

# A Method of Viewing 3D Horror Contents for Amplifying Horror Experience

Nao Omori<sup>1</sup>, Masato Tsutsui<sup>2</sup>, and Ryoko Ueoka<sup>3</sup>

<sup>1</sup> Solidray Co., Ltd.

<sup>2</sup> Graduate School of Integrated Frontier Sciences, Kyushu University, Fukuoka, Japan

<sup>3</sup> Faculty of Design, Kyushu University, Fukuoka, Japan

{morio-lp4, ds107766}@gmail.com, r-ueoka@design.kyushu-u.ac.jp

**Abstract.** Current 3D digital film gives us a realistic sensation. Also adding physical effect with 3D film called 4D film becomes common entertainment system which generates more realistic sensation. So there are many commercial entertainment systems in order to give realistic experience adapted to such as horror contents. However there is still some problem that is unable us to immerse the horror contents. In order to find an effective way to amplify horror experience to viewers, we propose an original film-viewing theater environment. In concrete, we made a locker-type theater environment implementing polarizing filters on peephole of a locker door. This makes a viewer force to stand when to peep a 3d horror movie in a closed space without wearing 3D glasses. And by peeping a screen from a small hole, it is unable to see an edge of a large screen. By evaluating heart rate of viewers and conducting questionnaire-based survey, we confirmed our proposed method amplifies a horror experience especially by producing a closed viewing space.

**Keywords:** 4D film, virtual reality, virtual horror experience.

## 1 Introduction

Current 3D digital film gives us a realistic sensation. Also adding physical effect with 3D film called 4D film becomes common entertainment system which generates more realistic sensation. So there are many commercial entertainment systems producing realistic experience such as horror contents. However there is still some problem that is unable us to immerse the horror contents. In order to find an effective way to amplify horror experience to viewers, we hypothesize that obstacles to reduce immersion is

### 1. Unusual 3d glasses

As we usually have to wear polarizing glasses when to watch 3D contents, this special eye ware may reduce reality of contents.

### 2. Open space

As most of 3D contents are watched in theater, we sit a seat surrounded by other viewers in a large space. This environment may obstacle the immersion even though the situation of the contents is opposite such as a horror story in a cage.

### 3. Visible edge of screen

We experience 3D contents in theater provided by a large screen. Under this situation, we know 3D contents are played on screen, which implicitly recognize that this is not real.

In order to analyze whether the hypothesis above is obstacles of generating reality, we made a 4D theater environment, which may solve these obstacles and created a horror movie to evaluate the effects. In concrete, we made a locker-type theater environment implementing polarizing filters on a locker door. This makes a viewer force to stand when to peep a 3D horror movie with a closed space without wearing a polarizing glasses. And by peeping a screen from a small hole, it is unable to see an edge of a large screen. By comparing heart rate response and conducting questionnaire-based survey, we evaluated which factors cause to reduce immersion and our proposed theater system amplifies a horror experience.

## 2 Related Commercial Entertainment System and Researches

3D digital film has become commercially known these days. By adding physical effect that occur in synchronization with 3D film is called 4D film <sup>(1)</sup> and the first 4D film is known as “Sensorama” <sup>(2)</sup>. Effects simulated in a 4D film may include rain, wind, strobe lights and vibration of which gimmick is installed above or under seat. Many of the 4D films are presented in custom-built theatres or arcade box such as theme parks or game center <sup>(3,4)</sup>. There are variety of the contents of 4D films such as adventures story, horror story and time travel story <sup>(5,6)</sup>. The commercial 4D film theater is seat-type entertainment system and in most cases, he/she experiences it by sitting a seat wearing 3D glasses. Under this environment, especially if the contents of the film is made based on subjective viewpoint, there may be lack of reality. As for the research of combination of film and physical effect, “ants in the pants” gives a novel haptic interface combining video image <sup>(7)</sup>. And olfactory display presented by Nakamoto et.al. combines scent and image to improve reality of the digital contents <sup>(8)</sup>. In this paper, we focus on horror contents and propose a method of experiencing 4D horror film. Thus, even though we add physical effect by implementing vibration devices, our main goal of this paper is the design of theater environment to change physical perception, which may cause to amplify horror.

