro,*

7 P: ((Goes backwards))

8 ((the view goes suddenly up and down))

9 R: oh, it jumps as well?  
*Oh addirittura, salta?*

10 (.2)

11 (h)m(h)o.  
*(h)m(h)o*

12 (.2)

13 Let's start over.  
*Ripartiamo.*

An attempt like the one at line 6 ('go backward a little,') are a way to solve the problem and to achieve a satisfactory grasp of the nature of the anomaly as well. In other words, they represent a practical problem solving, aiming at making sense of the situation pragmatically, by knowing how to deal with it from the consequences of different interventions (from example the anomalous 'jumping' of the view) (Lave, 1988). The series of attempts is produced together by the participant and the researcher, neither of whom can recognize the problem at first sight.

More specifically, the nature of the problem as a technical problem is not easily detected. In all episodes in our collection (but one, Note 1), the first explanation to appear is that of a bad maneuver on the user's part. This is manifest in the kind of solutions produced first and in the way the anomaly is described in words, namely as a problem in the user's action, not in the system. Let's analyze this in details in the extract below.

The participant is suggested to interact with the virtual object she's facing, a WC; she clicks on the WC and a weird sound is produced (a siren), by no means similar to the sound one would expect. This is a technical anomaly, as it will turn out in the end. So the participant (P) asks to the researcher (R):

37 P: like this<sub>s</sub>?  
      *cosi'?*

38 R: eh:: not really, se the: the bowl of the WC,  
      *eh:: non proprio, que li ve: la tazza del water,*

39 P: ((she adjusts her viewfinder on the target))

40 R: this one-try<sub>i</sub> (1.8) click<sub>i</sub>  
      *Questa.-Prova<sub>i</sub> Clicca<sub>i</sub>*

At line 37 the participant asks 'like this?', namely she responds to the anomaly by questioning the correctness of her action. The researcher replies in the same vein, by expressing a mitigated disagreement, (delayed by the initial particle 'eh::' and expressed by the phrase 'not really') and describing in another way the operation to perform. He verifies the execution of this bit of advice and then confirms its correctness ('this one'). After a pause he explicitly solicits her to perform the action ('try') and after another pause he solicits her again using a different form ('click').

So far, the idea is sustained that the participant has to achieve a better performance. What happens after the second try?

41 P: ((she clicks and a siren starts again;  
      she clicks once more))

42 R: [↓there are kind of [weird sounds linked.((mortified))  
      *ci sono dei suoni un po' strani associati.*

43 P: [((she goes out, looks at the sink))  
      {(1.5)} [°okay°((smile voice))  
              *okay*

By line 41, another attempt is made and the siren sound comes out again. The researcher is the first who talks; at this point the problem is recognized as a technical anomaly. The terms used by the researcher are those of a system designer: he talks about the 'link to the sound' which refers to the mechanism with which the acoustic effect is implemented in the system.

In synthesis, a sensemaking process follows the manifestation of a technical mistake, a process made of practical tries produced by participant and researcher together. A preference for blaming the participant first, instead of the system, appears throughout the whole corpus of episodes, although the anomalies analyzed are all technical dysfunctions of the virtual system. These elements together suggest that the perception of a technical anomaly is not straightforward, but mediated by various considerations, such as the criticality of a technical bug for the progression of the session or the inexperience of the user (Note 1).

The hypothesis of a sudden emersion provoked by the visibility of the technical medium is then not appropriate. In fact, what happens is exactly the opposite: the VE is still the place within which the action goes on and includes part of the physical body and the conversation with the researcher as well. Let's add that when the technical problem is finally recognized as such, we still cannot see any sign of emersion. In the coda of the episode above, for example, the researcher explains the technical dysfunction and apologizes for it, while the user displays only minimal participation and goes on with her exploration. In another session, once the problem is recognized, the user tries to solve it from inside the virtual environment, so that dealing with it becomes part of the navigation itself. In one session, for example, the virtual library was on fire and the participant was trying to escape. The system started delaying the output of the head rotation, making it hard to change direction. Once the problem was recognized, the participant carried out the task anyway, with the difficulty increased by the technical dysfunction.

#### **4. Emersion as the reconfiguration of a hybrid presence**

From the analysis we have carried out, we draw the conclusion that our presence in a place depends on many considerations besides the physical landscape alone. Emersion is not determined by the perceptibility of the technical medium per se. The way we outline the confines of an environment is probably more connected with the actions that are possible within it than with its physical homogeneity (Malpas, 1999). This is coherent with recent formulations in disciplines such as human geography and

anthropology, emphasizing the mediatedness of our presence in an environment (Thuan, 1977; Hanks, 1990).

