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# Perceived depth in Edge-based DFD (Depth-fused 3-D) display by changing edge width

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## 1. Introduction

In recent years, many 3-D display technologies have been proposed and developed [1]. In addition, many 3D displays do not need glasses for application to digital signage or etc.

In these technologies, we have studied DFD (Depth fused 3-D) display [2]. In DFD display, two overlapped images with different depth can be perceived as a single depth image. The perceived depth of the fused image continuously changes as the luminance ratio of the two images is changed. DFD display has merits of a simple structure, a little fatigue [3]. However, DFD phenomenon needs the same shape images in front and rear plane, resulting in limitation of content flexibility.

We proposed Edge-based DFD display [4], whose front or rear image is only the edge part of the desired 3D image. In edge-based DFD display, perceived depth can be successfully obtained only by changing edge luminesce.

In this paper, we evaluated the dependence of perceived depth when the edge width is changed.

## 2. Conventional DFD display

The principle of conventional DFD display is shown in Fig. 1. DFD display is composed of two conventional 2-D displays without any extra equipment for observers. It enables an observer to perceive an apparent 3-D image of continuous depth between two 2-D display images when their luminances are separated between them according to the 3-D image depth.

## 3. Perceived depth in the edge-based DFD display

The principle of Edge-based DFD display is shown in Fig. 2. Edge-based DFD display is also composed of two 2-D displays as well as conventional DFD display. However, front or rear image is only the edge image. In Edge-based DFD display, the perceived depth can be successfully changed only by edge image luminance change.

## 4. Experimental equipment

Edge-based DFD display is composed of a half mirror and two liquid crystal displays. The stimuli were 2-D green square and 2-D green edge part image. The full square image luminance was fixed and the edge part image luminance was changed from zero to full square image luminance. The front or rear edge images have 5 width patterns from 1/10 to 1/25 of square image width.

## 4. Experimental result

Perceived depth dependence on edge width in the case of front edge image is shown in Fig. 3. Perceived depth means the distance from front plane. At edge width of 1/10 in Fig. 3(a), perceived depth is gradually changed from 1.0 (rear plane) to around 0.3 (near front plane), when edge image luminance is increased. Moreover, even when edge width is decreased to 1/25 in Fig. 3(b), perceived depth is successfully changed as well as one at edge width of 1/10.

Thus, perceived depth change can be successfully obtained in the edge-based DFD display, even when edge width is decreased.

## 5. Conclusions

We evaluated perceived depth change in Edge-based DFD display by changing edge width. Perceived depth can be successfully changed, even when edge width is decreased. Moreover, perceived depth dependence is not affected by edge width change.

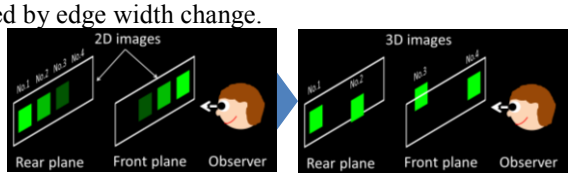



Fig.1 The principle of conventional DFD display

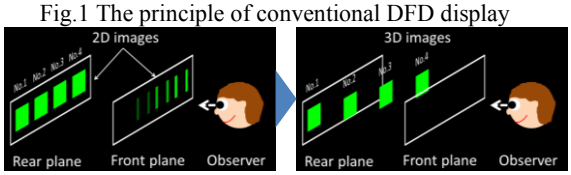
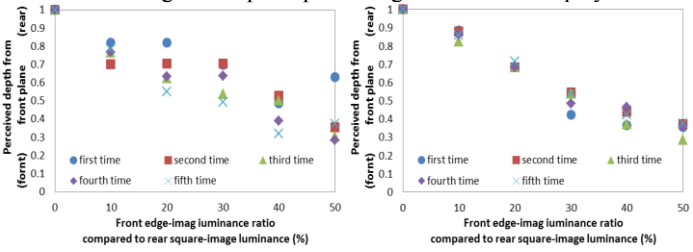



Fig.2. The principle of Edge-based DFD display




(a) 1/10 (b) 1/25

Fig.3 Perceived depth dependence on edge width

## References

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