## 3 Preliminary Experiment: Comparison of Our Proposed Theater System and Conventional One

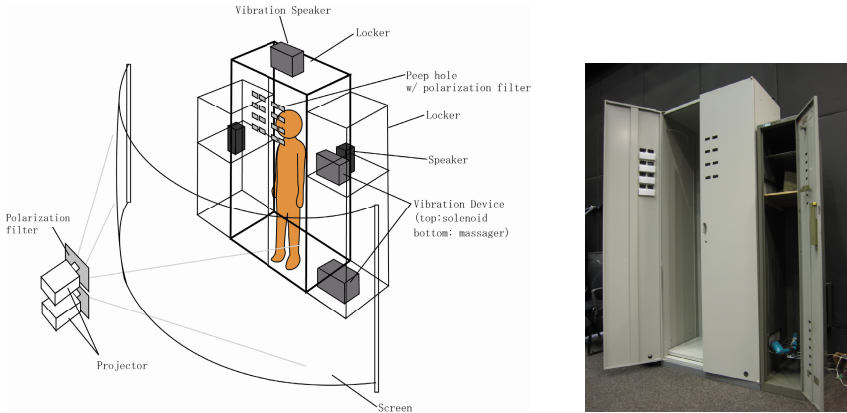
### 3.1 Purpose

As a preliminary experiment, we conducted an experiment in a locker-type viewing theater environment as figure 1 shows to examine whether our proposed environment amplifies horror experience. One of the authors created an original horror movie as follows;

**Title:** “Hide-and-seek at midnight” (scripted and produced by Nao Omori)

**Scenario:** The movie is created as one situation drama in a locker room at university. Because of a tragic murder during the event, a long time sealed event, a hide-and-seek at midnight is back on the day and you and two friends hide a locker room where the murder had occurred in the past. And you peep outside from the locker seeing that your friends are killed by a zombie and the zombie is seeking you next.

Figure 2 shows captured images from the original movie.



**Fig. 1.** Locker-type theater system outline (left) and locker(right)



**Fig. 2.** Horror movie capture image

The movie lasts about 4 minutes. In order to generate horror experience in a closed locker space, we implemented three types of vibration effects on the locker as follows.

A speaker: to give low frequency vibration

A solenoid: to give high-pitch vibration

A hand massager: to give strong vibration

Table 1 shows the categorized scene number and its description, their time duration, sound effect and devices used for vibration effect.

First of all in order to evaluate whether the system really affects viewers’ physical state, we compared heart rate of subjects between a standard seat-type theater environment and our proposed system. The standard 3D theater environment consists of a screen, and two projectors with polarization filter, a chair without vibration effect, a surround speaker and 3D glass.

**Table 1.** Horror movie scene description

Scene No.	Scene	Time(sec)	Surrond-sound effect	Vibration device
1	rest (pre experiment)	0-240		
2	pre locker vibration	241-293		
3	a subject's locker vibration	294-312		A speaker vibration set on top of the locker
4	a friend being dragged into a locker	335-342		
5	zombie appeared	356-414		
6	another friend is killed	415-427		
7	zombie approched (disappeared to left direction)	429-456		
8	locker vibration from left side	457-463	sound of opening a locker from a left speaker	A DC solenoid
9	zombie murmured	464-472	Zomvie's murmur, "Ready or not"	
10	zombie close-up	476-481	impact sound hitting a locker	A hand massager
11	rest (1-30s)	481-514		
12	rest (31-60s)	515-544		
13	rest (61-90s)	545-574		
14	rest (91-120s)	575-604		

### 3.2 Procedure

As for a subject experiencing our proposed system, he/she watches a two-minutes pre show movie to understand the context so that the following entering a locker behavior becomes natural. After watching the pre show movie, a subject entered a locker and watched a main movie through a peeping hole of the locker. A subject wore a heart rate sensor (Polar RS800) during the experiment to record RRI (R-R interval). A subject answered questionnaires about how he/she feels in each scene with 5 adjectives (Uneasy, Unpleasant, Astonished, Tensed and Scared) on a one-to-four scale. 9 subjects (4 male and 5 female average age 23.1 years old (SD1.9 years old)) participated the experiment. And as for a subject experiencing a standard seat-type theater environment, 9 subjects (five male and 4 female average age 21.9 years old (SD 1.0 years old)) participated the experiment. The sensor is same as the previous experiment.

