Senior Honors Theses   Honors College

2004

Animation - A Study and Comparison of Concepts and Software Issues

Alan Beesley

Animation - A Study and Comparison of Concepts and Software Issues

Abstract

This paper examines animation from several different views – historical through the modern computer generated. It covers a short history of animation with a detailed look at some of the early examples with an emphasis on the techniques and tricks used in their creation. It also looks at how computers have changed the animation industry and expanded it into other occupations such as architectural modeling. A comparison between traditional and computer animation processes is noted as well as a look at software, its components, usability, and more. Types of and processes for rendering are also described and compared.

Degree Type
Open Access Senior Honors Thesis

Department
Technology Studies

Keywords
Computer animation, Animated films

Subject Categories
Film and Media Studies

Animation – A Study and Comparison of Concepts and Software Issues

by

Alan Beesley

A Senior Thesis Submitted to the

Eastern Michigan University

Honors Program

In Partial Fulfillment of the Requirements for Graduation

With Honors in Communication Technology

Approved at Ypsilanti, Michigan, on this date

_____

_____   _____

Supervising Instructor   Department Head

_____   _____

Honors Advisor   Honors Director

Abstract

This paper examines animation from several different views – historical through the modern computer generated. It covers a short history of animation with a detailed look at some of the early examples with an emphasis on the techniques and tricks used in their creation. It also looks at how computers have changed the animation industry and expanded it into other occupations such as architectural modeling. A comparison between traditional and computer animation processes is noted as well as a look at software, its components, usability, and more. Types of and processes for rendering are also described and compared.

Animation has rapidly evolved as a result of the computer. It has changed from hand drawn processes to complex modeling, animation over time, and rendering. As part of this transformation its effects have been far reaching even to other industries. It has redesigned the way the world is viewed by consumers and the public as a whole.

Computers have made it possible, although no easier, for the common person to create their own animation. The process has become extremely complex with a variety of competing software packages available. Each has its own strengths and weaknesses. Combined, the best tools make or break the final product regardless of whether one person is doing the animating or a complete team.

Historical Perspective

Early Animation

Animation has fascinated audiences for over a century. (See Table 1 for a timeline of events.) In fact some of the earliest animations were pored over by experts looking for the secret to how objects could be made to move by themselves without wires. Vitagraph released one such film called *The Haunted Hotel*. Viewers "…were lining up to see the film just to guess at how the tricks were done" (Crafton 1993 p. 17). This turned out to be what is now known as stop motion animation. Stop motion animation works on the principle that an object is placed in front of a camera and photographed. Move the object a millimeter or two and take another photograph. Played back at approximately 30 pictures or frames per second, the effect is that the objects are moving by themselves.

This is a lengthy and time consuming process but it can be used to effectively create a very convincing animation.

Hand Drawn Animation

For many decades now, hand drawn animation has been the key process of animation. Hand drawn scenes, frame by frame, cell by cell, were painstakingly drawn and redrawn before being photographed and displayed in sequence at high speed. Walt Disney was at the forefront of this genre with the creation of *Steam Boat Willie* and *Snow White and the Seven Dwarfs* in the 1930s. It turned out to be a gold mine, which even today shows no sign of slowing. Not too long after that, and in some respects because of it, the Looney Tunes were introduced by Leon Schlesinger and Warner Brothers. Some of the animators, who have become well known because of the Looney Tunes, learned their craft in the workshops of Walt Disney. Other Disney innovations were the use of blue screens to merge real photography and animated sequences, like the ones found in *Mary Poppins* and *Bedknobs and Broomsticks*. Today these cartoons and full-length animated features, created by talented artists, continue to capture the hearts and minds of children and adults around the world.

Computer Revolution in Animation

New Processes for Old Concepts

Since the early days of Walt Disney, there has been only one significant development in the process of animation; the computer. The computer has done many things for animation that no other technology could. First, it brought animation to the masses; not the final product, but the ability to produce an animated clip or cartoon without an entire production team. Because of computers, one person can have all the

tools and skills needed to create a complete cartoon or even a full-length film. Secondly, computer animation simplifies the animation process. Traditional animation requires the creation of hundreds, thousands, or even millions of frames, each sequentially hand drawn to show a subtle change from the last frame. Animators used storyboards to draw out the animation. Each frame on the storyboard would represent a piece of the action. For example, one frame might be Wile E. Coyote floating in the air next to a cliff with a notation pointing down. The next might display a blank screen and a notation of 2 seconds. The third might display a dust cloud rising from below. The animators would need to follow this storyboard and translate it into a series of many drawings that covered each step of the animation described on the storyboard, including the frames between the ones on the board. Similarly, computer animation uses key frames to describe the animation. The change in the process lies between the key frames. Unlike traditional animation, computer animators do not need to create the frames in between the key frames. The computer interpolates them from the key frames reducing much of the tedium and monotony of the animation process. Third, computers have enabled the creation of lifelike models and sequences that were impossible to create in the past. Thanks to computer animation the immersive qualities of today's entertainment draw viewers deeper into the worlds established within.

