

A Study on the Physical Effects in 4D

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Abstract. Since the stereoscope invented by Wheatstone, stereoscopic pictures have been entering into a new era. And, there are many attempts to create emotional contents that respond to human emotion such as 3D film. A 4D is an entertainment presentation system combining a 3D film with physical effects that occur in synchronization with the film. The purpose of this paper is to analyze the physical effects for improving of presence in the 4D.

Keywords: 4D, Physical Effects, Presence, Reality, Experiment.

1 Introduction

Human has been trying continuously to expand their ability of perception based on the senses and developed from a radio to 3D which provides viewers with images closer to the real world and viewers, main agents which experience, show response nearly close to actual experience. And, in the present research, a presence is conceptualized as sensation of being sucked into the scene viewer's watch with no awareness of 3D image.

Many researchers have studied a presence which is defined as the subjective experience of being in one place or environment, even when one is physically situated in another. Cho [1] explained experience, affect factors and psychological effect of presence as user's personal experience with 3DTV. Keum [2] investigated the influence of 2D and 3D on individuals' presence, identification, enjoyment and liking through the contrast experiment between the movie Avatar's 3D and 2D viewers. Kim and Yoon [3] studied the subjectivities of audiences' attitude, and meaning of 3D media by Q methodology, and found 4 factors regarding the experience of 3D presence. Lee [4] explained the presence's types, conception, factors and effects. Lee [5] investigated what viewers' characteristics affect when they experience 3DTV and 3D virtual world and what presence effects are.

Recently, there are many attempts to create emotional contents that respond to human emotion such as 4D. A 4D is an entertainment presentation system combining

a 3D film with physical effects that occur in synchronization with the film. Because physical effects can be expensive to install, the 4D is most often presented in custom-built theatres at special venues such as theme parks and amusement parks. Effects in the 4D may include vibration, air jets, water sprays, and leg and back ticklers. Hall effects may include smoke, rain, lightning, air bubbles, special smells, and preshow space.

Despite the growth of 4D technology, the effects of such contents which help users to be more immersed into the contents or give users more fun have not been studied extensively. The technology for improving the presence means how to form and to maintain the unity of consciousness and experience for audience in the 4D, and that is related with storytelling, software, hardware and 4D effect design. And, a wide variety of devices that the audience can be immersed in the story should be reflected in the contents production and operation. Thus, the purpose of this paper is to analyze the physical effects (seat effects, film, preshow) for improving the presence in the 4D.

2 The Analysis of Experiment

The 4D technology consist of preshow, film representation, simulator, effect design, sensation, and system integration. Among them, we investigated whether 4D effects and preshow affect the user's presence. And we used the data mining technique to find the significant factors about a preference for effects.

The experiment is conducted on 61 participants by using the 4D of jeonju university, which is composed of 4 seats with 13 effects, 99 inch silver screen, HD project, audio with 5.1 channel, and control system. Also, we used the 3D film (Himalayazone), and the run time of the film is 10 minutes (5 minutes for preshow and 5 minutes for mainshow). The questionnaire is composed of 10 questions for satisfaction and preference according to the effects (3D film, preshow, seat)

After the experiment had been conducted, we asked the participants to rate on a five-point scale if they felt fun according to the seat effects. The results show that participants feel more fun on the neck air blast, seat back vibrator and seat bladder among seat effects as depicted in Figure 1.

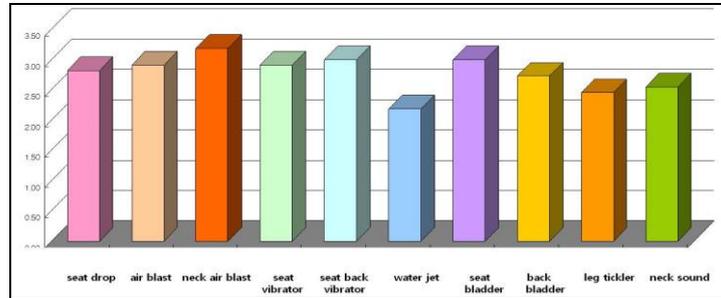


Fig. 1. Satisfaction of fun according to seat effects

And, we asked the participants to rate on a seven-point scale if they felt presence according to sensibility, reality and immersion. The preshow & 4D effects showed the highest rate in all areas except reality as depicted in Figure 2. 3D film showed the lowest rate in all areas. And 4D effects showed more higher level than preshow & 4D effects in reality. The results demonstrate that the preshow is the important facility in the 4D theater for improving the presence.

