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author={K. Carnegie and T. Rhee},   
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title={Reducing Visual Discomfort with HMDs Using Dynamic Depth of Field},   
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abstract={Although head-mounted displays (HMDs) are ideal devices for personal viewing of immersive stereoscopic content, exposure to VR applications on them results in significant discomfort for the majority of people, with symptoms including eye fatigue, headaches, nausea, and sweating. A conflict between accommodation and vergence depth cues on stereoscopic displays is a significant cause of visual discomfort. This article describes the results of an evaluation used to judge the effectiveness of dynamic depth-of-field (DoF) blur in an effort to reduce discomfort caused by exposure to stereoscopic content on HMDs. Using a commercial game engine implementation, study participants report a reduction of visual discomfort on a simulator sickness questionnaire when DoF blurring is enabled. The study participants reported a decrease in symptom severity caused by HMD exposure, indicating that dynamic DoF can effectively reduce visual discomfort.},   
keywords={ergonomics;helmet mounted displays;three-dimensional displays;virtual reality;HMD;VR applications;adverse physical reactions;depth-of-field blur;dynamic field depth;head-mounted displays;immersive stereoscopic content;personal viewing;visual discomfort;Displays;Hardware;Software;Stereo image processing;Virtual reality;Visual systems;Visualization;computer graphics;depth of field;head mounted display;immersive stereoscopic content;virtual reality;0},   
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**Bibliography**

Depth of focus blur effects has been studied not only for general visual discomfort as well as symptoms such as fatigue, headache, and eyestrain. Their study shows that DoF blur can considerably alleviate most of these discomforts, thereby reducing simulator sickness overall. This work has the potential to advance the widespread adoption of VR. The author considers the previous studies on visual discomfort and considering the approaches of previous studies an effective system for reducing the blur has been developed.

Author has concluded that, we can Reduce Visual Discomfort by viewing monoscopic or stereoscopic content with a small angle of difference between the two images. Removing and/or minimizing the vergence cues for depth and distance estimation also reduces discomfort. Other attempts to explicitly solve the accommodation–vergence conflict in stereoscopic displays have also used hardware-based approaches involving setups such as multifocal displays, alternative lens systems, or multi lens systems. Their system was constructed to meet the conditions like reducing the amount of focusing a user needs to perform and reducing the range of virtual depths on which a user must focus. For general stereo displays (such as an LCD), limiting eye movement to only focusing on the center of a screen will limit users’ spatial degrees of freedom. However, in HMDs, most of spatial movement will occur through head movements rather than through eye movements, compensating for this drawback. Effects such as variable acuity resolution on the Oculus, where central pixels are of a higher perceived density, also serve to drive user focus away from the periphery, limiting the effect of DoF blurring on peripheral information.

**References:**

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"This is entirely my own work, except as disclosed in the documentation. I gave help to the following persons:   
None  
Signed Kiran C Shettar"