

Introduction

Computer animation and ray-tracing is a very incredible, powerful form of animation. As the power of computers increases and the programs written for producing animations improve, computer animation becomes more accessible to a greater number of people. But with the computer animated movies entertainment is vastly improved.

Once upon a time, the artist and the scientist were really very much akin – think Leonardo Da Vinci: a man who was an engineer, an artist, and a scientist (are there others?). Why should there not be a similarity between scientists and artists? The best of both cases are observers. It is important to accurately observe but also important to be able to understand the observations. This is where the physics comes in.

So, what is unique about computer animation and computer generated imagery? This is not a book about how the images are produced, but more a book discussing the physical reality that the computer software and artist are attempting to reproduce.

The science within computer animation and computer graphics is a simulation of the real world aspects of the interaction of light with objects and the simple motion of objects – Newtonian physics.

Of course, of importance is the ability to animate a character. But even characters are governed by Newtonian physics – Biomechanics. The human eye and brain can detect when the physics of an animation is wrong. So it is helpful if the animator understands, at least conceptually, what the physics is supposed to do so that errors in animation can be corrected.

Just look at the computer imagery that is produced. It can appear absolutely real! But to do this often requires “getting around” the idealness, or recognizing what happens in a given situation to the light. For example, consider the scenario of someone producing a wonderful model of a car, then placing that model inside a reflective, hemi-spherical dome to produce a reflection to show the other side of the car. The problem is that the image is inverted? Why would that happen? Is it a flaw in the software?

Or imagine someone creating a model of a character that has a red pupil in their eye, but giving the eye a green “contact-lens,” and then complaining that the red pupil disappeared. Should they be concerned about this? Is it fixable?

When modeling the physical world, it helps to be aware of what goes on in the world and the real world limitations of the computer models of this world. That is what we are trying to discover!