The 'presence of others' in a Virtual Environment: Different collaborative modalities with hybrid resources

Gamberini Luciano, Spagnolli Anna, Cottone Paolo, Martinelli Massimiliano, Bua Laura.

Department of General Psychology
University of Padova
Via Venezia, 8 – 35131 Padova
ITALY

Correspondence to:

Luciano Gamberini
Department of General Psychology
University of Padova
Via Venezia, 8 – 35131 Padova
ITALY

Phone: + 39 049 8276605
Fax: + 39 049 8276600
e-mail: luciano.gamberini@unipd.it

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Abstract

The purpose of the present study is to see in which forms and under which conditions social presence turns into collaboration. 8 couples of participants were asked to find some objects in a virtual environment where collaboration was allowed but not mandatory. The qualitative analysis of the video-recordings shows that all participants resorted to collaboration in forms that were justified by the requirements of the task, the environmental affordances and the different expertise.

Keywords

collaboration, social presence, situated action, hybrid environments

1. Social presence and collaboration in VE

Social presence is referred to in the literature as the 'awareness that other people are present in the same environment'. This concept has been relevant in media and social studies since the appearance of computer mediated communication (Lombard & Ditton, 1997; Mantovani, 1996; Sproull & Kiesler, 1991) to describe the way in which different communication media convey the presence of the interlocutor. The literature on cyberspace and, most systematically, on virtual environments (VE) has inherited the concept, along with the rationale with which it was used (Heeter, 1992; Biocca & Harms, 2002a,b).

From an ethnographic perspective, presence is a pragmatic phenomenon, directly organized and shaped by people's actions (Zahoric & Jenison, 1998; Mantovani & Riva, 1999). Social

presence, then, consists in the practical ways in which another person is taken into account, more than in the mere acknowledgment of her/his presence. In accordance with this perspective, a study was carried out investigating the way in which participants take into account the presence of other people while carrying out a task in a multi-user VE. The goal was to see *in which forms and on the basis of which resources* participants worked together at the completion of the task if the degree of collaboration was left open. The analytic focus was on the emerging characteristics of the interaction throughout the immersive session and not on pre-defined models of collaboration; in addition, the definition of 'environment' and of 'partners' was left open as well. Previous work, in fact, has lead us to consider the VE as a hybrid environment, where elements of the real environment are inevitably taken into account (Spagnolli, Gamberini, 2002; Waterworth, Waterworth, 2001). The following paragraphs will illustrate setting, procedure and findings of the study.

2. Research procedure

A multi-user VE (figure 1) was developed for this study [Note 1]. The immersed participants had an egocentric view of the environment and could move forward or backward through a joystick and turn laterally via head rotation. A head mounted display tracked participants' head position and offered them visual and acoustic access to the VE. During the immersion, participants were standing, surrounded by a safety fence; a member of the research team (the same person in all sessions) was always present.

-FIGURE 1-

FIGURE 1. A view of the VE

Participants were 16 people, aged 24 to 32, grouped in 8 couples (3 all males, 3 all females, 2 mixed), whose members already knew each other. All participants signed in an informed consent

form. Written instructions were given after a training phase, carried out individually in a virtual library for about two minutes, and repeated at the beginning of the multi-user session by a recorded voice. Participants were asked to find some objects in a limited amount of time (ten minutes). The instructions were deliberately ambivalent on the collaborative nature of the task: participants were addressed sometimes in singular sometimes in plural person (which differ in Italian) and advised that their instructions could differ from the partner's; collaboration was mentioned as technically possible and vaguely described ('success in the quest is not as important as navigation and interaction with the partner').

