

The Enhancement of Presence with Respect to Moving Images

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Abstract

In this paper we measured individual emotions and sense of presence. This is measured by two methods, a questionnaire survey and electroencephalography (EEG), in order to obtain objective data. EEG brain signals were measured when participants looked at the moving images. The psychophysiology test results of questionnaire survey and EEG for the figurative images were good. In this paper we revealed that the concept of presence is a psychological and physiological reaction related with the individual emotions to the images and that EEG signals can be used as one of the important tool for the visual arts.

Keywords: *EEG, Experimental Film, Presence Measurement, Presence Questionnaire Survey*

1. Introduction

This paper suggests a measuring and analyzing method for individual emotion and participation in terms of the sense of presence in response to interactive moving images. It is hard to define 'presence', it is often said to be a feeling of being there in the place within the virtual environment (VE). Human beings recognize their presence in a space by comprehending the information from their surroundings using the five senses of human body. This thesis analyzes the "presence" that evokes the feeling of being in "the place in the image" when participants look at an image. The measurement of presence was carried out via a questionnaire survey and EEG measurements.

2. Method and Materials

In this paper, we measured presence by two methods, a questionnaire survey and electroencephalography (EEG), in order to obtain objective data. There have been limited attempts to do a brain wave test based on bio-signals relating to how presence as a reaction to an image affects the EEG. In this chapter, let us examine EEG signals and presence in more detail.

2.1. Electroencephalography (EEG) and Presence

As Rapid interpretation of basic intentions or analysis of emotions is possible via neuroscience and EEG. EEG signals change temporarily and spatially depending on the actions of the brain, brain status during measurement, and brain function [1]. The study of the brain is connected with cognitive science, brain science, and the development of technology. Definition of presence are mostly restricted to the condition of the Virtual Environment (VE).

Another definition is, given in the field of collaborative and networked environments, researchers in that field reviewed existing theories and measures of social presence, and suggested that presence is frequently treated as consisting of spatial presence or physical presence and social presence [2], and the subjective experience of being in one place or environment, even when one is physically situated in another [3]. In addition to this, there are a number of definitions. Many researchers concede that the area has expanded to include research incorporating any other communication medium, such as television, advertising, photography, film and sound. The causes of presence are given below.

Table 1. Causes of Presence in Response to Moving Images [4-7]

Image & Sound	Camera	Individuality
Image Quality	Camera Technique	Personality
Image Size	Motion & Color	Perception
Dimensionality of Images		Memory
Viewing Distance		Knowledge
Sound Fidelity		Emotion
		Diseases
		Psychological
		Disorders

Prior to the concept of presence was the concept of telepresence. This is a phenomenon where the operator feels like he or she is physically in another place through feedback from the machine using remote control technology. The core of the concept of telepresence, which is applied to two different spots which are physically separated far away from each other (such as via video conference or exploration via a robot), is the feeling that the operator is working at the distant location. The operating method of remote control technology used for this and the working conditions of the operator are discussed as important variables. In early studies about virtual reality, this term was used as a concept to explain the subjective feeling of user to the mediated environment. This was extended to studies about the sense of recognition, senses, and responses of media arts spectators.

Now that we have become familiar with the history of presence and the definition of presence and EEG signals, we will be able to discuss the experimental method and results of this study.

2.2. Experiments

Participants for the experiment were from our colleges plus additional volunteer personnel. Their ages ranged from those in their 20s, 30s, 40s, 50s and 60s. We used moving images concerning different locations. The 'Individual Differences Questionnaire Survey (IDQS)' was created based on the 'Immersive Tendencies Questionnaire' [3], [8]. Participants rated their emotional feeling on a scale out seven on the IDQS and the PQS sheets. Also, participants indicated their preferred answer by marking an "O" on R.Plutchik's Wheel of Emotions. Their EEG signals were measured when spectators looked at the moving images. Since the participants were opening their eyes and watching images, we expected the EEG results to show mostly β waves.

Table 2. IDQS [3, 8]

Questionnaire	Seven Point Scale
Do you easily become deeply involved in movies?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NEVER OCCASIONALLY OFTEN</p>
Do you easily become deeply involved in experimental films?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NEVER OCCASIONALLY OFTEN</p>
How mentally alert do you feel at the present time?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NOT ALERT MODERATELY FULLY ALERT</p>
How physically fit do you feel today?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NOT FIT MODERATELY FIT EXTREMELY FIT</p>
Do you ever become so involved in a daydream that you are not aware of things happening around you?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NEVER OCCASIONALLY OFTEN</p>
How well do you concentrate on enjoyable activities?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NOT AT ALL MODERATELY WELL VERY WELL</p>
How well do you concentrate on the fine arts?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NOT AT ALL MODERATELY WELL VERY WELL</p>
How often do you go to the gallery or the art cinema theater?	<div style="display: flex; align-items: center; gap: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div> <p style="text-align: center; margin-top: 5px;">NEVER OCCASIONALLY OFTEN</p>

3. Results

The test was performed while participants were watching the figurative and non-figurative images of parts of an experimental film. Group 1, 2 are females and group 3,4 are males. The variation in individual EEG patterns matched with the result of the IDQS and PQS. In the EEG test, the left hemisphere's β value was high. The left hemisphere is dominant for pleasant emotions and the β wave shows that the mind is focused and awakened.

