

## Determining NNDs in Image Distortion due to Display Curvature

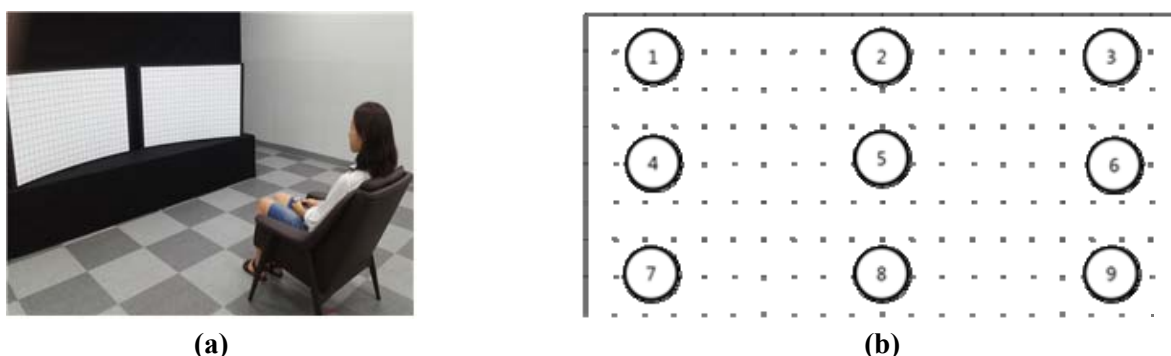
Sungryul Park<sup>1</sup>, Jihyeon Yi<sup>1</sup>, Donghee Choi<sup>1</sup>, Songil Lee<sup>1</sup>, Ja Eun Lee<sup>2</sup>, Byeonghwa Choi<sup>2</sup>, Seungbae Lee<sup>2</sup>,  
and Gyouhyung Kyung<sup>1</sup>

<sup>1</sup> Department of Human & Systems Engineering, UNIST, Ulsan, Korea

Tel.:82-52-217-2711, E-mail: ghkyung@unist.ac.kr

<sup>2</sup> Display R&D Center, Samsung Display Co., Ltd. Gyeonggi-Do, Korea

Diverse curved display products (e.g. TV, computer monitor, smart phone, and smart watch) are now available in the market. As TV comes with a relatively large screen compared to other products, any effects of its display curvature on visual perception, and hence on visual experience, are expected to be more intense. The current study investigated NND (not noticeable difference) in image distortion due to display curvature applied to TV. NND is a psychophysical concept considered 'more valid' than JND (just noticeable difference). More severe viewing conditions (i.e. closer viewing distance and smaller radii of curvature) were considered in the current study such that any image distortion could be easily perceived. The range of display curvature investigated was 2000 ~ 3000mm with a 100 mm increment. A total of 16 younger individuals were individually exposed to four series of curvatures, which were presented either in ascending or descending order. Each series was paired with one of three reference curvatures (2000mm, 2500mm, and 3000mm). The participant compared 9 pairs of grid zones on two 55" Styrofoam mockup displays (Fig. 1.a), and made a 2AFC (two-alternative forced-choice) decision regarding whether or not two set of gridlines were identical (Fig. 1.b). Based on the NNDs observed in the current study, one curvature-radius appeared to be sufficient over the range of 2000-3000mm when investigating the effects of display curvature on visual perception and watching experience.



**Fig. 1. (a) Experimental setting with a viewer at the center and a reference display on the right side  
(b) 9 grid zones for pairwise comparison of image distortion between two curvature levels**

### Acknowledgment

This research was supported by Samsung Display as well as by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2013R1A1A2061151).

### References

1. Helander, M. G., Little, S. E., & Drury, C. G. (2000). Adaptation and sensitivity to postural change in sitting. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 42(4), 617-629.
2. Ulrich, R., & Miller, J. (2004). Threshold estimation in two-alternative forced-choice (2AFC) tasks: The Spearman-Kärber method. *Perception & Psychophysics*, 66(3), 517-533.
3. Park, S., Choi, D., Yi, J., Kyung, G., Lee, S., Choi, B. (2014, Aug 26 -29) Ergonomic evaluation of flexible display: Influences of curvature on legibility and visual fatigue, IMID2014, Daegu, Korea.
4. Kyung, G, Park, S., Yi, J., Choi, D. (2014, Aug 26 -29) Benefits of Curved Display: A short review and an experimental study, IMID2014, Daegu, Korea.