### 3.3 Result

Figure 3 shows the result of the mean heart rate (M-HR) of categorized scene of each subject, which experienced the locker-type theater environment. 7 out of 9 subjects react similar physiological response, which gradually raises heart rate from "zombie approached (7)" to "zombie close-up (10)" scene and maximizes heart rate afterwards. This reaction may relate to the surround-sound and vibration effect as table 1

shows. When the subject started to watch the contents, he/she watched the movie from the third person view but with vibration effect after “zombie approached (7)” scene, the view point becomes more subjective and raises horror experience.

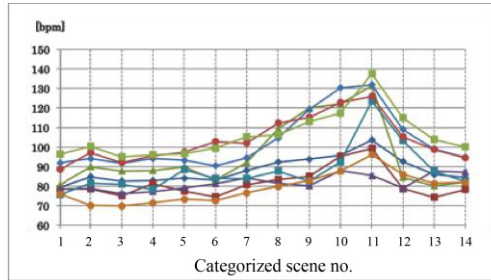


Fig. 3. Result of M-HR(mean heart rate)

Figure 4 shows the baseline comparison of the mean heart rate among subjects(M-HRS) and M-HRS of seat-type theater environment. In all of 13 scenes, we confirmed that two conditions has significant difference (t test 6 scenes:  $p < 0.05$ , 7 scenes:  $p < 0.01$ ).

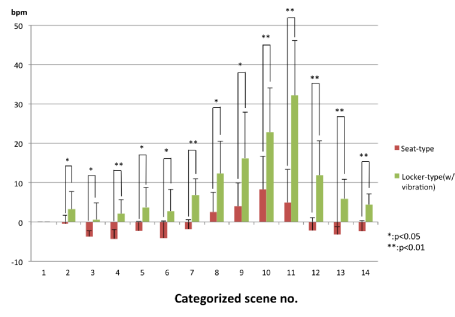


Fig. 4. Comparison of M-HRS (mean heart rate among subjects) between locker-type and seat-type

Figure 5 shows the average score of subjective feelings of each scene. They continuously raise from “another friend killed” scene except for “zombie murmured” scene. “Zombie close-up” scene shows highest score of all five adjectives. The reason why “zombie murmured” scene lowered the subjective horror scale, it is considered that as he/she heard the zombie murmured from the left side of the locker, the zombie was not shown on the screen which did not impact them so much.

In this previous experiment, we confirmed that our proposed theater system succeeds to amplify horror experience. However, we implemented vibration effect as well as designed the theater environment, so it is not clear which factor affects to

amplify horror experience. If vibration effect amplifies horror experience, there is no difference between commercial 4D film and our proposed system since vibration effect is already implemented in most of the commercial system.

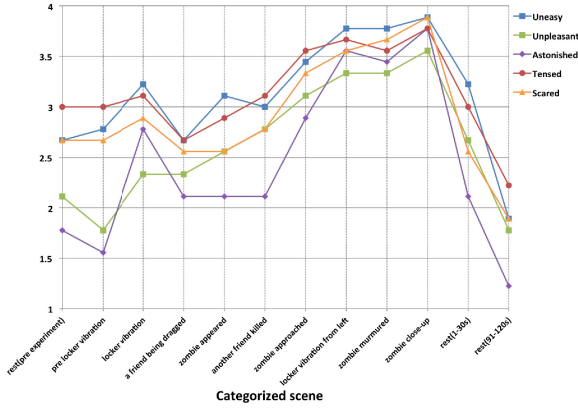


Fig. 5. Average score of subjective feeling of each categorized scene

## 4 Preliminary Experiment 2: Evaluation of Vibration Effect

### 4.1 Purpose

In order to evaluate the effect of vibration, we conducted the experiment to measure RRI in the locker-type theater environment with and without vibration effect.

