Selective Rendering of Task Related Scenes

Veronica Sundstedt* Alan Chalmers Kirsten Cater
Department of Computer Science
University of Bristol, UK

1 Introduction

The perception of a virtual environment is heavily influenced by the task the user is currently performing in that environment [Yarbus 1967]. Thus the human visual system can be exploited to significantly reduce computational time when rendering high fidelity images, without compromising the perceived visual quality. This poster considers how an image can be selectively rendered when a user is performing a visual task in an environment. In particular, we investigate to what level viewers fail to notice degradations in image quality, between non-task related areas and task related areas, when quality parameters such as image resolution, edge anti-aliasing and reflection and shadows are altered.

Figure 1: Experimental images: (left) Kalabsha temple (right) Red balls scene.

Cater et al. showed that conspicuous objects in a scene that would normally attract the viewer's attention are ignored if they are not relevant to the task at hand [Cater et al. 2002]. This failure of the human to see unattended items in a scene, is known as *inattentional blindness* [Mack and Rock 1998]. In their experiments, viewers were presented with two animations. One was always always a high quality rendering, while the other, only the pixels in the visual angle of fovea (2°) centered around the task object within the environment were rendered at high quality, since it provides the highest spatial and chromatic resolutions of the eye. We extend this work to investigate whether people would indeed even fail to notice parts of a scene within the visual angle of fovea rendered in low quality in the presence of a high-level task focus, i.e. if it is the visual angle of fovea that is important or only the objects related to the task. The importance of this result is that the portion of an image covered by the foveal angle is related to the distance the viewer is from the screen and this area may contain many more objects than those related to the task. The study involved two rendered environments,

*e-mail: veronica@cs.bris.ac.uk

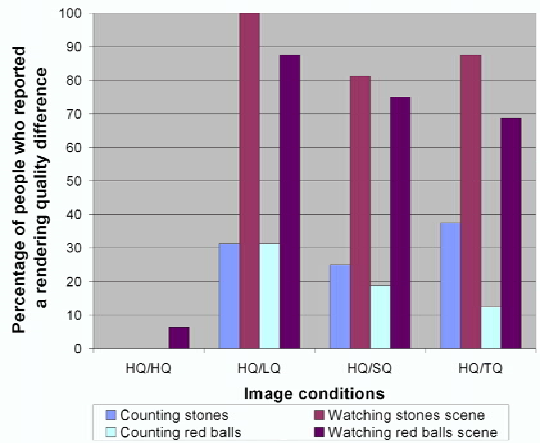

Figure 2: Experimental results for the two tasks: counting objects vs. simply viewing the images.

see figure 1, one with varied sampling resolution (the task was to count loose stones in the Kalabsha temple) and the other with different edge anti-aliasing qualities (counting red balls in a geometrical scene). Pilot studies were conducted to determine the noticeable difference for each case and the appropriate times it took to perform the task. In the main experiment each participant were shown one high quality image (HQ) and either a low quality (LQ), selectively rendered by high quality in the visual angle of fovea (SQ) or for the task objects (TQ). We also tested a separate case when the whole scene was rendered without reflections and shadows (RQ).

2 Results

The results, see figure 2, of our experiments confirm that, at least for edge anti-aliasing, inattentional blindness can in fact be exploited to significantly reduce the rendered quality of a large portion of a scene without having any affect on the viewer's perception of the overall (high) quality of the rendered image. The results go further than previous work by showing that, when performing the task, a high percentage of the observers even fail to notice low quality of non-task related areas within the visual angle of the fovea. This applies to a number of quality parameters including edge anti-aliasing and reflection and shadows. This will lead to significant computational savings for selective renderers as the perceptual high quality of the resultant image will be preserved despite removing the high quality restriction from all non-task areas within the foveal angle.

References

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