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*Nikiforos M. Papachristos, Tassos A. Mikropoulos*

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## On the Necessity of Studying Social Presence in Educational Virtual Environments

Nikiforos M. Papachristos, Tassos A. Mikropoulos

University of Ioannina

npapachr@grads.uoi.gr, amikrop@uoi.gr

### ABSTRACT

*Virtual reality environments can be considered as highly interactive communication interfaces. Considering that social interaction and social context play a dominant role in learning, the affordances provided by educational virtual environments for shared experiences can be exploited only if we understand the mechanism of social interactions within virtual environments. Social presence is a key notion to communication and interaction in virtual environments. The main purpose of this article is to argue on the relevancy of social presence research to educational virtual environments. Social presence research can contribute to develop a more complete exploratory basis for research related with social cues in educational virtual environments. It might provide more meaningful correlation with learning outcomes and a more adequate explanation of quasi-social interactions. Virtual environments can be powerful educational environments on the premise that they provide the necessary context for users to feel socially present in the educational setting.*

**KEYWORDS:** *Social presence, Educational virtual environments*

### INTRODUCTION

Over fifteen years after Bricken (1990; 1991) described the potential pedagogical affordances of virtual reality environments, her prediction that “virtual reality will be commonplace” (1990, p. 8) in our days, seems not to have come true. Even though a considerable number of virtual environments for educational use have been developed and studied since then, the use of virtual reality (VR) in classroom based teaching and learning is reported almost solely in the context of educational research projects and the integration of this new medium in the curriculum is not yet considered.

There could be many reasons why this is the case, least of which, we believe, are endogenous characteristics of the technology itself or technological inefficiency. It is mostly our approach to educational technology that poses difficulties for research and development of VR environments to reach the level of widespread application in education. Following Papert’s notions of technocentric thinking and computer criticism (1990) we call for a shift of focus from questions such as “is VR good for this or that?”, “can VR do this or that?” or “does virtual reality work?” to questions like “what pedagogical and learning theories underlie or support the development and use of VR in education?”, “what rules of correspondence exist, if any, between these theories and the design and development techniques of VR

environments?” or “how can interdisciplinary research contribute to a better understanding of how humans interact with virtual environments?”

One of the implications of such a shift is that research should try to shed light on the socio-cultural phenomena that take place in Virtual Environments (VE). Since learning is also a socially driven act that takes place in a cultural context, it is important to know how this context is being transferred and represented in the VE and how the virtual context influences learning in the VE. A key notion for this research is social presence.

Having been, often carelessly, overused in very broad way, the term “virtual learning environment” has ended up describing almost every software system designed to support teaching and learning in an educational setting, not mentioning the ambiguity of whether the term “virtual” refers to learning or the environment. It is therefore necessary to provide some clarifications. For this paper the term “virtual environment” refers to an environment that is generated by virtual reality technologies. Virtual Reality (VR) is a combination of high-end computing, human computer interfaces, graphics, sensor technology and networking which allows the user to become immersed in, interact and experience in real time a three-dimensional (3D) artificial environment representing realistic or other situations (Mikropoulos & Strouboulis, 2004). The unique characteristics of VR which differentiate it from any other ICT application are:

- creation of 3D spatial representations, namely virtual environments (VE)
- multisensory channels for user interaction
- immersion of the user in the VE
- intuitive interaction through natural manipulations in real time.

VR, as any technology, does not have endogenous pedagogical features. Its educational affordances derive from features such as free navigation, first – person point of view, natural semantics, size, transduction, reification, autonomy, and presence (Mikropoulos & Bellou, 2006). As a next step in clarifying terms, we choose to avoid using the term “virtual learning environment” and to adopt the term “Educational Virtual Environment” (EVE) as “a virtual environment that incorporates educational objectives, pedagogical metaphors, provides users with experiences they would otherwise not be able to experience in the physical world and leads to the attainment of specific learning outcomes” (Mikropoulos, 2006).

The main purpose of this article is to argue that it is necessary to study social presence in EVEs.

## **SOCIAL PRESENCE**

### **Sociocultural foundations of EVEs**

As Winn (1993) noted, EVEs would possibly be just another educational gimmick if their use was based on “traditional” theories of how learning occurs. The use of EVEs is founded on constructivist theories of learning (Winn, 1993; Dede, 1995; Mikropoulos & Bellou, 2006) and all the aforementioned affordances characterize them as environments that are highly experiential and enactive (Osberg, 1997).