One thing that has not changed is the need for the animator to understand the subject. "' …If you want an animation of a ballet dancer, you need an animator who knows a lot about ballet.'" (Getting Animated 1998, p. 2). Studying a clown would not produce a realistic ballet dancer. A detailed knowledge of the subject allows the smooth emulation of movement that fits the attitudes and character of the scene.

Modeling in brief

Modeling is the part of the computer animation process that involves creating the character and the stage or set. Even without adding motion or interactivity to the models, their power becomes clear. As a direct result of computer modeling, architects have been forced to adapt by creating virtual walkthrough models as well as physical scale models and drawings for their clients. The power of computers and animation is real.

Challenges of Computer Animation

Thinking 3-Dimensional

The animation industry has seen a great shift toward using computers to create cartoons and movies. Regardless of the process of animation chosen, challenges exist for animators. Computer animation is definitely no exception to this rule. The number of functions that must be provided by quality 3D animation software is astounding and can be seen in the size of the software itself and also in the complexity of the interfaces. The main difference is the way the animator must think in order to position elements in relation to others. Traditional cell animation is always two dimensional, by necessity. It is not very difficult for anyone with the slightest drawing abilities to draw two objects and establish a two dimensional relationship, such as distance, between them. On the other hand, computer animation is done on a three plane grid consisting of the X, Y, and Z axes. Aligning an object takes much more effort because at minimum three, and usually four, different viewing angles are needed to ensure that the baseball really does collide with the bat and is not missing it on one of the three dimensions.

Color

Other considerable differences are the ways that colors and textures are created.
People used to mixing paints and pigments will have a little difficulty adapting to the
computers color mixing paradigm. Instead, a color can be selected from the palette and
textures developed within the software. These components are then assigned to the model
in specific regions to color and mold its characteristics. Because of computers, the people
involved in producing the final animations are not just creative artists with drawing skills
any longer. Computers have opened the medium to people with varying skills from the
traditional creative to the technical/programming skills to design and control the
software. Indeed, the technical people advance the capabilities of the software and thus
raise the bar of possibility within the animation.

Modeling in Depth

Computer modeling is no small feat. Hash Animation Master is one program that
offers a lot of power in modeling but doesn't make it simple. The process involves
creating individual control points and connecting them with splines, much like sewing.
Using it requires an understanding of polygon patches and a great deal of patience.
Programs such as Alias | Wavefront's Maya and Discreet's 3D Studio Max simplify this
with the ability to create NURBS surfaces. NURBS, or Non Uniform Relational B-
Splines, surfaces are essentially pre-formed 3Dimensional shapes. This means that the
animator can simply "create" one of these shapes and move or scale it into place for the
model. NURBS have predefined angles and sharp or rounded sides and can be easily
created and combined to compose an effective model very quickly. By combining these

and polygon patch modeling, the best model can be produced. In all, the tools provide

powerful means to produce realistic models for animating.

Difficult Concepts

The most difficult concept to grasp varies from program to program. The more advanced

the software becomes, the broader the number of options that are available and the

greater the number of ways to perform the same task. Rendering is the process of creating

each frame of the final animation--and it is by far one of the most affected by this

principal. "Most 3D artists produce rendered results: the final bitmap images used in web

art, print, television shows and commercials, and in motion picture film. Not all 3D

careers require this, however, since a video game modeler might strictly produce

geometry for a game and thus have no need to render it" (Choosing, 2004).

Rendering

There are many different types of rendering. The two most basic are hardware and

software. Maya allows the ability to work with both of these and more. Raytracing is a

software rendering technology and is the process of following each particle or ray of light

from the source to the object, creating a shiny, reflective surface on the model. This is

excellent for objects with some transparency because the light can bounce around, inside,

and through the object. Z-Buffered rendering is a rendering process where the hidden, not

visible, sections of the model are removed before rendering to reduce time and resources.

There are many others. The biggest challenge is to pick the rendering software that will

produce the proper result for a given project. Some rendering systems are designed for

2D images and keep the work smooth and crisp. Some are specifically designed to cover

animation deficiencies. Some work faster; others process raytraced effects more

efficiently. The needs of the final project and the cost should dictate the tools chosen for the job.

Customized Work Space

One of the most powerful features of most animation software is the ability to customize the interface to ease the workflow. Most 3D animation software takes this to the extreme to help users get the most out of the program. Maya for instance, allows the total removal of all menus and option sets from the screen. Doing so leaves nothing but working space. Would this not make the program difficult or impossible to use? It actually makes it easier. Keyboard shortcuts are available for most common operations and holding the space bar will also produce a "hotbox" or radial layout of the menus for simplified and faster navigation throughout the software. A mere inch or two from your cursor, accessing the commands is less difficult then trying to locate a particular function amid a sea of buttons in the interface. Users can also selectively show the option box or other part of the interface that is currently important. Commonly used functions can be added to the hotbox. Unused tools can simply be removed. Customizable software makes the work easier and more efficient.

