Perceived depth by monocular motion parallax in passive head movement

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In recent years, 3D cinemas are widely spread all around the world. However, as only binocular parallax is used in 3D cinemas, some people cannot perceive 3D impact because of stereoblindness[1]. It is important to make such stereoblind people perceive 3D depth. One of the solutions is to use motion parallax. Because it is difficult to control the different active head movement of many people, we propose a new method of moving their head passively by adjusting the moving direction and speed for motion parallax depth perception.

In this paper, difference of depth perception in active head movement and passive movement of subjects by motion parallax has been evaluated in order to achieve 3D depth perception only by passive movement of subject.

In the experiments, perceived depths were evaluated by the distance between thumb and first fingers. This evaluation needed the training. Figure 1 shows experimental apparatus for training of perceived depth evaluation. The subjects were let measure the perceived depth after training using motion parallax or binocular disparity. The results are shown in Fig. 2. When the subject was trained using motion parallax, perceived depth is closer to designed depth.

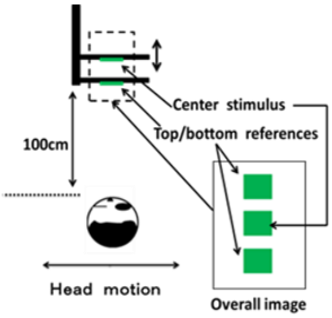

Fig. 1. Experimental apparatus for training of perceived depth evaluation.

Figure 3 shows experimental apparatus for perceived depth evaluation in passive motion parallax[2]. When the center of the square moves in the same direction with the subject movement, the subject can perceive the square behind the display. When the center of the square moves in the counter direction with the subject movement, the subject can perceive the square in front of the display. The designed depth of center stimulus was from + 50 mm (in front) to - 50 mm (behind). Three trials were measured at each designed depth.

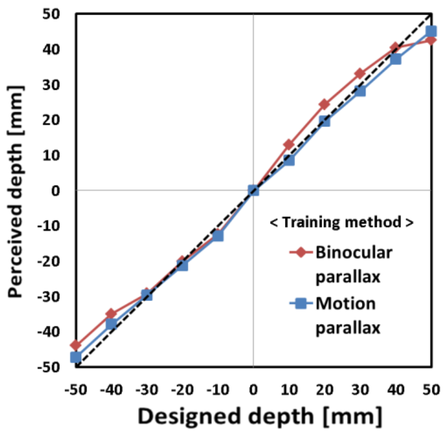

Fig. 2. Perceived depth difference by training method in motion parallax.

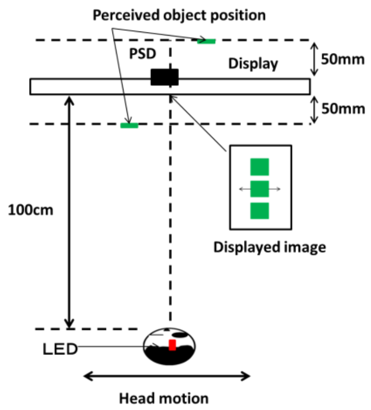

Fig. 3. Experimental apparatus for perceived depth evaluation in motion parallax.

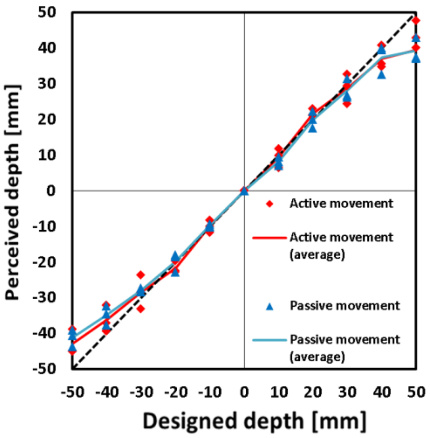

Fig. 4. Perceived depth differences between by active motion parallax and by passive motion parallax.

The subjective tests results are shown in Fig. 4. When the designed depths are small, perceived depths are almost consistent with the designed depths. On the other hand, when the designed depths have large values, the perceived depths are slightly smaller than the designed one. However, the subject can perceive almost the same depth between by active head movement and by passive movement of subject.

Thus, our proposed method by using passive monocular motion parallax is promising for providing 3D impact to stereoblind people.

References

1. Whitman Richards, Experimental Brain Research, vol. 10, issue 4, pp. 380-388, (1970).
2. K. Tatehata, et al., Proc. IDW '13, vol. 20, pp. 1120-1121, (2013).