A Comparative Study of Presence in Virtual Reality vs. Presence in the Real World

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ABSTRACT
The main objective of this project was to study and compare the relationship between the sense of presence in the virtual environment and the sense of presence in the physical world while experiencing the virtual world. The study consisted of two parts, each experimenting with thirty-five subjects. A virtual plane environment was experienced using a head-tracking system and a head-mounted display. After completing fifteen minutes in the simulation, participants were given a sense of presence questionnaire. The Parts I and II results lead to a preliminary and interesting theory that a person's overall sense of the world actually increases slightly when put into a virtual environment.

Keywords
Sense of Presence, Virtual Environments, Virtual Reality

1. INTRODUCTION
One of the known aspects of virtual reality is the sense of presence that subjects experiences in the virtual environment. This sense of presence is often referred to as the sense of "being there." A few theoretical research articles were published in the journal of *Presence, Teleoperators and Virtual Environments*, published by the Massachusetts Institute of Technology (MIT) [2, 3, 6] in the 1990's. However, since then a limited number of research articles have been published in this area and appear to lack much needed experimentation [1, 4, 5].

There is a great need to develop a scientific body of knowledge or theories of sense of presence to assist researchers in the development of efficient virtual environment applications. This current study has been designed and implemented to extensively study the sense of presence and its relationship in the real and virtual environments.

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2. RESEARCH METHODOLOGY
2.1 Experiment - Part I
Thirty-five volunteered undergraduate Kennesaw State University (24 male and 11 female) participated in this part of the study. The virtual reality system for this study was installed and operated in the Virtual Reality Technology Laboratory in the Computer Science and Information Systems department. The system consisted of a Pentium-based computer using a 6D head-tracking system and display. The virtual environments were created using the Sense8™ Virtual Reality Development Software Package and Libraries. The virtual environment scene used was a moderately simple simulation of a commercial 767 airliner. The participants were seated in a chair equipped with simulation of the engine noise and vibration (Figure 1). Participants experienced fifteen minutes in the plane simulation, and responded to a sense-of-presence questionnaire immediately afterward. Each participant rated the question quantitatively on a scale of 0 to 10, with zero being equal to no sense of presence and ten being equal to complete immersion in the environment.

Figure 1. A subject is wearing a head-mounted display and head-tracking device and is immersed in the virtual environment.

2.2 Experiment - Part II
Thirty-five volunteered undergraduate Kennesaw State University (25 male and 10 female) participated in this part of the study. The virtual reality environment for this part of the study was the same as in the part I of the study. Basically, there were three differences

in this part of the study from the previous part. First, this part of the study replaced the chair with the vibration capabilities with a flex-backed padded chair that did not swivel. The second difference was that any misalignment between the head-tracking device and the computer was eliminated. The third difference was with the survey. In order to keep the data samples comparable, the two critical survey questions were kept the same. However, the definition of presence changed to "your depth of immersion."

3. RESULTS AND CONCLUTION

Investigating averages in the data (Part I), the average sense of presence in the virtual world was 6.0 while the average sense of presence in the real world was 5.0 (Figure 2). Therefore on average, presence in the virtual world was felt more strongly. When looking at the averages of the sense of presence scores (Part II), the average sense of presence in the virtual environment was 6.4, while the average sense of presence in the real world was 6.1, giving an average difference of only 0.3 in favor of more presence in the virtual environment (Figure 3).

In both studies (Parts I & II), the sense of presence in the virtual environment was felt more strongly on average than the sense of presence of the real world, and the total sense of presence score was greater than ten for both parts of the experiment. Incidentally, the sense of presence in the real world was 1.1 units higher for Part II than for Part I, an almost negligible amount given the nature of subjective surveys.

Participants rated their sense of presence in each environment on 11-sacle rating (0 through 10). Surprisingly, when each score pair was taken individually, the totals ranged from two (2) to as high as seventeen (17), with the average total sense of presence being 10.8. The Parts I and II results lead to a preliminary and interesting theory that a person's overall sense of the world actually increases slightly when put into a virtual environment.

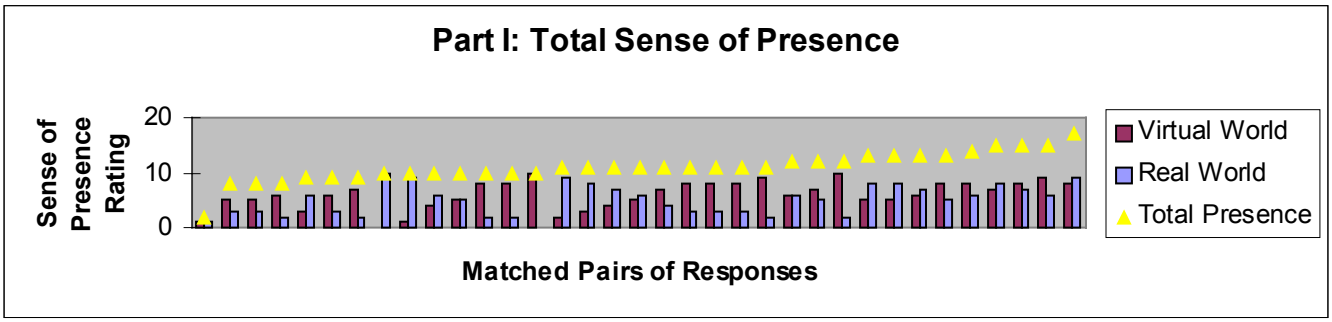

Figure 2. A graph of total sense of presence scores combination of virtual and real environments for each participant that ranges from 2 to 17 out of 10 possible score in Part I.

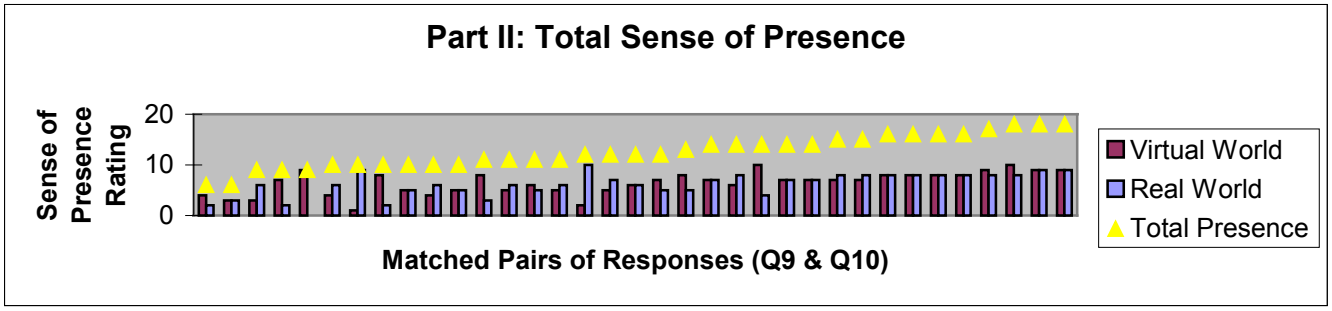

Figure 3. A graph of total sense of presence scores combination of virtual and real environments for each participant that ranges from 6 to 18 out of 10 possible score in Part II.

5. REFERENCES

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