

# A gaze-contingent display with variable temporal resolution

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We investigate the role of high temporal frequencies in the visual periphery. Previous research has mainly been focused on the use of well-controllable, artificial stimuli, such as flickering sinusoidal gratings, etc. While this approach has yielded many important insights, recent findings have shown that visual performance in free-viewing condition differs significantly from that in paradigms where a steady fixation has to be held ([3]).

To conduct experiments facilitating natural stimuli, we have developed a gaze-contingent system capable of foveating the temporal resolution of movies (1024x576 pixels, 30 Hz) in real time. Gaze-contingent displays have been used before in vision research, but those approaches had been limited to varying only spatial resolution, see e.g. [4].

The system uses a multiresolution pyramid to create six temporally downsampled versions of an image sequence. Depending on eccentricity, the different levels of the pyramid are then interpolated in the upsampling reconstruction step to yield a varying temporal resolution across the visual field. Although any arbitrary resolution map could be defined, we currently use a sigmoidal falloff from the centre. Thus, moving objects in the periphery become blurred or even seem to disappear completely, while full temporal resolution is kept at the centre of gaze.

First experiments with this system have shown that even a significant reduction in temporal resolution can remain invisible to the subject ([1]). As movement in the visual periphery is a strong attractor for saccadic eye movements, a peripheral suppression of high temporal frequencies also changes eye movement characteristics ([2]).

## References

- [1] Michael Dorr, Martin Böhme, Thomas Martinetz, and Erhardt Barth. Visibility of temporal blur on a gaze-contingent display. 2005. To be presented at: Applied Perception in Visualization and Graphics Symposium, A Coruña, Spain.
- [2] Michael Dorr, Martin Böhme, Thomas Martinetz, Karl R Gegenfurtner, and Erhardt Barth. Eye movements on a display with gaze-contingent temporal resolution. 2005. To be presented at: European Conference on Visual Perception, A Coruña, Spain.
- [3] T M Gersch, E Kowler, and B Doshier. Dynamic allocation of visual attention during the execution of sequences of saccades. *Vision Research*, 44(12):1469–83, 2004.
- [4] Jeffrey S Perry and Wilson S Geisler. Gaze-contingent real-time simulation of arbitrary visual fields. In B E Rogowitz and T N Pappas, editors, *Human Vision and Electronic Imaging: Proceedings of SPIE, San Jose, CA*, volume 4662, pages 57–69, 2002.