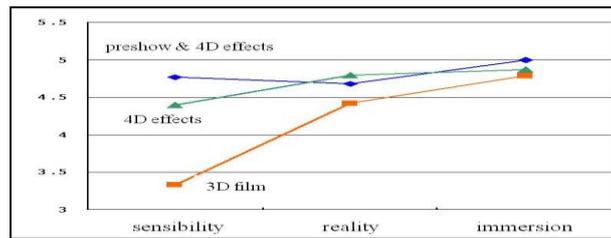


Fig. 2. Presence according to sensibility and immersion

To get some more useful information, we use the data mining analysis that is the process of posing various queries and extracting useful information, patterns and trends often previously unknown from a data set. Particularly, the decision tree technique that is used extensively for classification, is carried out to find significant factors about a preference for effects using the SAS E-miner

The results show that the presence is positively related to the effects as depicted in Figure 3. Respondents who gave sensibility rate less than 1.5 experienced the 3D film. Also respondents who gave immersion rate less than 5.5 and sensibility level 2.5 up to 3.5 were likely to experience preshow & 4D effects. Moreover respondents who had reality rate less than 5.5 and sensitivity rate more than 3.5 were likely to experience 4D effect.

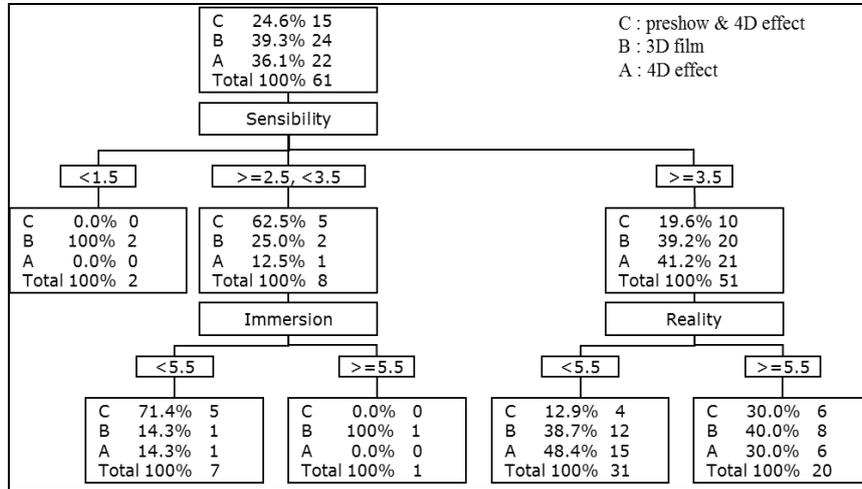


Fig. 3. Relation between presence and contents

And, there is no significant result between seat effects and contents as depicted in Figure 4.

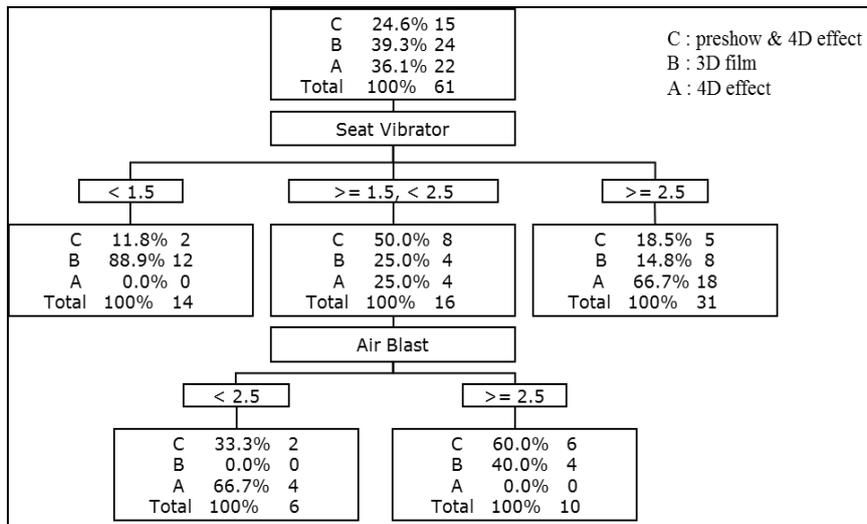


Fig. 4. Relation between seat effects and contents

The further research needs to consider the integration of storytelling, software, hardware and 4D effect design for improving the presence.

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