The multi-user sessions were video-recorded with the split-screen technique (Gamberini, Spagnolli 2003; Gamberini et al, 2003, Mantovani et al., 2002), where the images of what goes on in the VE and in the real environment are displayed in parallel. Each action in the video-recordings, namely each set of verbal and nonverbal moves aiming at the same interactional result, has been transcribed (Heath, Hindmarsh, 2002; Atkinson, Heritage, 1984) and participant's position in the VE has been drawn on a map. Six collaborative dimensions were created by identifying those forms of collaboration that could occur independently from any other in the sessions (section 3 below). Each couple's action was coded as either collaborative (A) or non-collaborative (B) with reference to the 6 dimensions, thereby obtaining six coded timelines for each couple (Figure 2). The occurrence of the various collaborative dimensions has then been registered and interpreted. No gender comparison was made, since the sample was not designed to allow conclusions to this respect.

FIGURE 2

FIGURE 2: part of the coded timelines of couple 3.

3. Results

Participants display six different forms of collaboration:

1. 'NAVIGATION': they jointly navigate in the VE, in a common route.

2. **‘**GOALS’: they think to have the same goal.
3. **‘**EXECUTION’: they help each other out in the execution of the task
4. **‘**INFORMATION ON THE TASK’: they exchange information ‘on’ or ‘for’ the task [Note 2].
5. **‘**INFORMATION ON THE NAVIGATION’: they exchange information on the technical aspects of the navigation or on the topology of the VE [Note 2].
6. **‘**MONITORING’: they keep track of each other’s position in the VE, with questions such as ‘where are you?’

Dimension 2 was excluded from the subsequent analysis because it proved too redundant with the other ones. Table 1 below shows the occurrence of each dimension of collaboration in the eight couples of participants.

TABLE 1

TABLE 1 - Percentage of collaboration calculated on the number of lines out of the whole transcript (in parenthesis). (*) Exchanges with the experimenter not included.

No dimension covers the whole session, since couples alternate different forms of collaboration. The aftermath is that even when participants do not collaborate in one dimension, they may be collaborating in another (Table 2).

TABLE 2

TABLE 2- Amount of collaborative exchanges on dimensions 4,5,6 when no collaboration occurs in dimensions 1,3.

Table 3 shows the amount of collaboration with the experimenter, not considered in table 1. The experimenter represents another ‘social presence’, since she is available acoustically and shares the view of the VE with the immersed participants.

TABLE 3

TABLE 3 - Information exchanged with the experimenter (exp). The percentage is calculated from the amount of lines out of the whole transcript.

Three aspects justify the distribution of collaboration over different dimensions and people: task, environment and expertise. The *task* fosters variability because it is not restrictive on the kind of collaboration tolerated and because - in order to find out the objects - it is more sensible for participants to split in the VE and exchange information verbally. In this sense, continuous visual collaboration as proposed in Benford et al., 1998 is not necessary throughout the whole session. In addition, the *perceptual affordances* of the VE make visual coordination hard, as it is often the case in VEs where gestures or gaze are difficult to check (Fraser et al. 2000). Thus, in the limited time available, participants need to constantly adjust their co-presence to the requirement of the moment, mostly sharing the acoustic dimension and the visual scenario with the experimenter and the acoustic dimension with the immersed partner. Finally, exchanges involve participants and experimenter selectively on different topics according to a *different expertise*. Exchanges with the experimenter mostly regard technical information about the navigation or clarifications on the nature of the task; exchanges with the immersed partner regard basically the results of the exploration, the reciprocal position and the orientation in the VE [Note 3].

4. Conclusions

The purpose of the study was to see in which forms and on the basis of which resources people resorted to each other for collaboration. The results show that, even in a simple task like the one proposed, participants orchestrate their collaboration passage by passage, exploiting the resources available in accordance with the nature of the task, the environment and their expertise.

In collaborative Virtual Environments (Churchill et al., 2001) the issue is no longer the recourse to collaboration, but, more subtly, the way in which collaboration may be optimized. People rely on situated knowledge and emerging practices of interaction as their major collaborative asset (Nocker, Garcia-Lorenzo, 2003) and –as it was shown in this study -conjure up hybrid environments composed of elements both internal and external to the digital space, of different domains of co-presence, of specialized communicative exchanges. Hence, crucial information for developing adequate collaboration policies can be obtained by observing spontaneously emerging patterns of collaboration.