This characteristic of presence, which can be called hybridity, has already been pinpointed in other works (Gamberini, Spagnolli, in press; Spagnolli, 2001). In general, we have observed three forms of it so far.

1) expanded setting; the environment the user is inhabiting while navigating expands beyond the confines of the simulation to include elements from different environments in the *same* setting; as a result, presence in the simulation does not exclude aspects of the real world: users controls their bodily position, pay attention to the instructions from the lab,...; the actual confines of the environment are appreciable with reference to action and its coordinates. Consider clinic, training, experimental applications, where a non-immersed expert is supposed to assist the user from outside the simulation: the action of the user takes place in a setting constituted of the user, the therapist and the simulation at least. In this paper, hybridity as expanded setting was represented by the cases in which the technical equipment and the physical body got included into the virtual environment.

2) multiple actions; people are able to keep multiple settings running at the same time, acting on each of them simultaneously or in close alternation. Virtual settings are then made of different possible arenas for action. Let's consider the following example (figure 1 below). First the participant is moving in the VE; than he asks a question to the researcher assisting him in the lab. The change of setting is underlined by the interruption of the walk and by the direct involvement of the researcher while the conversation is going on; such discontinuity is also marked by the way the participant uses his right hand: to operate on the joystick in the first setting, to indicate the objects he is talking about in the second (figure 2).

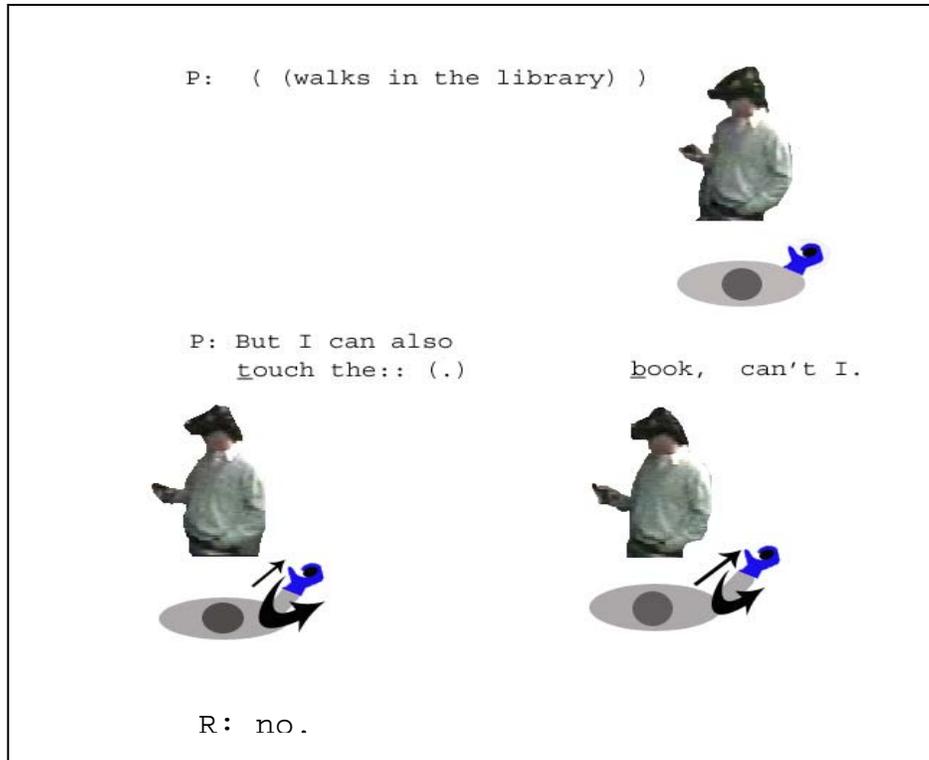


Figure 1: under the timeline marking the temporal unfolding of the action two kind of actions alternate: the walk in the VE and the talk to the researcher. To start talking the participant interrupts the walk, which nonetheless maintains many aspects of its setting

