



## Introduction

### Crossroads Computer Graphics edition

by [Adam Lake](#)

Welcome to this season's issue of Crossroads. Computer graphics research has a rich yet brief history. As in any field, it is difficult to assign graphics a specific domain: it is multidisciplinary by definition. For instance, many researchers work to make the computer a better tool to aid in the collection and interpretation of scientific information through scientific visualization, while other scientists in image processing work to develop techniques to interpret images for information and enhancement. In addition, computer animation has changed the landscape of the entertainment industry forever. We now take for granted the surreal experiences presented to us in commercials with talking cats and morphing cars. Virtual reality has the potential to change our notion of reality, ultimately giving us a better understanding of what we are and what we have the potential to be, both as individuals as well as collectively. Computational geometry strives to make the representations in the computer a more accurate, robust, and realistic representation. From mathematics to medicine to art, computer graphics has advanced and will continue to advance those fields. We are continually striving for what Ivan Sutherland, the father of interactive computer graphics, called *The Ultimate Display* [1]. One in which the world "...looks real, acts real, sounds real, and feels real."

Through the talents of creative computer scientists, mathematicians, and artists, each of whom often wears each hat to some degree, computer graphics is used to convey ideas that are more easily represented or more easily interpreted in a virtual world. Many times we wish this control to be omnipotent, other times we find it useful to

restrict the degrees of freedom one has in the virtual world. Computer graphics is the visual aspect of the virtual world, it is the aspect we will explore in this edition of *Crossroads*.

We have a collection of articles of dealing with a variety of topics. Paul Rademacher has written an excellent introduction to ray-tracing. He gives a step by step tutorial with the hope that motivated students will try to use this article (and the accompanying code) to write their own ray-tracer. Another tutorial is by Matt Cutts, who gives a review of his favorite image processing tool, the General Image Manipulation Program, or GIMP. Matt gives a description of the tool, as well as ways to use the tool to do some of the more common operations the GIMP performs.

Moving to some of the more research oriented articles, Ellen Scher has written an article on her cutting edge research in frameless rendering. In traditional rendering, a virtual model is rendered by updating the entire frame and then displaying it at a high enough rate that the viewer doesn't notice the update. Frameless rendering is a different approach which updates the scene continuously a pixel at a time rather than a screen at a time. This has several advantages, including the ability to update the screen using the most recent information, which is not possible in traditional rendering pipelines.

Kenneth Hoff III has described his research in rapid culling methods, and contemplates their utilization in next generation games. This article is a must read for anybody interested in some of the most current research in virtual environments and ways to write games that render quickly. Kenny first surveys existing rendering methods and then describes how the most current work in view frustum culling can be utilized to greatly reduce the processing load in these systems.

Also in this issue of *Crossroads* is an article by Phil Agre of the Communications Department at the University of California, San Diego. He gives some extremely useful advice to the undergraduate who is pondering the idea of obtaining a graduate education and gives some basic principles to follow in making yourself the best possible candidate.

## References

508, 582-583, 1965.

## Biography

**Adam Lake** ([lake@cs.unc.edu](mailto:lake@cs.unc.edu)) is a graduate student in the Department of Computer Science at the University of North Carolina at Chapel Hill and a graduate research assistant in the Applied Theoretical Physics and Computational Science Methods Group at Los Alamos National Laboratory. His research interests include computer graphics, artificial life, immersive computing environments, computational geometry, and distributed computing. He is working under the advisement of Henry Fuchs and Greg Welch. One of their current research projects is a real-time depth extraction system to be used in tele-collaborative virtual environments.