

# Creating Telepresence in Virtual Mediated Environments

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## INTRODUCTION

Why examine the concept of telepresence? A number of emerging technologies, including virtual reality, simulation, home theater, state-of-the-art video conferencing and virtual three-dimensional (3-D) environment, are designed to give the user a type of mediated experience that has never been possible before. This new experience seems to be “real,” “direct” and “immediate.” The term telepresence has been used to describe this compelling sense of being present in these mediated virtual environments (Held & Durlach, 1992; Steuer, 1992). On the empirical side, the use of this new revolution in media technologies has expanded to telemedicine, telepsychiatry, distance learning, legal testimony from remote locations, arcade games and more (see Lombard & Ditton, 1997). An enhanced sense of telepresence is central to the usefulness and profitability of the new technologies mentioned above, and others such as the World Wide Web and high-definition television. As underlined by Zhang, Benbasat, Carey, Davis, Galletta and Strong (2002) in the management information systems field, the concept of telepresence has become an important component of our understanding of how people experience computer-mediated environments. On the theoretical side, researchers in communication, psychology and other fields are interested in particular in how people are influenced by media presentations. An understanding of telepresence can enhance our theories here, too. Despite the centrality and importance of telepresence, it has not yet been carefully defined and explicated. In fact, researchers, especially those working on human performance in virtual reality, have noted the need to conceptualize and measure telepresence more effectively (e.g., Held & Durlach, 1992; Sheridan, 1992).

In the remainder of this article, we (a) review several conceptualizations of telepresence and presence in literature, (b) review telepresence determinants, (c) outline the main methods commonly used for measuring telepresence and (d) recommend attributes of future research concerning this concept.

## PRESENCE AND TELEPRESENCE: CONCEPTUALIZATIONS IN THE LITERATURE

The key to defining virtual reality in terms of human experience rather than technological hardware is the concept of presence. Presence can be thought of as the experience of one's physical environment. It refers not to one's surroundings as they exist in the physical world, but to the perception of those surroundings as mediated by both automatic and controlled mental processes (Gibson, 1979). From this perspective, presence is defined as “the sense of being in an environment” (Steuer, 1992, pp. 73-93). In other words, presence refers to the natural perception of an environment. However, when perception is mediated by a computer, one is forced to perceive two separate environments simultaneously: the physical environment in which one is actually present, and the environment presented via the medium. In this way, Steuer defines telepresence as “the experience of presence in an environment by means of a communication medium” (1992, pp. 73-93).

The use of telepresence to refer to any medium-induced sense of presence is similar to some, but not all, previous uses of the term. In fact, Gerrig (1993) uses the term “being transported” for mass media such as books, newspapers, magazine and television. Reeves (1991), in a discussion of responses to television, describes this experience as a sense of “being there.” Minsky (1980) used the term telepresence in reference to teleoperation systems for remote manipulation of physical objects. Others (Sheridan & Furness, 1992) have adopted the term presence (rather than telepresence) for a new journal dedicated to the study of both teleoperator and virtual environment systems. In fact, Sheridan (1992) uses the term telepresence to refer to the generic perception of being in an artificial or remote environment, reserving telepresence only for cases involving teleoperation.

The definition of presence has yet to be agreed upon by researchers. Two definitions of presence, which are most often discussed in the literature, are proposed. The first is the “sense of being there” in one place or environment (i.e., virtual environment), even when one is physically situated in another (Witmer & Singer, 1998). In this way, Heeter (1992) describes three distinct types of presence that contribute to the experience of “being there”: subjective personal presence, social presence and personal presence. The second definition of presence is “the perceptual illusion of nonmediation” (Lombard & Ditton, 1997, p. 42). This means that a participant experiences presence when he fails to perceive or acknowledge that the environment is being presented to him through some type of media. We propose to define this last experience of presence by the term of “telepresence,” since it has been adopted to describe the compelling sense of being present in a mediated virtual environment. Thus, we propose to consider telepresence as a facet of presence.

As the concept of telepresence is becoming an important component in our understanding of how people experience television, virtual reality and other mediated environments (Kim & Biocca, 1997; Lombard & Ditton, 1997; Steuer, 1992), we decided to explore its determinants in the computer-mediated environment.

## EXPLORING THE DETERMINANTS OF TELEPRESENCE

There has been little research, and even less systematic research, conducted to investigate the determinants or factors that contribute to a sense of telepresence. In this section we synthesize what is known and what has been suggested about the determinants of telepresence. Our goal is to identify key factors and groups of factors to further our understanding of telepresence.

Although the definitions of telepresence and related terminology vary across authors, there is a broad agreement on the major determinants of this construct. In fact, the identified determinants influence whether a particular mediated situation will induce a sense of telepresence. All of them include the following: the combination of sensory stimuli employed in the environment, the ways in which participants are able to interact with the environment, and the characteristics of the individual experiencing the environment (Steuer, 1992). Lessiter, Freeman, Keogh and Davidoff (2001) divided the determinants of users’ telepresence into two general categories: (a) media characteristics and (b) user characteristics.

On the first hand, the media characteristics category has been further partitioned into aspects of (a) *media content* and (b) *media form* (Heeter, 1992; Lombard & Ditton, 1997). First, *media content* refers to the objects,

actors and events represented by the medium (Gaggioli, Bassi & Delle Fave, 2003). Lombard and Ditton (1997) point out three dimensions of media content: social realism, use of media conventions and the nature of task or activity. Second, *media form* refers to proprieties of a display medium, such as the extent of sensory information presented, the degree of control a participant has over positioning his or her sensors within the environment, and a user’s ability to modify aspects of the environment. These characteristics of media form were discussed by Steuer (1992) as referring to two major dimensions of communication technologies: the interactivity and the vividness. In fact, Zhang and Li (2004), in Human Computer Interaction (HCI) research, outlined the importance of the interaction between human and information technologies. The authors established relationships between computer techniques (basic or advanced) and user-specific characteristics (demographics, physical/motor and cognitive, and affective level) pertinent to their interaction with the information technologies. These relationships are related to two processes. The first one concerns the design of interactive systems to specific users under specific conditions of use. The second one shows the role of the usability of information technology in influencing its evaluation and, thus, its adoption and sufficient use by users.

On the other hand, user characteristics include relevant individual aspects, such as users’ perceptual, cognitive and motor abilities, users’ prior experience with a mediated environment, the length of their exposure to and/or interaction with the virtual environment and their willingness to suspend disbelief. Witmer and Singer (1998) suggest that allocating sufficient attentional resources to the virtual environment is an important determinant of telepresence. According to this hypothesis, as users focus more attention on the virtual environment stimuli, they should become more involved in the virtual environment experience, thus attaining increased telepresence (Gaggioli et al., 2003). Finally, social aspects of a virtual environment, such as the interaction between the user and other actors, be they virtual or real, can contribute in determining telepresence (Heeter, 1992; Lombard & Ditton, 1997). The importance of social aspects of a virtual environment was also underlined by Sheridan (1992) through two task- or context-based factors inducing the sense of telepresence: task difficulty and degree automation.

Many telepresence studies appear to be using some version of telepresence determinants. In fact, some researchers in HCI used the term user’s sensory immersion as a key determinant of telepresence in mediated environment (Kim & Biocca, 1997; Biocca & Delaney, 1995; Held & Durlach, 1992). This is consistent with the proposition that a user’s degree of immersion into the mediated environment is determined with the balance of the unmediated

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