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Perceived depth by viewing distance change in LED DFD display

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1. Introduction

We have studied the Depth-Fused 3-D (DFD) display[1] by using two layered liquid crystal displays or transparent sheets, etc. The DFD display has several advantages, such as simple structure, little fatigue[2], small degradation in perceived depth when both eyes have different visual acuities[3].

Recently, we proposed long viewing-distance DFD display by using layered LED displays[4]. However, estimation of viewing distance dependence on perceived depth should be neccessary because disparity between two displays changes when viewing distance and two display gap are linearly changed.

In this paper, we evaluate perceived depth dependence when viewing distance and two display gap are linearly changed.

2. Principle of the DFD display

Figure 1 shows the principle of the DFD display. DFD display in which two overlapped images with different depth can be perceived as a single depth fused image with continous depth change by luminance ratio[1]. When the luminance ratio of the front and rear images displayed according to the depth position of 3-D image is changed, perceived depth position of the fused image changes continuously.

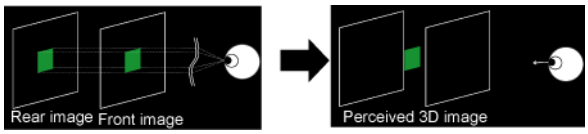

Fig.1 Principle of DFD display

3. Method of measuring depth perception

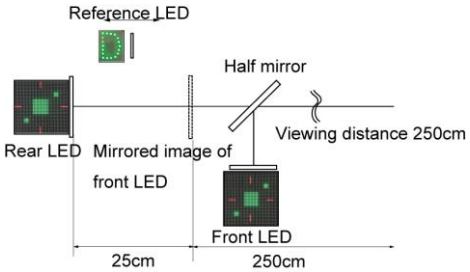

Fig. 2 Apparatus of evaluating perceived depth of DFD display with the pixel pitch 6mm of LED panels.

Figure 2 shows the apparatus of evaluating perceived depth of DFD display with the coarse pixel pitch 6mm of LED panels. DFD display was composed of two LED panels and half mirror. Image of rear LED panel was set behind front LED panel by using a half mirror. Subjects evaluated perceived depth of stimulus by moving reference LED panel. Viewing distances were (a) 5.0m, (b) 2.5m and (c) 1.25m, and two displays gaps were (a) 50cm, (b) 25cm and (c) 12.5cm.

4. Depth perception measurement results

Figure 3 shows dependence of the perceived depth on luminance ratio, when the viewing distance is changed as (a) 5.0 m, (b) 2.5 m and (c) 1.25 m and two display gap is also changed linearly. The line is drawn from front plane to rear plane. The perceived depth increases linearly as a rear luminance ratio increases in Fig. 3 (a), (b) and (c). As compared with the straight line, almost the same depth is perceived. Even when viewing distance is changed from 1.25 m to 5.0 m, that is, from 2.03 min. to 8.12 min. of arc, perceived depth dependence is almost the same and perceived depth keeps its linearity.

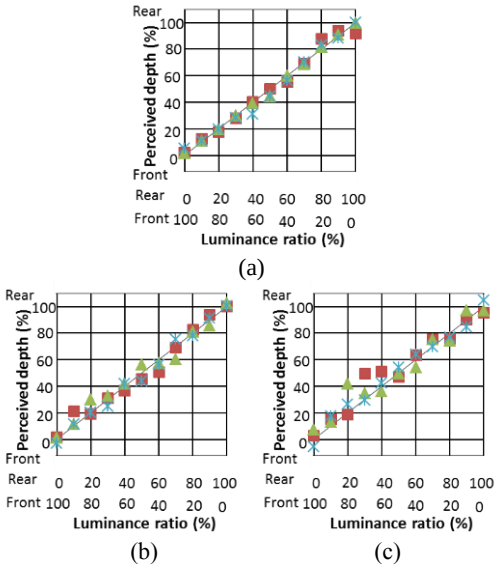

Fig. 3 Dependence of the perceived depth on luminance ratio, when viewing distance is (a) 5.0 m, (b) 2.5 m and (c) 1.25 m.

5. Conclusion

In the DFD display that uses two LED panels, we evaluated perceived depth dependence when viewing distance and two display gap are linearly changed. Even when viewing distance is changed from 1.25 m to 5.0 m, that is, from 2.03 min. to 8.12 min. of arc, perceived depth dependence is almost the same and perceived depth keeps its linearity.

References

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