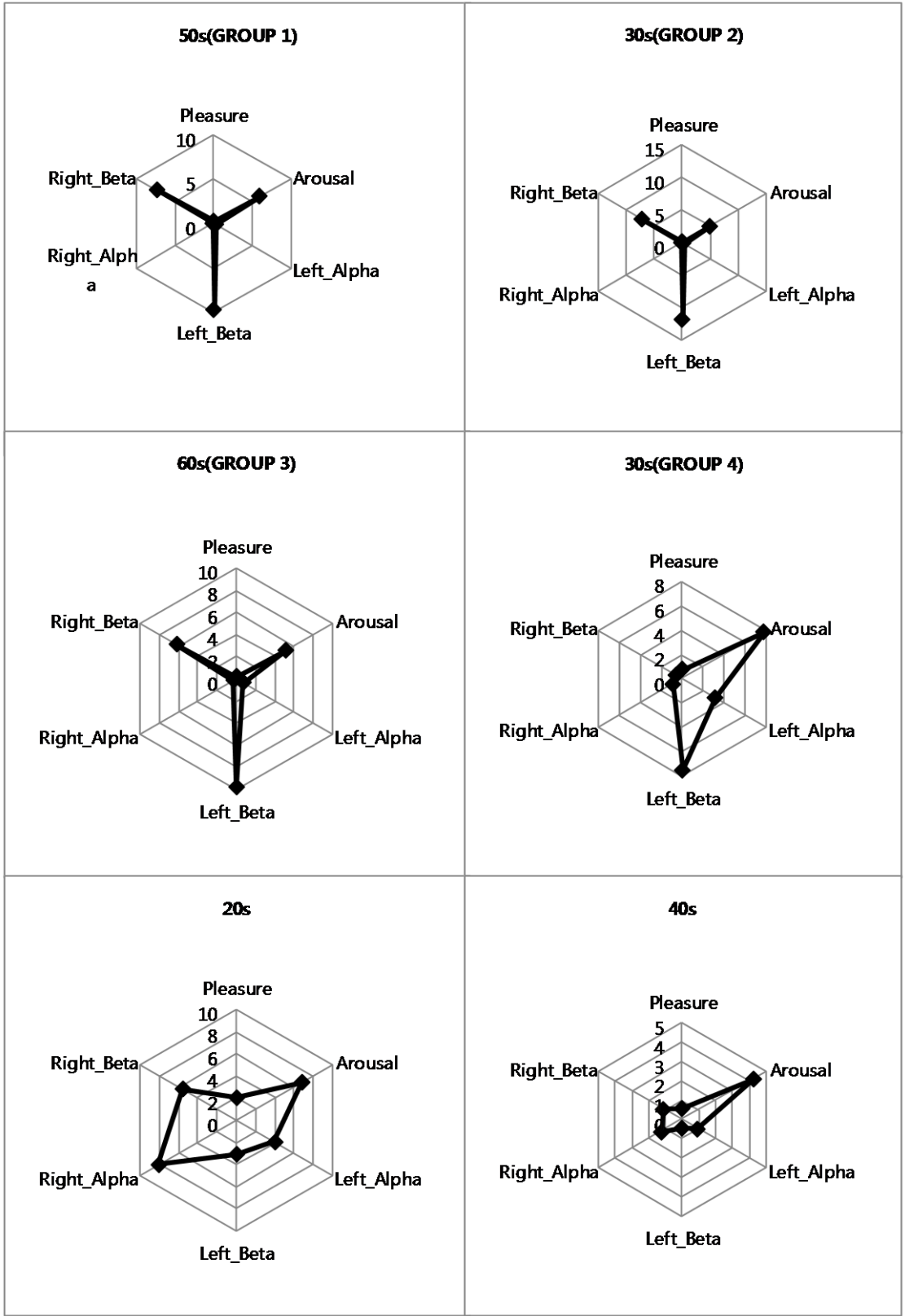


Figure 1. EEG Test Results

4. Discussion

The EEG pattern itself has great inter-individual variability [9]. Alpha waves are neural oscillations that primarily occur in the occipital lobe during wakeful relaxation with closed eyes [10]. In this test, there is room for reconsidering the cases of the variation in unmatched EEG patterns with the results of the IDQS and PQS. Using the result of this survey with emotional evaluation on various types of media content will be the further research. A continuous examination of the scale coordinates for the set of words describing emotions would strengthen the analysis method of an individual emotion and participation in terms of presence with respect to the moving images.

5. Conclusion

Though it is hard to define 'presence', it is often said to be a feeling of being there in the place. Visual imagery is the visual perception registered from the eyes. While presence is a subjective experience, it is based on a perceptive reaction to the stimulation from the image. Using our practical orientation towards experimental research on presence, we briefly explored the foundation suggested by several researchers. 90% of the participants' answers to the PQ and IDQS matched with the EEG test results. In the EEG test, the left hemisphere's β value was high. The left hemisphere is dominant for pleasant emotions and β wave shows that the mind is focused and awakened. The participants who rated high scores on the IDQS, were easily involved with the moving images, and their β values were high [11].

Acknowledgements

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