

# Incorporating Models of Early Vision Processing into Virtual Reality

Martin Reddy<sup>†</sup>

Department of Computer Science,  
University of Edinburgh,  
JCMB 1408, King's Buildings  
Mayfield Road,  
Edinburgh, EH9 3JZ

## Abstract

Recent models of early visual processing espouse a computational approach to vision. Such computational theories can in principle be implemented on a computer system to demonstrate their utility and efficacy. However with the development of computer graphics technology, another form of computer simulation can be envisioned: that is, to visually experience the effects of a model. Thus, a model of human early visual processing has been incorporated into a real-time, 3D graphics system; commonly referred to as virtual reality (VR). Specifically, it will be demonstrated how models of spatiotemporal contrast sensitivity can be encoded efficiently into a VR system. With this knowledge, the VR system can then decide to remove certain regions of detail from a scene which it believes to be sub-threshold (based upon attributes of the model such as its velocity, eccentricity, distance, orientation etc.). Effectively, by degrading the sensations which are presented to the visual system, we can investigate the information that is available to the higher vision processes. Also, because the inherent latencies of contemporary VR systems are aggravated by the amount of detail in a scene, this also has the potentially beneficial effect of improving the interactivity of VR technology. However, it is hoped that the development of this kind of tool will not only produce a more efficient interactive graphics system, but also provide a flexible mechanism to evaluate models of threshold vision in a simulated, real-world and full-colour environment.

**Keywords:** computer graphics, spatial frequency, contrast sensitivity, visual perception, virtual reality.

---

<sup>†</sup>e-mail: [M.Reddy@ed.ac.uk](mailto:M.Reddy@ed.ac.uk), URL: <http://www.dcs.ed.ac.uk/~mxr/>