A valued tenet of constructivist practice is the process of collaborative learning. According to Vygotsky's social development theory, social interaction is a corner stone in the development of cognition and the social environment has influences on students' thinking and learning (Vygotsky, 1997). Collaborative VEs (CVE) can be developed to allow multiple participants to interact simultaneously, sharing control in real time interactions (Bricken, 1991). They can support user representations through avatars and interactions through multiple communication channels, the latter being effected through a variety of means (Churchill & Snowdon, 1998). In this sense, VR can be considered as a communication interface, "whose main characteristic is the full immersion of the human sensorimotor channels into a vivid and global communication experience" (Riva & Mantovani, 2000). A key notion to interaction and communication between users in VEs is social presence which, as of special interest from the point of view of learning in a VE, is discussed in the next section.

### **Definitions and determinants**

It is almost commonly agreed by VR researchers that a central conceptual component of VR is presence, which Lombard & Ditton (1997) elegantly described as "the perceptual illusion of non-mediation", the phenomenon where a person fails to perceive or acknowledge that a mediated experience is mediated. A major school of presence conceptualization defines presence as consisting of two interrelated phenomena: physical presence (also known as spatial presence or telepresence) and social presence (Heeter, 1992; Biocca, 1997; Ijsselstein et al., 2000; Biocca, Harms, & Burgoon, 2003). Physical presence, refers to the "the sense of being physically located somewhere" (Ijsselstein et al., 2000).

The origins of the term "social presence" date back to 1976 when Short, Williams, & Christie defined social presence as "the degree of salience of the other person" in a mediated interaction. Heeter (1992), being one of the pioneers introducing the concept in VR, defines social presence as the sense of "being with others". Connecting the concept with presence she suggests that communication and interaction with other human or non-human beings could lead to a more strong perception of being in the environment. Lombard & Ditton (1997), not explicitly referring to social presence, suggest that a form of presence could emerge when a user acts as social actor inside VEs describing that they would respond to interactive entities contained in the VE by behaving in accordance with the social rules which would apply to a similar situation in the real world. Ijsselstein et al. (2000) argue that social presence "refers to the feeling of being together (and communicating) with someone." Biocca & Nowak (2002) define social presence as the "level of awareness of the co-presence of another human, being or intelligence" and the "feeling that one has some level of access or insight into the other's intentional, cognitive, or affective states". Calling for the need to found a more robust theory of social presence, Biocca et al. (2003) in their extensive review, noted that the existing definitions tend to be vague, overly broad, or circular.

Social presence can be meaningfully distinguished from physical presence since a medium can cause physical presence without allowing any communicative interaction and, conversely, other media, such as the telephone, can provide communicative cues with minimal physical representation. On the other hand social presence is interrelated with physical presence having possibly common determinants, like immediacy in interaction (Ijsselsteijn et al., 2000).

An open question that is crucial for the development of a coherent social presence theory is whether social presence is a quality of the medium or a psychological state of the user. Short, Williams, & Christie (1976) perceived social presence as a “subjective quality of the medium”, explaining that it depends upon the objective qualities of the medium but the weight of each quality is subjectively determined. Biocca et al. (2003) question the usefulness and effectiveness of such an approach because of the unreliability of self reports.

Discussing the determinants of presence Ijsselsteijn et al. in their review of the presence literature categorized four factors (2000):

- i) The extent and fidelity of sensory information, which produces a rich mediated environment (e.g. cues to spatial layout, resolution, field of view, spatialized audio).
- ii) The match between sensors and the display (e.g. using head tracking, motion of the user’s head should match the visual and auditory display).
- iii) Content factors (a broad category including interaction, user’s representation in the VE, the extent to which objects and actors of the VE exhibit autonomous behaviors, acknowledgement of the user through the reactions of other actors, virtual or real, the nature of the potential task or activity, the meaningfulness of the content).
- iv) User characteristics (e.g. user’s perceptual, cognitive and motor abilities, stereoscopic acuity, susceptibility to motion sickness, concentration, prior experience, expectations and a willingness to suspend disbelief, age and sex of the user, mental health conditions).

Social presence seems more likely to be affected by content factors and user characteristics (Richardson & Swan, 2003; Mikropoulos & Strouboulis, 2004).

Research in the social presence domain is still in its infancy and no generally accepted theory of presence has been developed. A consequence of this situation is that a variety of measures have been reported which are usable but limited in scope (for an extended review of social presence measures see, Biocca et al., 2003. More information can be found at <http://www.presence-research.org>).