MEL

Arguably the most powerful feature of Maya is MEL, the Maya Embedded Language. MEL is a scripting language. Scripting usually brings up negative feelings in non programmers. Maya makes it easy and worth the time to learn. Earlier it was mentioned that there are technical sides to computer animation that simply aren't present in hand drawn work. MEL is one of them. It is an optional but very powerful component of Maya. One nice feature for beginners is that as the animator works graphically, the

script window shows the MEL for the operation. By copying and pasting the MEL for various functions and operations, new interface buttons and macros can be created with no programming experience whatsoever. Even so, learning MEL is fairly easy. To create a sphere for example, the script would be "sphere -radius 3.6 -name Ball;" (Got Mel). Delving deeper into MEL, it's possible to control the interface, particle animation on a detailed level, and more. Far too many animators dismiss MEL as something they will never be able to learn. Instead, they should be studying it to simplify and streamline their work to make the most of their time.

In summary, computers have brought animation to the masses. They have blended the creative with the technical and restructured the process and capabilities of animation. Computer animation has brought a new vitality to the entertainment industry with 3D models and instantaneous animation in video games. Fully computer animated movies such as *Toy Story* and *Finding Nemo* have been huge favorites with moviegoers of the last few years. Other uses of computer animation include special effects incorporated into films and the complete generation of scenery that does not exist or would be impossible to film, such as a scene on another planet. With computer animation becoming an integral part of our lives, take a look around, computer modeling and animation are everywhere.

Works Cited

Animation timeline. retrieved May 17, 2004, from

    http://www.bergen.org/AAST/ComputerAnimation/Hist_Timeline.html.

Choosing the best 3d rendering application for your needs. retrieved April 10, 2004, from

    http://www.scifi-meshes.com/forums/showthread.php?t=11840.

Crafton, Donald. <u>Before Mickey: The Animated Film 1898-1928</u> University of Chicago

    Press, Chicago IL 1982,1993

Andrewartha, J. Got mel?. retrieved April 10, 2004, from

    http://www.3dgate.com/techniques/000124/mel_script.html.

(1988). Getting animated over computer animation. retrieved May 17, 2004, from

    http://whyfiles.org/077comp_anim/2.html.

Table 1 – (Animation Timeline 2004)

The following table presents a chronological listing of events related to animation.

1824   Peter Roget presented his paper 'The persistance of vision with regard to moving objects' to the British Royal Society.

1831   Dr. Joseph Antoine Plateau and Dr. Simon Rittrer constructed a machine called a phenakitstoscope which produced an illusion of movement by allowing a viewer to gaze at a rotating disk containing small windows, behind which was another disk containing a sequence of images. When the disks were rotated at the correct speed, the synchronization of the windows with the images created an animated effect.

1834   Horner developed the zoetrope from Plateau's phenakistoscope.

1872   Eadweard Muybridge started his photographic compilation of animals in motion.

1887   Thomas Edison started research work into motion pictures.

1889   Thomas Edison announced his kinetoscope which projected a 50ft length of film in approximately 13 seconds.

1889   George Eastman began the manufacture of photographic film strips using a nitro-cellulose base.

1895   Louis and Augustine Lumiere issued a patent for a device called a cinematograph capable of projecting moving pictures

1896   Thomas Armat designed the vitascope which projected the films of Thomas Edison; this machine had a major influence on all sub-sequent projectors.

1906   J. Stuart Blackton made the first animated film called "Humorous phases of funny faces."

1908   Emile Cohl produced a film depicting white figures on a black background.

1908   Winsor McCay produced an animation sequence using his comic strip character "Little Nemo."

1909   Winosr McCay produced a cartoon called "Gertie the Trained Dinosaur" consisting of 10,000 drawings.

1913   Pat Sullivan created an American cartoon series called "Felix the Cat." J.R. Bray devised "Colonel Heeza Liar," and Sidney Smith created "Old Doc Yak."

1915   Earl Hurd developed cel animation

1917   The International Feature Syndicate released many titles including "Silk Hat Harry","Bringing Up Father", and "Krazy Kat".

1923   Walt Disney extended Max Fleisher's technique of combining live action with cartoon characters in the film "Alice's Wonderland".

1926   Lotte Reiniger produced the first feature-length animated film called "Prince Achmed".

1927   Warner Brothers released "The Jazz Singer" which introduced combined sound and images.

1928   Walt Disney created the first cartoon with synchronized sound called "Mickey Mouse".

1943   John and James Whitney produced "Five Abstract Film Exercises">

1945   Harry Smith produced animation by drawing direct onto film.

1957   John Whitney used 17 Bodine motors, 8 Selsyns, 9 different gear units and 5 ball

integrators to create analogue computer graphics.

1961   John Whitney used differential gear mechanisms to create film and television title

sequences.

1964   Ken Knowlton, working at Bell Laboratories, started developing computer

techniques for producing animated movies.