An Experimental Design of Analyzing 3D Depth felt by users for Functional Game

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Abstract. In this research paper seeks to leverage the change in the 3D image's Depth level to present 3D Depth level analysis index that will enable users to feel the three-dimensional effect and engagement level most effectively depending on distance and location, and to capitalize the findings to present 3D image control system that can adjust 3D Depth following the three-dimensional effect felt by user for functional game.

Keywords: Depth level, Image control system, 3D effect, three-dimensional effect start, engagement.

1 Introduction

In particular, interest on the 3D multi-dimensional image is increasing significantly as the film, the key 3D image method is one that leverages eyeglasses based on the method of using the disparity of two eyes in order to observe two images at the same time, which in turn is used to produce synthesized 3D image [1]. This method enables users to feel the multi-dimensional image that provide sense of depth and sense of distance.

Accordingly, this method is used often for the 3D TV and at the movie theaters these days. Likewise, the physiological factors that enable human beings to feel the three-dimensional effect involves viewing 3D image, mostly through the eyes of the human beings. This method is characterized by side-effects such as the eyes getting fatigued easily [2,3] and causing dizziness or vomiting [4]. Moreover, the reality today is that there are no suitable solutions for these problems as of today. Another problem is that users can feel the 3D three-dimensional effect only when they maintain specific distance and location in order to effectively feel the 3D three-dimensional effect.

In this research, we design an experimental procedure for 3D Depth analysis. Which experimental procedure includes an analysis of three-dimensional effect felt by user and three-dimensional effect under various environment.

2 Related Works

2.1 Anaglyph method (REd-Cyan method)

Anaglyph method is the method that utilizes red and blue, which are complementary colors. Likewise, only red and blue are left behind in the photo for the left eye and photo for the right eye, respectively. Then, two images that can be perceived by two eyes, that is the left and the right eyes, are placed into one photo at the same time. When the Anaglyph photo completed by using the difference of the two colors is perceived through the 3D eyeglasses that includes red filter and blue filter on the left and right sides, respectively, it is possible to feel the three-dimensional effect as each of the two eyes recognize the images on the left and right separately.

2.2 Polarized light eyeglasses method (passive method)

Polarized light eyeglasses method is the method that enables users to distinguish the images on the left and right through polarized light effect. This method is the same as the Anaglyph method in the sense that the images of the left eye and the right eye are composed separately, but there is a difference in the sense that it uses polarized light effect. Users can perceive 3D image through the 3D eyeglasses with the polarized light filter of the vertical direction processed on the left eye and through the polarized light filter of the horizontal direction processed on the right eye. The advantages include the ability to highlight the color of the image properly and low price of 3D eyeglasses. Disadvantages include the need to carry two motion picture projectors at all times and the cross-talk phenomenon since the direction of vibration uses specific polarized direct light at all times. In other words, multi-dimensional perception may be distorted even when users tilt their head even slightly since 3D eyeglasses and angle of the light that is reflected on the screen are not aligned.

2.3 Shutter eyeglasses method (active method)

Shutter eyeglasses method is the method that images for the right and left eyes on the display are expressed in a cross-over manner for each of the field or frame when it comes to the left and right sides. This is the method that opens and shuts the left and right sides liquid crystal shutter in a cross-over manner so that the field will be the same as the frame's timing. It advantages include the ability to apply to both 2D and 3D panels from the display aspect, and that it is possible to realize Full HD without decrease in resolution. On the other hand, expensive special eyeglasses are needed since it is necessary to open and shut the shutter in a cross-over manner according to display's signal. Another disadvantage may be that dizziness may result due to the flickering of the screen since left and right sides are converted from the visual aspect.

3 Experimental Design

3.1 Environmental Factors

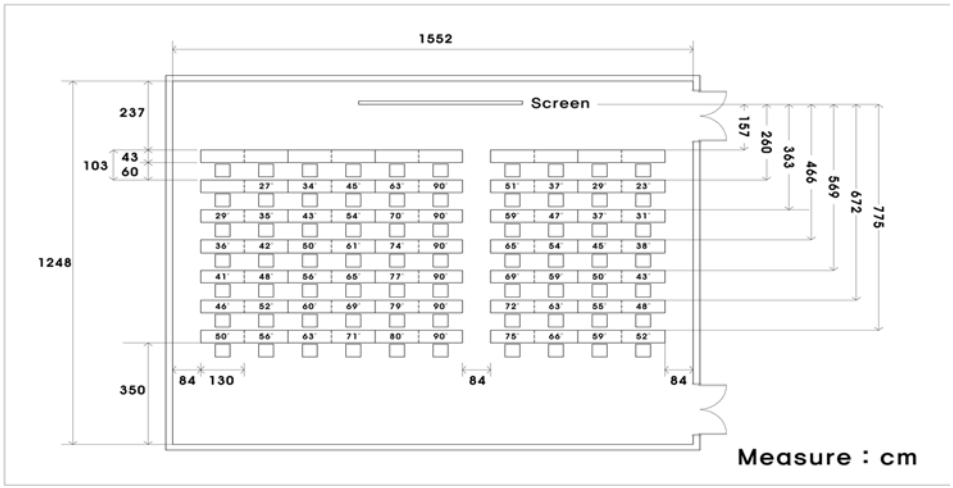

Fig. 1. Experimental Environment

To analyze 3D Depth level of images, distance and location that will enable large number of viewers of the multi-dimensional images to view them effectively, this research conducted the experiment in a university's lecture hall, targeting large number of people, and external factors (light, noise etc.) were minimized to increase the engagement level for the image viewing. To increase the reliability level of the experiment, distance was measured for each of the locations where 3D images were viewed, targeting lecture hall and subjects. Overall experiment environment is shown on Fig 1.

4 Conclusion

This paper design an experiment, targeting 33 subjects in order to analyze the 3D Depth level depending on distance and location to mitigate the fatigue of the users' eyes and to enable them to feel the three-dimensional effect and engagement level in the most effective manner by changing the 3D Depth level and subjects' location and distance.

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