

# Measuring Presence in Virtual Environments

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## ABSTRACT

This demonstration presents findings from two studies on presence that use a new technology for developing photo-realistic virtual environments. Our studies have used a combination of qualitative and quantitative measures, and in doing so have pointed to the importance of exploring place as part of presence. The demonstration explores issues of presence in such environments and the range of data capture methods we used and methodological issues found.

## Author Keywords

Place, presence, Photo-realistic virtual environments, Quantitative and Qualitative measures.

## ACM Classification Keywords

H5.2 User Interfaces.

## INTRODUCTION

The European Union funded BENOGO project is concerned with developing photo-realistic virtual environments of real places, such as art gallery's, museums, and other public venues. These environments are displayed in either head mount displays or immersive caves using image based rendering (IBR) technology. As well as a graphic representation of the places they also contain real and virtual augmented objects.

The BENOGO environments use a new form of image based rendering technology. In order to create the scenes a panorama of the location is captured using a high-resolution camera. This panorama is then used to generate the virtual world and as the technology develops the underlying algorithms allow for movement in all directions, it is also possible to add augmented objects which can exist in the virtual and/or real world.

As the project deals with real places it is important for us not only build the virtual representations but to gain an

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understanding of the key aspects of the real place which make people present. For example in the botanic garden study discussed later heat, smell and humidity were all important aspects.

To date we have conducted four studies covering aspects such as soundscapes [1] of real and virtual places, an analysis of comments made in a visitors book, a comparison of a real and virtual botanic gardens and the exploring of presence and technical aspects in a virtual stairwell. This demonstration discusses the last two studies and the methodologies we have used to measure presence.

## BACKGROUND ISSUES

Presence is often defined as 'a sense of being there'. The relationship between presence and place is complex and has been subject to much research and debate. For the purpose of this project, we simply define a sense of place to mean the direct everyday experience (phenomenology) of that place and one of the measures of a sense of place is presence - being there.

An important aspect of our studies and the work of others is the importance of distinguishing between space and place. A space is traditionally thought of as the physical manifestation of something, where as Relph [2] and others suggest the sense of place is an elusive evanescent quality, and that place can be thought of as space+meaning. **Relph's model of place** (1976) defines three components of 'place identity'

- Physical setting
- Activities afforded by the place
- Meanings attributed to the place

We have decided to base our work around Relph's model as it provides a general framework within which we can describe the experiences of the virtual and real places.

## STUDIES

Two studies using photo-realistic environments have been carried out, one compared a real and virtual representation of botanic gardens and another used a virtual stairwell. In both cases the objectives were to examine presence

(including aspects of place) and the effectiveness of the different methodologies.

### Methods

In order to undertake both studies we used a variety of data capture methods, ranging from questionnaires, video analysis and talk-aloud to repertory grids, with each study using a selection of the methods listed. This allows us to capture different information as well as compare the methods.

- **Immersive Tendencies Questionnaire (ITQ)** [4]. This questionnaire was developed to identify real world tendencies (e.g. using computer games) that may affect a person's sense of presence.
- **ITC-SOPI** [3]. Developed for the UK's Independent Television Commission, this is a cross media questionnaire, which explores: spatial presence, levels of engagement, sense of naturalness and negative aspects that effect presence.
- **Talk-aloud Video**. While people were using the demonstrator they were asked to provide comments.
- **Structured Interviews**. After using the environment the participants were asked to describe the environment and asked a series of specific questions,
- **Repertory Grids** are a means of gaining the meaning a person has attached to their experience and/or properties of the environment e.g. objects or locations. In our study we based the grid on the work of Relph (discussed earlier).

### A Real and Virtual Botanic Gardens (Demo 1)

This study used a virtual environment representation of the botanic gardens in Prague (containing an augmented object) viewed inside an HMD and a real botanic gardens in Edinburgh. The study consisted of measuring place and presence in the virtual environment and comparing them (benchmarking) against the real environment.

### The Staircase Environment (Demo 2)

This study used a HMD based virtual environment of a stairwell which was situated in a university. The environment consisted of an augmented table, which the participants could touch. The participants could sit down, stand up and look around for a full 360 degrees. During the study they were asked to assume the role of a security guard and were asked to report any strange events to the control room.

### DISCUSSION

From a technical perspective a number of themes emerged including the need to increase the level of interaction, reduce blurred graphics and pixilation, use only augmented objects which are relevant to the scene, the effect of using a realistic or interesting scenario and temporal effects on presence.

There were a number of issues uncovered with the measurement methods used. For example we would have expected there to be a correlation between the results of the ITC and ITQ-SOPI questionnaires, however this was only found to be the case in demo 2. Also during the studies it became apparent that asking people to talk-aloud may be distracting them from their actions, and that using post-use data capture methods (such as questionnaires, interviews and repertory grids) may be ignoring the fact that presence is a phenomenon experienced while being in the environment. However despite limitations we did find that the video analysis (talk-aloud) and repertory grids could be used to identify relationships between phenomenon experienced and the subsequent meanings participants attach to them.

### FUTURE WORK

This demonstration is part of on going research, at the time of writing this paper another seven virtual environments are in the process of being designed and tested. During which time the methods used and environments will evolve.

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### REFERENCES

1. Turner, P., McGregor, I., Turner, S. and Carroll, F. (2003) Using Soundscapes to Create A Sense of Place. *Proc. Int. Conference on Auditory Display*.
2. Relph, E. (1976) *Place and Placelessness*, London: Pion Books
3. Witmer, B.G and Singer, M.J. (1998) Measuring Presence in Virtual Environments: A Presence Questionnaire, *Presence* **7**(3), 225-240.
4. Lessiter, J., Freeman, E., Keogh, E. and Davidoff, J. (2000). *Development of a New Cross-Media Questionnaire: the ITC-Sense of Presence*, 3<sup>rd</sup> *International Workshop on Presence*