Computer Animation

It will not be an exaggeration to say that animation can bring the dullest of the features to life. It has the magic of injecting energy and emotions into the most seemingly inanimate objects. Over the years the advancement of technology has made animation, a very attractive and much sought after component of multimedia.

What is Animation?

'To animate' literally means to give life to. Animating is moving something that cannot move on it's own. Animation adds to graphics the dimensions of time, which tremendously increase the potential of transmitting the desired information. In order to animate something the animator has to be able to specify directly or indirectly how the 'thing' has to move through time and space.

The Heritage of Animation

It's interesting to note that the concept of animation has been a focus of study and research for a long time. Resources indicate that as far back as in1824 Peter Roget presented a paper titled "The persistence of vision with regard to moving objects" to the British Royal Society. Later in 1887 famous scientist Thomas Edison started his research into motion pictures. Two years later he announced his kinetoscope which projected a 50ft length of film in approximately 13 seconds. Winsor McCay is considered by many to

have produced the first popular animation. He used ricepaper to draw images each one slightly different from the other. Later John Bray (1910) used translucent cels (short for celluloid) in compositing multiple layers of drawings into a final image as well as the use of grey scale (as opposed to black and white) drawings. Later in 1915 Fleischer patented 'rotoscoping.' Rotoscoping is drawing images on cells by tracing over previously recorded live action. Many such innovative ideas were put to test before Walt Disney burst onto the scene with his film "Alice in Wonderland" in which live action was combined with cartoon characters. Later in 1928 Walt Disney created the first cartoon with synchronized sound called "Mickey Mouse." Some of the innovative techniques used by Disney were the use of storyboard to review the story, the use of pencil sketches to review motion and the multi-plane camera stand. Multi-plane camera stand is a powerful technique, which allows a sort of parallax effect, moving the backgrounds at different rates as the observer pans across an environment to create an illusion of depth and zooming. (Parent 1998). In1964, the scene of animation shifted to computers for the first time when Ken Knowlton, working at Bell Laboratories started developing computing techniques for producing animated movies. The University of Utah is said to be amongst the earlier pioneers in computer graphics. In the late sixties Chuck Csuri of The Ohio State University did some initiatory work in computer animation as a member of the Computer Graphics Research Group. In the early 80s, the research group became the Advanced Computing Center for Art and Design and continues to produce computer animation. Since then the scene of computer animation has remained dynamic with new ideas and path-breaking innovations. Some of the current activity centers include; University of Toronto's computer Science Department, UC San Diego's Department of Computer Science and Engineering University of North Carolina's Computer Science Department and MIT's Media Lab and MIT's Lab for Computer Science

Traditional Methods:

As is evident from the history, animators have used and invented a variety of different animation techniques. Traditionally most of the animation was done by hand. All the frames in an animation had to be drawn by hand. Since each second of animation requires 24 frames (film), the amount of work required to create even the shortest of movies, can be tremendous. Some of the traditionally used methods are described below.

Key Frames

In this technique a storyboard is laid out and then the artists draw the major frames of the animation. These major frames are in which a lot of changes take place. They are the key points of animation. Later a bunch of artists draw in the frames in between. This technique is, of course, very time and effort intensive.

Cel Animation:

In this technique each character is drawn on a separate piece of opaque paper. Then, at the time of shooting animation the different characters are overlaid on top of the

background in each frame. This is relatively a less tedious process, as the artists do not have to draw in entire frames but just the parts that need to change such as individual character.

Rotascoping:

Rotascoping is a technique where images are copied from a moving video into an animation. The animator draws the motion and shape of the object by referring to the video as opposed to imagining in his head. With the help of the rotascoping one can animate some complex scenes that would be hard to visualize otherwise. The disadvantage is that one will have to hunt for the exact video that one wants to animate.

Computer Animation

With time the technique of animation has become more and more computer -assisted and computer- generated. All of such techniques require a trade-off between the level of control that the animator has over the finer details of the motion and the amount of work that the computer does on its own. Broadly, the computer animation falls into three basic categories: keyframing, motion capture, and simulation.

