

Flash: Animation in the Third Dimension

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Abstract

This paper explores the possibilities of utilizing 3D space to enhance content delivery and the user's experience. We report on a special topics course, "Flash 3D," taught at the Rochester Institute of Technology this year. This graduate level course was comprised of 15 students from the Computer Graphics Design MFA program within the School of Design. The course's objective was to create interactive 3-D environments within Macromedia Flash.

Flash was originally designed for two-dimensional animation. Throughout its evolution, it has grown to produce many rich-media applications. Currently new media designers have yet to break out of a two-dimensional world into a more robust three-dimensional environment.

1 Introduction

Computers work in two dimensions. The computer screen is an extension of a piece of paper. Our stereoscopic vision allows us to perceive depth, but this is lost on a flat computer screen. Just like artists drawing on paper computer graphics designers must create the illusion of depth by incorporating perspective, highlights and shadows, and size differences. The "Flash 3D" course expanded on this concept by adding interactivity to "move into" the screen.

Interactivity is an important component in delivering rich-media content. However, many Flash designers fail to utilize all the program's interactive possibilities. As a result, interactivity is reduced to basic two-dimensional navigation and simple button clicks. As a computer graphics designer it is important to expand the capabilities of interactivity and to explore the possibilities of 3D space to enhance content delivery and the user's experience.

2 Animating the Third Dimension

The "Flash 3D" course was developed as a ten-week elective course. The material was organized into one three-hour lecture/critique per week with the expectation that students would find their own time to develop solutions to the assignments given. Their first assignment dealt with illustrating depth.

We started our "Flash 3D" course with parallax scrolling. This is a common 2-D animation technique that simulates depth. It uses depth cues from real life to communicate an object's distance from our viewpoint. To simulate three-dimensional space through animation, we use two of these depth cues: size and speed.

Objects further away from us appear smaller than objects closer to us. If these objects were moving, objects further away would appear to move slower than objects closer to us (*Figure 1*). This can be accomplished in Flash by creating separate layers of scaled images. Each layer would animate at a different speed. With that in mind, students created variations of parallax scrolling.

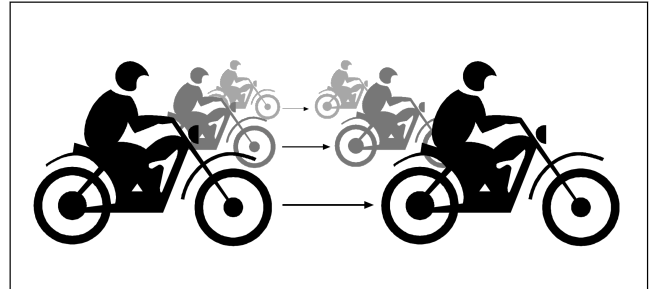


Figure 1: Parallax scrolling

The power of changing scale to suggest three-dimensional space was extended with the investigation of zooming objects in simple one-point perspective (*Figure 2*). Students were shown how to approach zooming using both Flash tweening techniques as well as simple programming scripts. The initial concepts were presented as simulated 3-D and then extended to actual movement of planar shapes along the z-axis.

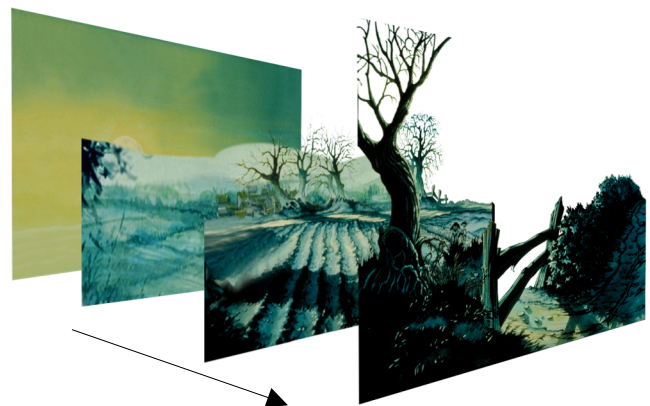


Figure 2: Zooming in one-point perspective

3 Translating the Third Dimension

Navigating in 3-D involves moving objects and changing your point of view. The transformation from 3-D coordinates to 2-D screen coordinates was the third assignment in the "Flash 3D" course. Many design students (and designers) have an aversion to trigonometry and were relieved to know they can do some three-dimensional solutions without sines and cosines.

Converting a coordinate from three-dimensional space into a 2-D screen coordinate involves basic algebra and geometry. Figure 3 illustrates this. "SP" is the station point. This is where the viewer is standing. P represents a point in 3-D space. It contains x, y, and z coordinates. "d" is the distance from the viewer to a picture plane (2-D screen monitor). From this we can calculate the distance ratio (z-axis movement) from a simple equation.

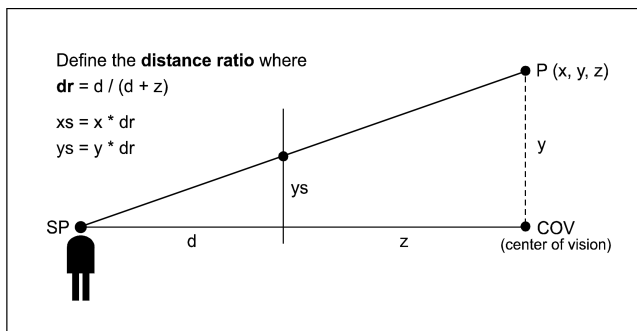


Figure 3: Conversion of 3-D coordinates to 2-D screen coordinates

Establishment of z-axis movement led in a natural way to the introduction of a camera in 3-D space that could be zoomed and panned. This also provided the opportunity to discuss how changes in tint can be used as aerial perspective depth cues.