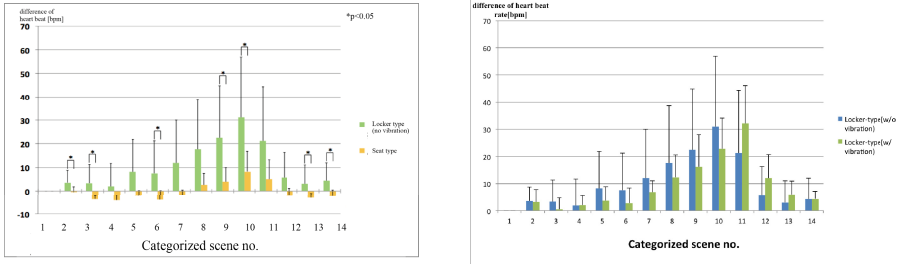
### 4.2 Procedure

The system is same as the experiment 1. 10 subjects (5 male and 5 female average age 21.8 years old SD 1.69 years) participated the experiment. In this experiment, all the subjects experienced the experiment without vibration effect and its heart rate is measured by the same heart rate sensor used in experiment 1.

### 4.3 Result

Figure 6 left shows baseline comparison of M-HRS without vibration effect and M-HRS of seat-type theater environment. 7 out of 13 scenes, we confirmed that two conditions have significant difference (t test  $p < 0.05$ ). As for the comparison of vibration effect, there is no significant difference between two conditions as figure 6 right shows.

From these results, the factor which amplifies horror experience does not depend on the vibration effect. And this confirms that the factor depends on either of the three hypothesis we defined.



**Fig. 6.** Comparison of M-HRS between locker-type w/o vibration and seat-type(left) and comparison between w/ vibration and w/o vibration

## 5 Evaluation of the Effect of Three Factors of the Proposed Theater Environment

### 5.1 Purpose

In preliminary experiment, we confirmed that our proposed system may amplify horror experience, but it is not clear what affects to amplify horror experience exactly since we included three factors we defined as hypothesis which may effect amplifying horror experience. In order to evaluate the effect of horror experience of each hypothesis quantitatively, we modified the system and conducted three experiments. First one is to compare the effect of wearing and not-wearing 3D glasses. Second one is to compare the effect of open and closed space. And the third one is to compare the effect of visible and invisible edge of the screen. The purpose of each experiment is described as follows.

#### 1. Unusual 3D glasses

In order to compare the effect of wearing and not-wearing 3D glasses whether it affects to amplify horror experience, we took the polarization filter out of the peeping holes of the locker and a subject watches 3D movie by wearing 3D glasses while in the locker.

#### 2. Open space

We use a front door of a locker. A subject watches horror movie through the front door while it is open space.

#### 3. Visible edge of the screen

In order to compare the effect of visibility of the screen, we made two sizes of peeping hole of the locker (large and small). By sizing up the peeping hole, a viewing angle of a subject in the locker broadens so that he/she is able to see the edge of the screen or landscape of the laboratory.

### 5.2 Procedure

A subject watches a pre-show movie for two minutes. Afterwards, he/she moves to each designated position in a next room. A heart rate sensor (Polar RS800) is worn during watching the horror movie. In experiment 1, 5 subjects (4 male and 1 female (average age 21.6 years old, SD 0.894)) participated. In experiment 2, 5 subjects (4 male and 1female (average age 20.8 years old, SD 0.837)) participated. In experiment 3, 5 subjects (4 male and 1 female (average age 20.8 years old, SD 0.837)) participated.

### 5.3 Result

- Figure 7 shows the baseline comparison of M-HRS between wearing 3D glasses and not wearing 3D glasses. The result shows no significant difference between two conditions.

