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Summary:

- a brief revision of the presence concept;
- some reflection on the design of 3D virtual environments for learning;
- considering the relationships between presence, attention and the design of 3D learning environments

Virtual environments are assumed to provide a different kind of experience, which is known as presence. However, it is a concept that has proven difficult to define and operationalize.

Presence is commonly referred as a person's reported feeling of being in the place or engaged in the interactive experience. Such feeling are often talked about by writers, graphic and theater artists, filmmakers etc. It is interesting to question the properties of virtual environments that enable an improved sense of presence, beyond its more traditional usage by authors and artists. What is different about it in this new context? To answer this we need to distinguish among different situations that can produce similar reported/observable effects by subjects (see Barfield, Zeltzer, Sheridan and Slater, 1995). Reading a good book may have a high level of engagement or immersion but does not have the same sensorial cues compared with entering a virtual environment, so the cognitive processes involved are, at least to some extent, different.

Slater and Usoh (1993) suggest that both external elements (related to the technology) and internal elements (related to individuals) need to be considered if one wants to understand how a sense of presence is achieved. In particular, the sense of presence can be diminished if care is not addressed to appropriate interactive techniques (Slater, Usoh and Steed, 1994). Slater et al. (1994) go further to propose that "body centered interaction" designs (dependent on the existence of consistent relationships, predictability and completeness available to the user, and on the usage of natural action schemas) promote higher levels of presence. Others have found that the degree of interactivity, or maybe in other words the realism of the interaction, appear to be much more crucial than the degree of pictorial realism for a high level of presence (Hendrix and Barfield 1996a and 1996b; Welch, Blackmon, Liu, Mellers and Stark, 1996). This supports the notion that the design of the interaction loop is a key factor.

The problem remains however, as to how to assess the level of presence or, put another way, how to measure presence. It is consensual that the notion of presence should incorporate objective and subjective measures. The former includes task demands, task results and correlated measures such as gross motor activity and psycho-physiolical measures, and the latter includes on line reports (verbal reports), post test evaluation with rating scales and questionnaires and event explanations (Hendrix and Barfield, 1996a). One can see from the variety of assessment methods that there is still a lot to be investigated before its operational value can be determined.

Another question is to clearly understand the advantages of building a system for a particular task or goal that allows the emergence of the sense of presence. In other words, what does presence bring to user performance? Maybe this is task dependent. Intuitively, we can see that a more realistic graphical system is useful for training purposes, but when considering more abstract tasks the question raises many uncertainties.

The research that I am pursuing concerns to the assessment of 3D virtual environments for learning. In particular, I am focusing on the different forms of visualising and manipulating representations that VE technology allows and its relations with conceptual learning. There has been much hype in education about these technologies, but the validation of the benefits is still not clearly established. Little structured cognitive analysis has been carried out to explain the real advantages of applying VEs to learning. Moreover, it seems that there is a big gap between the investigations about interactivity properties/design principles of virtual environments and its use to support learning.

My aim is to contribute to the clarification of this problem through the use of an external representation framework. In particular, my research focuses on the dynamics between internal and external representations. This research will contribute towards an understanding not only of how to design virtual environments for learning, but also when to design virtual environments for learning and how to use 3D interactive representations in conjunction with other types of representations for an effective learning process. As such, I have chosen to focus more on measures of interactivity and learning in VEs.

However, considering the topic of this workshop and the goals of the research stated above, one initial point of reflection could be the relationship between levels of attention towards representations that a learning activity requires and the phenomena of presence. In fact, if presence is closely linked with attention then one should be able to understand how this can affect the learning process. This argument subsumes that presence is correlated with focused attention in the virtual environment and that the computer system is designed in such a way that guides the user to the salient and important aspects of the overall representation. Hence, a core problem is to understand how this focused attention can be maintained when users are interacting with different representations or, in other words, if it is possible to create different interactivity characteristics for different types of representations and still maintain the level of presence and/or attention.

The importance of the problem comes from the underlying question of knowing if the use of more natural ways to manipulate representations is always the best learning solution, especially when dealing with more abstract concepts. Moreover, we can also reflect on what types of graphical representations and interactivity properties we should implement to explain a certain concept and in what sequence, considering that each one can foster differently the learning process.

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