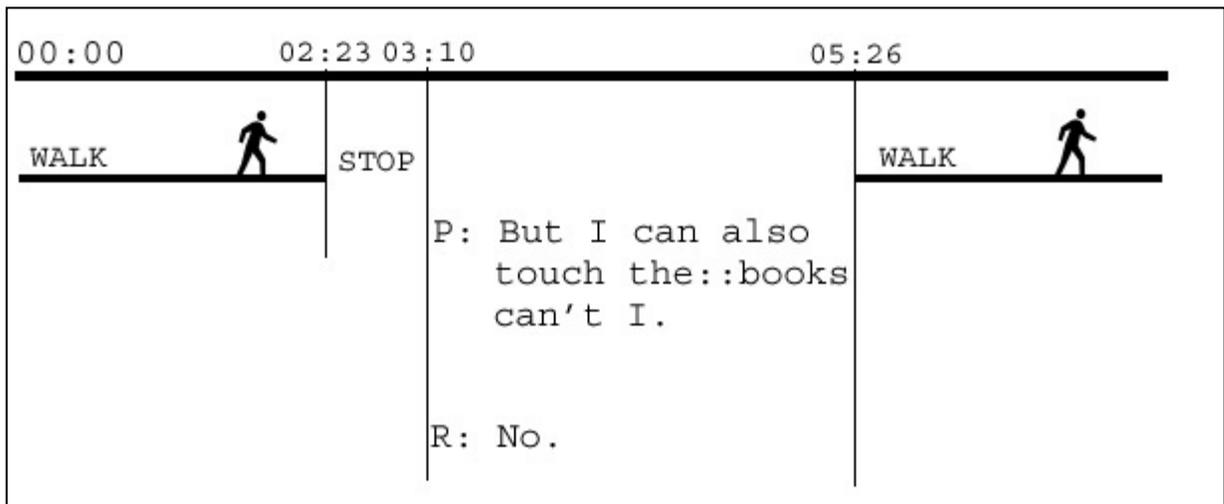


Figure2. Different uses of the hand, marking the change of action and setting.

However different, those settings share some elements: while talking to the researcher, for instance, the user refers to the virtual objects by indicating them in front of him with his hand. The previous action in the virtual setting and the current interaction with the researcher are separate but involve both the virtual books. After the question has been asked, the participant goes on walking while the researcher is answering, thereby taking care of two settings simultaneously. The idea of multiple settings for action extends also outside the virtual environment, since attention can be divided among the physical and the virtual world (Singer, Witmer, 1997).

3) uncertainty; sometimes an element does not fit or different scenarios compete to take over, thereby giving rise to breakdowns or dilemmas where a sensemaking process is required until we turn any oddity into something familiar and manageable. From this point of view, the sense of ordinariness and naturalness is the achievement of a process which weaves the fabric of our reality and lacks when we feel displaced and alienated. Besides being an ordinary characteristic of the environment, hybridity may sometimes stand out as discomfoting; we can assume that such a feeling would emerge while inhabiting a newly assembled environment, where concurrent activities seems at first to conflict until we learn how to adjust them in the same space. In this paper, this type of hybridity was represented by the second group of cases, where the participant and the researcher started a series of attempts to figure out the nature of the dysfunction.

In any case, the questions seems not to be whether the user is present in the virtual environment, but what is the configuration of the virtual environment in which she is present at any given moment. It may be the case that the hybrid composition of the virtual environment, where the technical medium is visible and actions are performed on multiple settings, instead of representing a distracting factor, makes for a richer experience of the virtual simulation.

## **Appendix.**

(base on the code elaborated by Gail Jefferson; for a broader version, refer to Ochs, Schegloff and Thompson, 1996, pp. 461-465).

[[ point of overlap onset at the start of an utterance  
[ point of overlap onset  
= latched utterances  
(0.5) pause, represented in tenth of a second

(.)	micropause
:	stretching of the preceding sound
∴	falling intonation contour
∵	rising intonation contour
.	falling or final intonation contour
-	cut-off or self-interruption
↑↓	sharp rise/fall in pitch or resetting of the pitch register
<u>word</u>	emphasis; represented by the length of the underlining
WORD	especially loud sound
°°	softer sound
hh	marked expiration, whose length is represented by the number of letters
(h)	expiration within a word (e.g. while laughing)
.h	inspiration
(( ))	transcriber's descriptions of events (e.g. cough, telephone rings, ) or non-verbal actions
><	compressed talk (rushed pace)
<>	stretched talk (slowed pace)
(word)	uncertain identification of the word
(word A)/	
(word B)	alternative hearings of the same strip of talk
( )	inaudible talk; the distance among the brackets should represent the length of the missing talk
,	'continuing' intonation
?	rising intonation
¿	mild rising intonation

## Notes.

1. In one episode the problem is immediately described as a technical problem by the user ('it's not moving forward anymore'). Yet, this negative case confirms the fact that the experience of the user influences the opportunity to present the problem as a technical one, since the participant was acting as an expert navigator during the session (and described as such by the researcher: 'you went about with more experience, you move faster,/ hai girato con più esperienza, ti muovi più veloce, '). In addition, a

series of attempts followed anyway before the hypothesis of a technical breakdown was eventually credited.

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