It seems that social presence research is still in a premature phase (Biocca et al., 2003) but it also is a very promising area which will possibly contribute to gain insight into computer mediated social interactions, especially within EVEs.

### **Relevancy of Social Presence research to EVEs**

As mentioned before, social interaction and social context play a dominant role in the process of learning. Thus the relevancy between social presence research and

research on EVEs appears to derive spontaneously. But such an approach would lead to redundancy. Simply saying that social presence is relevant with EVEs because learning is of social nature does not add anything new to the discourse. So, why is social presence research important for EVEs? In the next we will try to locate issues where social presence research could contribute in relation to EVEs research.

Increasing bandwidths and the evolution of highly immersive environments are promising the end of EVEs where the user wanders around alone, meeting inanimate avatars occasionally. In the new era of collaborative EVEs many users (teachers and students) will be able to engage simultaneously in real time social interactions. Many issues concerning this kind of interactions, such as gestures, facial expression, dress, direction of gaze, posture, personal space and vocal cues are put under focus. These issues may seem to be technological but they also denote factors of social presence (Sallnas, 2005), so social presence research can contribute to a more complete exploratory basis for these factors (Biocca et al., 2003).

Since the ultimate goal of EVEs is to support knowledge construction it is important to correlate learning outcomes and specific characteristics of EVEs. But, is it meaningful to correlate learning outcomes with the technology being used? As Papert put it, "the context for human development is always a culture, never an isolated technology" (1990). An EVE can be described univocally in terms of its technological characteristics only until the very moment humans enter it. After that moment the EVE is incorporating also the human's individual characteristics. Social presence is a cognitive synthesis of many factors (Sallnas, 2005) including technological attributes of the medium -an approach that implies that individual differences play also an important role- and might be able to provide more meaningful correlation with learning outcomes in EVEs. Until now, even though a considerable number of studies have been made, most of them refer to computer mediated communication systems such as online courses, asynchronous education and virtual conferences (see, for example, Gunawardena, 1995; Tu, 2000; Richardson & Swan, 2003; Selverian & Hwang, 2003; Shih & Swan, 2005). Witmer & Singer (1998) report on a relation between presence and task performance in VEs. Whitelock et al. (2000) report on the enhancement of feeling of teamwork and coordination due to social presence in an EVE.

Users of EVEs will often find themselves interacting quasi-socially with entities like computer generated agents, whether artificially intelligent or not (Biocca & Harms, 2002). It is not evident that such a mediated social interaction is of the same nature as the mediated social interaction with a mediated human being. What form should the agents have? What cues should be provided? Should agents imitate human beings? Social presence research can provide a more adequate explanation of quasi-social interactions.

Social presence research can also play a motivational role in EVE research,

design and development. The mere fact that we can trigger the perception of social presence in an EVE is a driving force to develop socially richer environments.

Turning the relationship between social presence research and EVEs around, EVEs could be used as “cyclotrons for the mind” (Biocca, 2003) (i.e. as experimental settings) helping psychologists to explore social interactions and the effect of various cues in virtual educational settings, to gain insight in the psychological mechanism that underlie the automatic response of humans to social cues and to understand how the mental models of other minds are generated by the physical and communicative cues their bodies and actions provide (Biocca et al., 2003). This kind of research, even though not directly related to EVEs, could in return provide important knowledge not only to EVE research, design and development but also to the theories that underlie their use.

Presence, physical and social, is a fruitful research domain which has caught the interest of scientists who study computer generated environments in the last 15 years. Presence related journals are being published (e.g. *Presence: Teleoperators and Virtual Environments*, *Presence-Connect*, *Keho*), associations have been founded (e.g. International Society for Presence Research) and a number of large scale Presence projects are being funded by the EU FP6 IST FET Programme (e.g. *Presencia*, *PEACH*, *Omnipres*), indicating that presence is a hot research field.

If our goal is to design and develop successful EVEs then we have to take into consideration that humans learn by communicating and interacting with their social environment. The implications of Vygotsky’s theory are that learners should be provided with socially rich environments in which to explore knowledge domains with their fellow students, teachers and outside experts. EVEs can be such environments on the premise that they provide the necessary context, cues and means for users to feel socially present in the virtual educational setting. Our research interest is the study of the relations between social presence, instructional design, learners attitudes toward EVEs and learning outcomes.

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