Hybrid Transparency Summary

Trenton Plager

Introduction & Related Work

Hybrid transparency is a unique method of getting around the problem of transparency algorithms consuming quite a bit of memory. As a result, it can also be used to render more complex scenes at a higher fidelity with a higher framerate and less artifacting. These are all improvements upon other methods of order-independent transparency rendering such as adaptive transparency, Z^3 and k-buffer. However, a great deal of the algorithm that defines hybrid transparency is based upon the work of those who created other methods of order-independent transparency rendering such as Porter and Duff.

Methods

Hybrid transparency works by separating the more important layers in a scene from the less important ones. This conclusion was reached by observing that less important layers/fragments contribute less to the overall rendered view of a scene. As a result, hybrid transparency can use different algorithms to calculate the color of the more important (core) fragments and the less important (tail) fragments. The algorithm for the core fragments is more accurate, but also more expensive to process. The tail algorithm uses the weighted average technique developed by Bavoil and Myers to compose the opacities and colors of its fragments. This algorithm is much faster but is also much less accurate because it does not perform sorting. Once the core and tail fragments are composed into their own layers, these layers are combined with the opaque background layer to render the final scene.

Results & Discussion (I'm not sure what to do here since it's listed as one item on the paper and multiple items in the guideline)

The team that designed Hybrid transparency designed several methods to test their algorithm against some of the other popular transparency algorithms. Some of these tests, especially those listed earlier in the paper, are the same tests that were originally used to test other methods of transparency rendering. The first is a rendering of a hair model with 15,000 strands and up to 663 transparent layers. As you can clearly see from the rendering in the paper, the hybrid transparency method performed incredibly, much better than all other methods, especially when looking at lower numbers of slots per pixel. The second test was a rendering of 22 aligned dragons. However, unlike most rendered scenarios, the dragons closer to the viewer are more transparent than those behind. It was thought that this would cause difficulty for the hybrid transparency model because the layers further from the viewer are only approximated and are not calculated very accurately. However, it still proved to be the model with the least artifacting. The adaptive transparency model shows some disturbing artifacting in the form of dark spots throughout the image, while others don't even render the layers further from the viewer. Beyond these tests, further tests were conducted in a more systemic manner to better understand the image quality that the hybrid transparency model renders. From these tests, hybrid transparency still seems to present the smallest errors, even with limited memory. The only instance where the authors found that the hybrid transparency model would generate more errors than adaptive transparency is when no important layers are captured for the model's core layers *and* this is combined with the subsequent important layers.

Conclusion

The hybrid transparency model for order-independent transparency rendering is a unique method that uses an accurate algorithm to calculate the color and opacity of those pixels close to the viewer and a much faster, but less accurate method to calculate those pixels further from the viewer. It can operate in situations where memory is bounded unlike many methods of transparency rendering. The tests conducted in this paper showed that hybrid transparency is a significant improvement to many other methods and can be used in real-time applications with very little visual problems. In the future, the authors of the paper plan to find ways to eliminate and/or mitigate the worst case for the hybrid transparency model, the one test in which hybrid transparency performed worse than some other methods of transparency rendering.