

Sense of Presence

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INTRODUCTION

Sense of presence is one of the most interesting phenomena that enriches users' experiences of interacting with any type of system. It allows users to be there (Schloerb & Sheridan, 1995) and to perceive the virtual world as another world in which they really exist.

The interest in presence phenomenon is not novel (Gerrig, 1993), but it has grown lately due to the advent of virtual reality (VR) technology. The specific characteristics of virtual environments (VEs) transform them into suitable experimental testbeds for studies in various research areas. This also resuscitated the interest in presence, and much work has focused on the development of a theoretical body of knowledge and on a whole set of experimental studies aimed at understanding, explaining, measuring, or predicting presence. All of these efforts have been made to increase the understanding of how presence can be manipulated within the VEs, particularly within the application areas where presence potential has been acknowledged.

Probably one of the most important reasons motivating presence research is the relationship it holds with task performance. This debatable relationship together with the more obvious one between presence and user satisfaction suggest that presence may play an important role in the perceived system usability.

Since presence may act as a catalyst for the learning potential of VEs, it can be harnessed for the training and transfer of skills (Mantovani & Castelnuovo, 1998; Schank, 1997). The potential of presence to increase the pervasive power of the delivered content motivates research on presence impact on e-marketing and advertising (Grigorovici, 2003). Another promising application area for presence research is within the realm of cognitive therapy of phobias (Strickland et al., 1997).

The highly subjective nature of presence continues to challenge researchers to find appropriate

methodologies and instruments for measuring it. This is reflected in the ongoing theoretical work of conceptualizing a sense of presence. The difficulties related to investigating presence led to a large set of definitions and measuring tools.

The purpose of this article is to introduce the concept of presence. The first section offers some conceptual delimitations related to presence construct. The second section describes its main determinants along two dimensions (i.e., technological factors and human factors). The third section addresses the challenges of measuring presence, offering also an overview of the main methods, tools, and instruments developed for assessing it. The fourth section presents the complex relationship between presence and task performance.

BACKGROUND

Attempts to define presence have been numerous, and the lack of a unanimously accepted definition suggests the multi-dimensional nature of this construct and its not yet mature understanding.

Presence has been described as a sense of being physically present at the remote site (Schloerb & Sheridan, 1995; Sheridan, 1992), a basic state of consciousness consisting of the attribution of sensation to some distal stimuli (Loomis, 1992), a suspension of disbelief experienced by users while being in a remote world and not the physical one (Slater & Usoh, 1993), or the perceptual illusion of non-mediation (Lombard & Ditton, 1997). After analyzing various presence definitions, we proposed the following one (Sas & O'Hare, 2001, 2003):

Presence is a psychological phenomenon, through which one's cognitive processes are oriented toward another world, either technologically mediated or imaginary, to such an extent that he or she experiences mentally the state of being (there), similar to one in the physical reality,

together with an imperceptible shifting of focus of consciousness to the proximal stimulus located in that other world.

Any attempt to conceptualize a construct also should consider its discriminant validity by contrasting it with other close concepts in the field. Furthermore, three other constructs—telepresence, immersion, and flow—are introduced, and their relationships with presence are outlined briefly.

The term of telepresence was coined by Marvin Minsky (1980), emphasizes the meaning of mediation, and denotes a sense of being physically present at a remote world. Draper, et al. (1998) defined it as the perception of presence within a remote environment. This concept precedes and is closely related to the presence construct. Despite often being taken as synonyms, there is, however, a subtle difference between presence and telepresence, rooted in the proximity to the site where one perceives, acts, and ultimately experiences presence.

Another distinction often mentioned in presence literature is that between presence and immersion. Immersion is usually associated with technological factors referring to the extent to which computer generated worlds are extensive (able to accommodate a large set of sensory systems), surrounding (able to provide information from any virtual direction), inclusive (able to shut out all information from the physical world), vivid (able to provide rich information content, resolution, and display quality), and matching (able to accurately reproduce the body movements previously tracked) (Slater et al., 1995, 1996). In contrast, presence relates more to user characteristics, whose impact is unfortunately less explored.

The last useful distinction is the one between presence and flow, defined as a state of optimal experience that occurs when people attempt tasks that challenge their skills (Csikszentmihalyi, 1990). Flow assumes a match between the task difficulty and one's abilities, highly focused attention that leads to enjoyment, feeling of control, and an altered perception of time. From this, several distinctions emerge with respect to both the experience itself and its results. The experience in the case of flow, as opposed to presence, always requires intense concentration and focus of attention, a sense of control, and usually an intense and active participa-

tion in the task, usually perceived more narrowly through only some of its characteristics (Fontaine, 1992). With respect to the results, since presence is not an optimal experience, it does not necessarily lead to pleasant and fulfilling experience. However, it is possible that during flow, someone will experience a strong sense of presence, but the latter also can occur outside the flow (Heeter, 2003).

Despite the diversity characterizing the definitions proposed for capturing the presence construct, there seems to be a common ground shared by researchers in the presence field, which refers to presence determinants.

PRESENCE DETERMINANTS

Several presence theories have been developed in the attempt to extend the understanding of presence. Draper (1998) identified a first group consisting of psychological models of presence and a second one consisting of technological models of presence. The first class of theories includes telepresence as flow experience developed by Csikszentmihalyi (1990), behavioral cybernetics theory (Smith & Smith, 1985), and a structured attentional resource model for teleoperation (Schloerb & Sheridan, 1995). The second class of theories groups different models, such as those elaborated by Sheridan (1992), Steuer (1992), Schloerb (1995), Zeltzer (1992), Witmer and Singer (1998), and Slater and Usoh (1993).

The factors affecting presence can be grouped into technological factors that consider the system and its characteristics, and human factors referring to users' cognitive and personality aspects (Lombard & Ditton, 1997; Lessiter et al., 2000).

Technological Factors

A large amount of work has been carried out in the area of technological factors affecting presence. Lombard and Ditton (1997) provided a detailed account of this. Some of these factors are visual display characteristics such as image quality; image size; viewing distance; visual angle; motion; color; dimensionality; camera techniques; and aural presentation characteristics such as frequency range, dynamic range, signal to noise ratio, and high quality audio. As stimuli for other senses, Lombard and

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