After projects dealing with parallax motion and zooming, it was felt that the introduction of simple camera movement provided an opportunity for a more advanced interactive project. The third assignment was the development of an historical timeline in 3-D space (*Figure 4*).



Figure 4: Historical timeline in 3-D space

4 Rotating in the Third Dimension

Another easy to implement 3-D technique in Flash is using QTVR (QuickTime Virtual Reality) concepts. In an object movie format, the method consists of taking a series of individual “snapshots” of an object rotating in equal increments about a vertical or y-axis. The individual rotational images can be either photographically or computer-generated in a 3-D software program. The individual images are imported into Flash and then simple scripts can be written to rotate the object clockwise or counter-clockwise. This technique is becoming quite popular in Flash sites to enable users to interact with, and examine, objects ranging in size from automobiles to diamond rings.

In addition to spinning an object around a vertical axis 360 degrees, another QTVR concept involves a person or camera taking snapshots at equal increments while rotating in a circle. This involves the stitching together of the individual shots into

one panoramic image using any one of a number of software programs available. The panoramic image can be imported into Flash where, as before, simple scripts enable the user to rotate clockwise or counter-clockwise in a 3-D environment (*Figure 5*).

With the inclusion of clickable “hot spots,” it is possible to easily navigate through complex interior or exterior environments. Like object movies, the imagery can be generated either photographically or by computer.

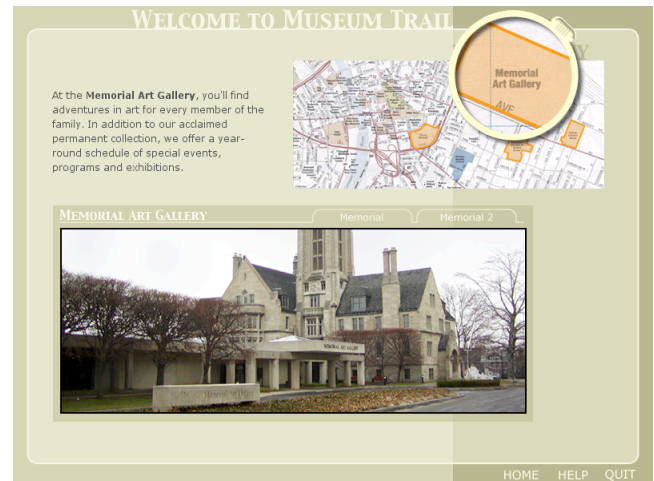


Figure 5: Interactive panoramic image

From an object rotating around in one spot, it is natural to ask what is needed to move an object in a circular path in the x, z-plane since we can still deal with only one-point perspective. The movement is easily done both with simulated 3-D as well as actual 3-D. As a way of introducing the desired motion it is first helpful to discuss circular motion in the normal x, y-plane. At some point the dreaded trigonometry must appear and this is a good place for it.

Starting from circular motion, it is easy to construct elliptical motion simply by changing vertical scale factors in Flash. From there, a change of size of an object can be tied to its vertical position while it is moving in an elliptical orbit. A change of tint can be effected in a similar manner. When all of these elements are combined, the elliptical motion in the x, y-plane visually looks like circular motion in the x, z-plane.

5 Results

The “Flash 3D” course demonstrated to the authors the great potential of applying 3-D to provide much richer and intrinsically more robust navigational possibilities. The assignments consisted of practical applications as well as experimental projects. Each project provided students with ways to conceptualize solutions, visualize data, and develop practical interactive applications.

The goal was to create tools for interactive learning systems within a three-dimensional world. As a result, each student built complete working models for various interactive systems. These reusable templates and creative methodologies expanded the students’ development and technical skills. The results demonstrate a broad range of Flash applications from website to CD-ROM/DVD delivery.

6 Future Work

This introductory elective course could easily be extended into an additional course. It was hoped that we would be able to cover more generalized 3-D movement of objects and cameras. It's fairly easy to develop a few simple 3-D primitives and extruded objects. Examples were shown to the class but there was insufficient time to teach and discuss the required scripts. Another concept that would be nice to explore is the idea of concentric slices like a topographic map that are given varying degrees of height.

7 Acknowledgements

The authors wish to thank the students of the Flash 3D special topics course for their enthusiasm, creative efforts and feedback.

8 Authors

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Chris Jackson has an MFA in Computer Graphics Design from the Rochester Institute of Technology (RIT). Currently, he is an Assistant Professor at RIT in the graduate Computer Graphics Design program. Before joining the RIT faculty, Chris was a multimedia designer with Eastman Kodak Company, creating and delivering interactive training via the Web and CD-ROM for various Kodak departments. He continues to be a multimedia consultant for Eastman Kodak. Chris has extensive background (and awards) in graphic design, printing and multimedia.

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Jim Ver Hague is a professor of Computer Graphics Design in the College of Imaging Arts and Sciences at the Rochester Institute of Technology. He has more than 25 years experience in the field of computer graphics, ranging from the US space program to microcomputer-based applications in graphic design to the design of training, educational and diagnostic tools for the medical profession. Jim has lectured, consulted, and conducted workshops internationally in the fields of multimedia, electronic publishing, computer-aided information design, and computer art and sculpture. Jim holds degrees in communications design, mathematics, and sculpture.