Keyframing

The significance of the term "Keyframing" can be traced back to traditional hand animation technique. Keyframing requires that the animator specify critical or key positions for the objects. The computer then automatically fills in the missing frames by

smoothly interpolating between those positions. The characters for a movie called Toy Story made in 1995 were designed through key frame animation. It's believed that each character had as many as 700 controls. Keyframing requires that the animator has a well thought out plan of how the moving objects are going to behave over time as well as the talent to express that information through keyframed information. The continued popularity of keyframing is a function of the degree of control that it allows the animator to exercise over the subtle details of the motion.

Motion Capture

Another technique is Motion Capture, in which magnetic or vision-based sensors record the actions of a human or animal object in three dimensions. A computer then uses these data to animate the object. This technology has enabled a number of famous athletes to supply the actions for characters in sports video games. Motion capture is pretty popular with the animators mainly because some of the commonplace human actions can be captured with relative ease. However, there can be serious discrepancies between the shapes or dimensions of the subject and the graphical character and this may lead to problems of exact execution.

Simulation:

Unlike key framing and motion picture, simulation uses the laws of physics to generate motion of figures and other objects. Virtual humans are usually represented as a collection of rigid body parts. These models though physically plausible are only an

approximation of the human body. With more research and complex models the simulations are becoming increasingly life like. Simulations can be easily used to produce slightly different sequences while maintaining physical realism while in other animations like key framing or motion capture a mere speeding up or slowing down the playback can spoil the naturalness of motion. Secondly real-time simulations allow a higher degree of interactivity where the real person can maneuver the actions of the simulated character. In contrast the applications based on keyframing and motion select and modify motions form a precomputed library of motions. One drawback that simulation suffers from is the expertise and time required to handcraft the appropriate controls systems.

Hardware and Software

Hardware and software are two of the major factors that determine the quality of computer animation that is produced. As both of these components work in conjunction with each other it is important to make the right choice for a product that is of lasting quality and accuracy.

Hardware

Hardware comes in many shapes, sizes, and capabilities. Some hardware is specialized to do only certain tasks while other hardware are equipped for a variety of things. Some of the commonly used hardware are:

Silicon Graphics Inc.(SGI)

The SGI platform is one of the most widely used platforms for quality computer animation productions. SGI computers operate using the wide spread UNIX system. Produced by Silicon Graphics these computers are extremely fast and produce excellent results. They come in a variety of types, ranging from the general purpose Indy to high power Indigo Extreme that is used for animations. Onyx is another type, which is suited to the complex calculations involved in rendering. Some of the software like Wavefront, Alias, and SoftImage are ran on SGI's.

PC's

PC's are very versatile machines combining flexibility and power. PC's have proven to be very useful for small companies and businesses as platforms to do computer animation. Applications such as 3DStudio and Animator Studio are used on PC's to make animations.

Macintosh

Mac's were originally designed for graphic and desktop publishing and hence are pretty useful platforms for producing computer graphics and animation software. Some of these applications that work well on Mac's are Adobe Products like; Photoshop and Premiere and Strata with Strata Studio Pro.

Amiga

Originally owned by Commodore, Amiga computers have held a position in the computer animation for long. The two software packages that Amiga is associated with are: Video

Toaster, and Light Wave 3D. The new d'Amiga systems has been customized to be a great graphics machine.

Sophisticated hardware has to be coupled with a good software to produce good results. There are literally hundreds of computer animation and graphic software packages. However, only some are considered good enough.

Software

Some of the popular software packages used by the companies, schools and individuals all around the globe include some of the following;

3Dstudio Max

The successor to 3DStudio 3.0. 3DStudio Max runs under WindowsNT. It is entirely object oriented, featuring new improvements, such as volumetric lighting, spacewarps, and all new redesigned interface.

LightWave3D

Light Wave 3D is another high end PC 3D computer software package. Originally developed for the Amiga platform, it's considered the best 3D product for the PC. This software has been used for quite a few television productions such as Babylon 5 and SeaQuest.

Adobe Premiere

Adobe Premiere is a tool that is used to composite Digitized video, stills, and apply a variety of transitions and special effects. Adobe Premiere runs both on Macintoshes and PC Windows.

AliasIWavefront

Alias is one of the topmost animation packages in the market. Produced by two companies, Alias and Wavefront who work in collaboration, it runs on the SGI's. Alias is well known for it's great modeler which is capable of modeling some of the most complicated objects. Also, this software package is very flexible allowing programmers that will allow the programmers to create software that will run in tandem.