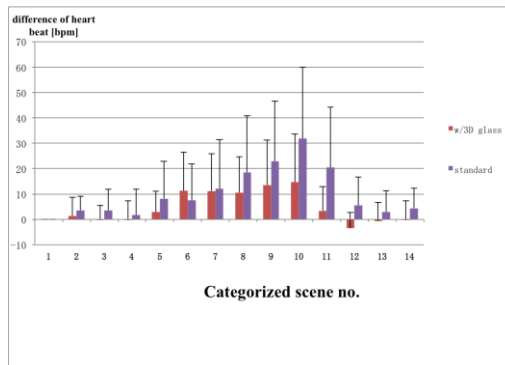


Fig. 7. Comparison of M-HRS between w/ and wo/ 3D glasses

- Figure 8 shows the baseline comparison of M-HRS between open and closed environment. The result shows significant difference in 4 scenes between two conditions. (t test  $p < 0.05$ )

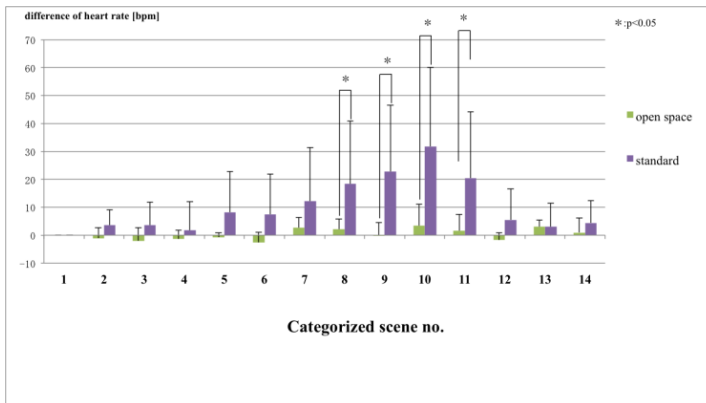
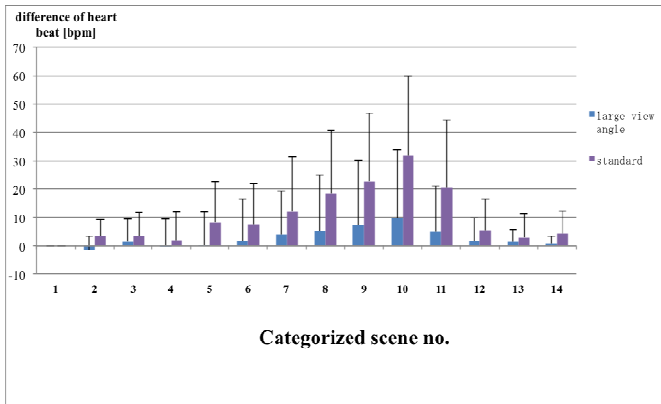


Fig. 8. Comparison of M-HRS between open and closed space



3. Figure 9 shows the baseline comparison of M-HRS between large and small peeping hole size. The result shows no significant difference between two conditions.



**Fig. 9.** Comparison of M-HRS between large and small angle

By evaluating the effect of each factor of hypothesis, we found that there is a significant difference between open and closed space of the proposed theater system. Therefore we confirmed that closeness of the space effects to amplify the horror experience of the contents.

## 6 Discussion

In this paper, we focus on finding the method to amplify reality when to experience a horror movie. We hypothesize three factors reducing the reality in the current 3D or 4D theater environment. By comparing a viewer's heart rate as a baseline of horror emotion, we confirmed that producing a closed space amplifies horror experience. This may relate to the effect of ambience since the closed space compresses a viewer into the small space, which implicitly changes his/her physical state. Also the closed space gives a metaphor of unescapable environment. This also raises horror emotion. In future work, we will work on generating horror virtually. In concrete, we will work on developing system to make a person virtually feel closed space even though it is an open space. If it becomes possible, it will expand this kind of horror amplifying system in commercial use. And we are also working on illusional VR which leads a personal horror feeling virtually.

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