Difference of Perceived Depth Change between Arc 3D Display and Stereoscopic Display by Increasing Visual Acuity Difference

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1. Introduction

Recently, many stereoscopic displays using binocular parallax become popular. However, not a few people, such as anisometropic people, are difficult to perceive depth only by binocular disparity. More human-friendly 3D display should be required, by which even anisometropic people can perceive 3D images. As a prior research [1], Sadakuni reported that DFD (Depth-fused 3D) display [2] is less degraded by increasing visual acuity difference of both eyes than stereoscopic display. Sadakuni proposed assumption that smooth motion parallax in DFD display would improve perceived depth degradation even at fixed head.

In this paper, we study perceived depth change in arc 3D display [3] as another type of 3D display with smooth motion parallax to verify the assumption.

2. Perceived depth change in arc 3D display

In arc 3D display in Fig. 1, each eye can perceive only one bright spot according to eye position movement by arc-shaped scratch directional scattering. This result in binocular parallax and smooth motion parallax. Difference of perceived depth change by increasing visual acuity difference was estimated using occlusion foil [4] between arc 3D display and stereoscopic display as shown in Fig. 2.

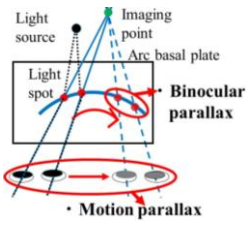

Fig. 1 Principle of arc 3D display

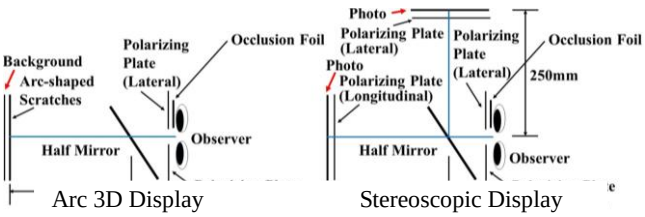

Fig. 2 Experimental system

Figure 3 shows perceived depth change in arc 3D display and stereoscopic display. In stereoscopic display, perceived depth is quickly degraded when visual acuity of one eye is decreased to around 0.2 and depth cannot be perceived at visual acuity of 0.01. On the other hand, in arc 3D display, perceived depth has little degradation around visual acuity of 0.1 and depth can be perceived even at visual acuity of 0.01.

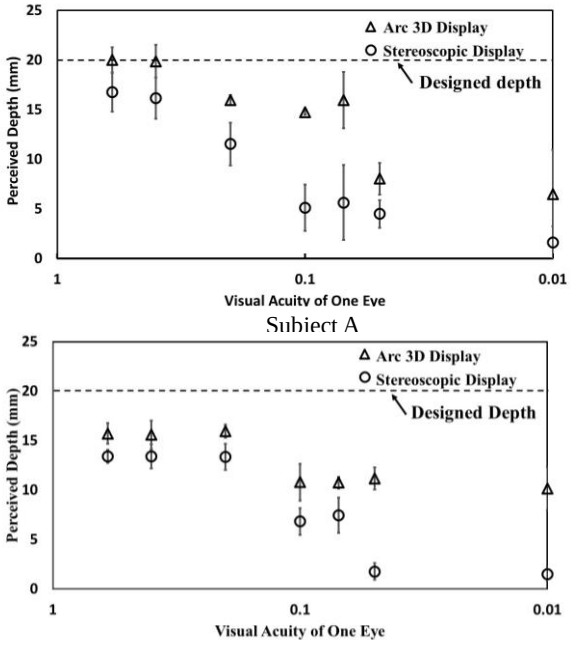

Fig. 3 Perceived depth change difference between arc 3D display and stereoscopic display

3. Conclusions

Even when visual acuity difference between both eyes is increased, perceived depth degradation of arc 3D display is much less than that of stereoscopic display. This perceived depth change in arc 3D display has similar tendency as that in DFD display in prior research.

Thus, the assumption is successfully clarified that small but smooth motion parallax would improve perceived depth degradation caused by visual acuity difference increase even at fixed head.

Acknowledgements

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References

[1] K. Sadakuni, T. Inoue, H. Yamamoto and S. Suyama, IEICE Trans. Electron., **E95-C** 11 (2012) 1707-1715.
[2] S. Suyama, S. Ohtsuka, H. Takada, K. Uehira and S. Sakai, Vision Research, **44** (2004) 785-793.
[3] N. Yamada, C. Maeda, H. Yamamoto and S. Suyama, IDW'12, **19** (2012) 1219-1222.
[4] M. Miyata, M. Miyata, R. Nakahara, I. Hamasaki, T. Furuse and H. Ohtsuki, Acta Medica Okayama, **70** 5 (2016) 339.