Animator Studio

Animator Studio is a cell animation program from AutoDesk. Animator runs on Windows. It has a multitude of features that minimize the animation creation time.

Elastic Reality

This is one of the top of the line programs used for morphing. Elastic Reality runs on Mac's and SGI's. One of the distinctive features of Elastic Reality is that it uses splines as opposed to points to define the morphing area. Elastic Reality allows to morph video as well as still images.

SoftImage

SoftImage is one of the three top most computer animation software packages. SoftImage is used in many top production studios around the country and around the world.

Strata Studio Pro

Strata Studio Pro is probably known the most known 3D graphics application on the Mac. Created by Strata Inc. Strata Studio Pro is mainly a still graphic rendering application, but it does have animation capabilities.

Director Vs Flash

Two of the currently popular and widely used tools are; Director and Flash. Both are products of the same company but interestingly enough have developed unique audiences often working in separate even opposing campuses. The following section of the paper traces the reasons that make both these products so competitive in the field of multimedia.

Director

Born in the world of CD-Rom creation and developed in-house by Macromedia, Director is treated as one of the grandfathers of multimedia. Director was originally VideoWorks Interactive, the first in a new breed of multimedia authoring applications designed for the Apple Macintosh back in the 1980s. It was later released for DOS/Windows in 1994. Since 1995, the Director with its Shockwave Player has become all-platform. With its flexible programming language, Lingo, Director continues to be the flagship product of Multimedia.

Flash

Flash on the other hand was purpose built for the Web and was purchased by Macromedia in the mid-90s from a company called FutureSplash. The product earlier known as the Animator was rechristened as Flash. Flash is based on scalable vector graphics instead of fixed size bitmapped images, and a growing number of Web builders have adopted Flash as a somewhat replacement for HTML. The Shockwave Player, in contrast, doesn't lend itself well to full window presentations because of the bitmapped Director graphics. Flash graphics can bend and stretch and still look gorgeous, but bitmapped graphics end up distorted when manipulated. Director content is usually developed for a fixed size and the included as a supplement to standard HTML text.

Streaming differences

In the beginning streaming was a big advantage of Flash over Director. However the playing field has been leveled recently. Director now has streaming capabilities. From the user's point of view there is not a big difference between the streaming performance of Flash and Director content. The quality of playback in both the tool is about the same.

Animation Styles and Asset Management

As mentioned earlier Flash artwork can be used as symbols but Director automatically turns everything into a cast member. Because it functions as an illustration and an animation program, Flash can afford more flexibility. The lines and shapes of animation sequence in Flash are easily editable without too many obstructions. On the other hand, using bitmaps and having limited drawing tools Director cannot support free-form animation. Thus Flash provides a more interactive animation platform.

The Interfaces

Flash and Director have interfaces similar in function but quite different in appearance and implementation. Director has a very strictly defined authoring metaphor of Cast, Score and Stage. All objects-including pictures, sounds and behaviors--used in a movie are called Cast Members and are centrally organized in the window. Time based activity is laid out and edited using the Score window, which allows only one object per layer. On the other hand Flash has a slightly fuzzy authoring metaphor. Artwork may or may not be designated as symbols. The Timeline places no restrictions on the number of object combinations that can occupy a single layer, and scripting can be organized according to the developer's whim

Extensibility and networking

Director promises more extensibility than Flash. Director can take on more responsibilities by dynamically loading Xtras. Flash movies can take advantage of prepackaged scripts and symbols but the non-modular nature of the Flash Player rules out the possibility of Director-styled additions.

Cost and availability:

According to Macromedia's sales reports, Flash has more buyers lined up for it than Director. And this could be a function of the disparity in the tag prices of Flash and Director at $399 and $999 respectively. Though the extras offered by Director could make it less expensive in the long run. .

Conclusion

The above factors give a fairly good idea of the animation tools available in the market. With so many different tools at his disposal, the animator faces the challenge of selecting or designing the most optimal tool. The right animation tool should be intuitive enough to understand what the animator wants and at the same time powerful or automatic enough

so that the animator doesn't have to specify the details she or he is not interested in. Obviously, there is no single tool that can be a perfect fit, as the appropriateness of the tool will depend on what effect the animator wants to generate. A good piece of animation will require a combination of different tools to simulate reality as artistically as possible.

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