Notes

1. The multi-user VE for this study was developed with Superscape VRT 5.6 and presented in 256 colors on the 640x480 V8 HMD from Virtual Research .

2. Unilateral offers of information or comments that were not part of an 'exchange' (or 'adjacency pair', in conversation analytic terms) were not included.

3. This difference is not explained by the fact that participants knew each other since before the experiment, because they were also well acquainted with the experimenter assisting them during the session and in charge of the recruitment of participants.

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References.

Atkinson J.M., Heritage J.(1984). *Structures of social action*, Cambridge, Cambridge University Press.

Benford S, Greenhalgh C., Reynard G., Brown C. and Koleva B. (1998) Understanding and constructing shared spaced with mixed –reality boundaries. *ACM Transactions on Human-Computer Interaction*, 5 (3): 185-223.

Biocca, F. and Harms C. (2002a). Social Presence. Presentation at the SIGGRAPH 2002 Conference, S. Antonio, TX, 21-26 July.

Biocca F. and Harms C. (2002b) *Networked Minds Social Presence Inventory. Measures of co-presence, social presence, subjective symmetry, and intersubjective symmetry.* Available at: http://www.mindlab.msu.edu/Biocca/papers/2002_netminds_scales.pdf

Churchill E. F., Snowdon D. N., Munro A. J. (2001) *Collaborative virtual environments*. London: Springer Verlag.

Fraser M., Glover T., Vaghi I., Benford S., Greenhalgh C., Hindmarsch J. and Heath C. (2000) Revealing the realities of collaborative virtual reality. *Proceedings of CVE 2000,* ACM Press, pp. 29-37.

Gamberini L., Cottone P., Spagnolli A., Varotto D., Mantovani G. (2003) Responding to a fire emergency in a virtual environment: Different patterns of actions for different situations. *Ergonomics,* 46 (8), 842-858.

Gamberini L., Spagnolli A. (2003) Display techniques and methods for cross-medial data analysis *Psychnology* 1(2), 131-140. *http://www.psychnology.org*

Heath C., Hindmarsh J. (2002) *Analysing Interaction: Video, Ethnography and Situated Conduct*. In T. May (ed), *Qualitative Research in Action,* London, Sage, pp. 99-121.

Heeter C. (1992) Being there: The subjective experience of presence. *Presence, Teleoperators and virtual environments*. 1(2): 262-271.

Lombard, M. & Ditton, T. 1997. At the Heart of It All: The Concept of Presence. *Journal of Computer Mediated Communication* 3, (2).

Mantovani, G. (1996). *New Communication Environments*. London: Taylor and Francis.

Mantovani G., Riva, G. (1999). Real Presence: How different ontologies generate different criteria for Presence, Telepresence and virtual presence. *Presence*, 5(7), 540-550.

Mantovani G., Gamberini L., Martinelli M., Varotto D. (2000) Exploring the suitability of virtual environments for safety training. *Cognition, Technology and Work*, 2, 1-9.

Nocker M., Garcia-Lorenzo L. (2003). Teaming in action: *Knowledge creation and sharing in project teams 19th EGOS Colloquium. Organization Analysis Informing Social and Global Development,* Copenhagen, 3-5 July.

Spagnolli A., Gamberini L. (2002). IMMERSION/EMERSION: Presence in hybrid environments. Proceedings of the *International Workshop on Presence*. Porto, Portugal: F. Pessoa University Press, pp. 421-434.

Sproull L., Kiesler S. (1991). *Connections: New ways of working in the networked organization*. Cambridge, MA: MIT Press.

Waterworth E.L., Waterworth J.A. (2001). Focus, locus and sensus: The three dimensions of virtual experience. *CyberPsychology and behaviour*, 4 (2), 203-213.

Zahoric P., Jenison R.L. (1998). Presence and being-in-the-world. *Presence,* 7 (3), 225-240.