

## The effect of blurred images for the accommodation response of integral photography

Sumio Yano<sup>1</sup>, Hiromichi Imai<sup>2</sup> and Min-Chul Park<sup>3</sup>  
<sup>1,2</sup>Shimane University, Matsue, Shimane 690-8504, Japan  
 Tel.:81-852-32-8906, E-mail: yano@ecs.shimane-u.ac.jp  
<sup>3</sup>KIST, Cheongryang, Seoul 136-791, Korea

It is said that the conflict between the convergence and the accommodation response does not arise in integral photography (here by referred to as IP). For this reason, it is thought that natural images are displayed and visual fatigue is not created in IP. The measurement results of accommodation response for IP are described in this paper. The examination for measurement results are also described at the point of the blurred IP image.

For the generation of IP images, multi-view images were generated at first. Next, the pixels in the multi-images were mapped to the LCD panel for displaying IP images. The specification of the LCD panel (Ortus Technology Co. Ltd.) was 4.8 inches, 1920(H) x 1080(V) dots, 55.5  $\mu\text{m}$  in the pixel pitch. The lens array was orthogonal arrangement, and 1 mm diameter in each lens. Therefore, the size of elemental image was 18 x 18 dots, and the spatial resolution on the lens array was 108(H) x 60(V) dots in the IP display. Figure 1 shows the measurement result of the accommodation response. The position of the visual target in IP is from 46 cm to 72 cm in depth. The accommodation response was measured by WAM-5500 (Shigiya Machinery Works Ltd.). The result showed that the accommodation response is a rectilinear change in the range or out-range of the depth of the focus.

At first, the depth discrimination caused from the blurred IP images were evaluated using Scheffé's Paired Comparison. The experimental equipment and conditions were according to the previously described IP display. Figure 2 shows the experimental result. In this figure, the ranges of depth decimation in the statistical significance are 46.5 cm at the near position, and 73.5 cm at the far. This range corresponded to 1 or 2 cpd (cycle per degree) in the spatial resolution. However, the propensity of statistical significance was shown out of range of this depth discrimination.

Next, the accommodation responses for the stereoscopic images at 31 cpd and 0.1 cpd in the spatial resolution, and real objects, were measured. The size of stereoscopic display was a 10-inch LCD, and a polarized filter was used for the image display. Figure 3 shows the experimental result. In this figure, it is shown that the accommodation response was saturated out of the depth of focus, and was a rectilinear response for the blurred stereoscopic images and the real objects.

As a result, it is shown that the accommodation responses were measured in the out range of subjective depth discrimination. Moreover, the accommodation response showed the rectilinear response for the blurred images. However, it is suggested that this effect was not so effective at 1 or 2 cpd at the spatial frequency. For these reasons, it is thought that a conflict between the convergence and the accommodation response does not arise.

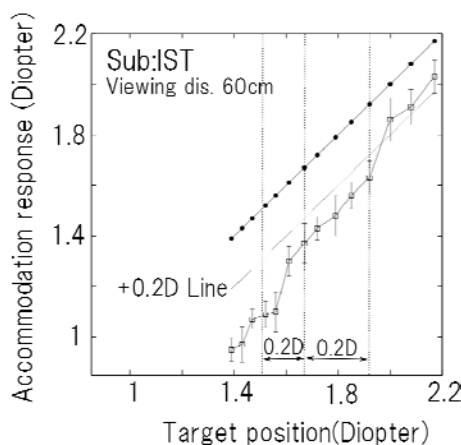


Fig.1 Accommodation response for integral photography

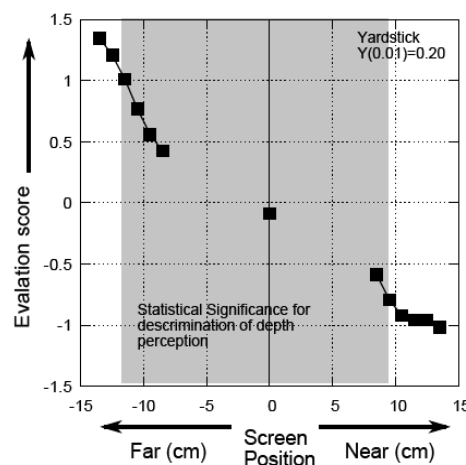


Fig.2 Depth discrimination for integral photography

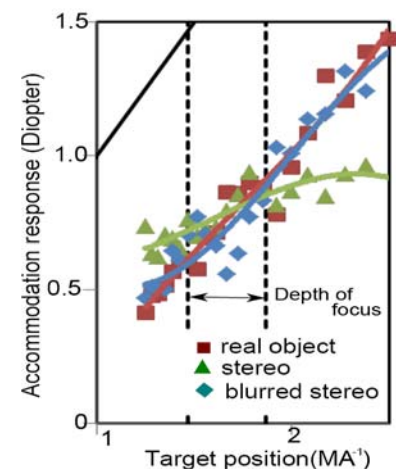


Fig.3 Accommodation response for stereoscopic images