

Chapter 1

Introduction to Character Animation

Learning Objectives

After completing this chapter, you will be able to:

- *Know history of animation*
- *Learn different types of animation*
- *Understand the concept of resolution and aspect ratio*



INTRODUCTION

Animation means ‘to give life’. The word ‘animation’ is derived from the latin word ‘anim’, which means soul or spirit. Animation is a presentation of various displays and movements in such a way that they create illusion of life.

The character animation is one of the specialized areas of animation. It involves creating different types of postures of a character and create movement. In this chapter, you will learn about history of animation and its different types. Also, you will learn about the production pipeline of the character animation, aspect ratio, and some concepts of physics in applying motion.

HISTORY OF ANIMATION

In early days, different motions of an animation were represented through drawings by using several devices. In 1872, a device was invented to produce an illusion of movement called Phenakistoscope, as shown in Figure 1-1. Using this device, an illusion of moving objects was produced by moving sequential drawings. The flip book and the praxinoscope are some of the other devices that were used for animation in earlier days. However, it was the introduction of Motion Picture films in the late 1890s which took animation to a new height.



Figure 1-1 The Phenakistoscope

Stuart Blackton was the first person who made an animated movie called “Humorous phases of funny faces” in 1906. He drew comical faces on a blackboard, one after the other, and filmed them together. To draw a new drawing, each time he had to stop filming of the existing image, erase the previously drawn images, and then film the newly drawn image. He then filmed all the drawings together to create a real picture like effect.

The year 1923 was most significant in the history of animation. Walt and Roy Disney launched the Disney Brothers Cartoon Studio which led animation entirely to a new level. In 1928, they produced the first successful animated movie with sound feature called “Steamboat Willie”, which set the benchmark for the Disney Studio of today. They became the first to have added sound to the movie. Again in 1937, they produced the first full length animated movie called “Snow White and the Seven Dwarfs.”

With the introduction of computers, the concept of animation went one step ahead. Movies like “Star Wars” used computer animation for most of their special effects. In 1995, Walt Disney and Pixar Studios together produced a movie called “Toy Story”, the first full length animated feature film completely animated on computers.

DIFFERENT TYPES OF ANIMATION

There are many types of animation. The three main types are: Cel animation, Stop motion animation, and 3D animation. These animation types are discussed next.

Cel Animation

The cel animation is also known as the traditional animation, classical animation, or hand-drawn animation. It is the oldest and the most popular method of animation. The cel animation was first introduced in cartoon animated movies where the scene would require hand-drawn frames. This works fine in small clips. However, in case of full-length films produced using the cel animation, the scene may require millions of hand-drawn drawings, which is a tedious and time-consuming task to complete.

The process of creating animation by using cel animation is discussed next.

Storyboarding

In cel animation, first comes storyboard which is similar to a very big comic strip created. In other words, a storyboard means adding various drawings as well as words in a sequence such that they together depict a story. The storyboard helps the animation team to plan the flow and sequence of the animation.

Animatics

Animatics involves the process of synchronizing the pictures of the storyboard with the soundtrack. This process is started after the voice has been recorded, so that timing of the pictures could match with the soundtrack.

Designing and Timing

Once the animation has been finalized, the process of designing the important characters and props starts. The designer creates the desired character from various angles with number of poses and expressions so that the artist can have a better idea about the look and appearance of the character. In this phase, the background and color schemes are also finalized.

Next, the time director fixes the timing by using animatics and analyzes which poses, drawings, and lip movements should be there in a particular frame. Next, the X-sheet or the Bar sheet is created. The exposure sheet (X-sheet) and the Bar sheet are the printed tables that break down the action, dialogue, and sound frame by frame. They show the relation between actions, dialogues, and music, which helps animate a scene efficiently.

Layout

Layout begins after a design has been approved by the time director. The layout artists determine the shading, camera paths, lighting, and camera angles of the scene. The character layout artists determine the major poses for characters in the scene, and make a drawing to indicate each pose.

Animation

The animators begin by drawing the sequences of animation one frame at a time. They create these animations on sheet of papers using colored pencil. The key animator draws the key drawings in the scene by using the character layouts as a guide.

While working on a scene, a pencil test is done by the key animator. The pencil test is a preliminary test of the final action. The drawings made with pencil are quickly scanned, photographed, and synced with the voice. This helps in reviewing and improving the animation before passing it to the final stage.

After the key animation is approved, the scene goes to the clean-up department. The clean-up animators job is to grab all the data and trace them on a new sheet of paper, such that detailing is done on the original model sheets, and it appears as if somebody is animating the entire film. The inbetweens job is to draw the missing frames in other animator's drawings.

Background

After the animation is complete, the background artists paint the sets over which the action of each animated sequence takes place. The background artists have to make sure that the background colors are harmonious with the character designs.

Traditional Ink and Paint and Camera

Once the clean-ups, tweening, and background layout have been done, the next step is to prepare for the photography. This process is known as ink & paint. In this process, each drawing is transferred from paper to a thin, clear sheet of plastic known as cel.

The drawing outline is inked or photocopied onto as well as on the reverse sides of the cels, and then colors are added in appropriate shades by using paint. In several cases, characters may have more than one color palette assigned to them. The usage of each color depends upon the mood and lighting of each scene.

Once you have transferred an entire sequence to cels, the photography process begins. Each cel used in the frame of a sequence is laid one over the other, with the background at the bottom of the stack. Then, the composite image is photographed by a special animation camera.

Stop Motion Animation

The stop motion animation is one of the latest animation techniques. In this technique, some drawings are drawn sketched and then they are captured separately using a camera. Next, these captured images are transferred to the computer and then combined using an editing software.

The process of creating stop motion animation is divided into three different phases that are discussed next.

Pre-production

This phase includes the following steps:

Scripting

To create a stop motion animation, first you need to have a script to get a clear idea about the animation. The script should be clear and precise. It should contain all minute details while scripting information about the animation such as the camera position, long, medium, and close-up shots, dialog, columns for action, and lighting. For example, you can specify whether the lighting should be projected from below or from above the animation.

Choosing Background and Camera

Next, you need to choose the background and digital camera which best suits your animation. You should look for a place where you can place the camera for a long time as the stop motion animation takes time. The digital camera suits best for creating such kind of animations as you can transfer pictures or videos side-by-side to the computer using this camera.

Selecting the Software

You need a software to animate and edit the animation. Install the required software in the system.

Production

During the production stage, the camera man starts taking shots of the scene from the best angle. While shooting from different angles and distances, it is recommended to use more than one camera. With multiple cameras fixed at required angle and distance, you will be able to maintain exact position and distance throughout the shooting. But incase you have only one camera, you can carefully mark the position of the tripod, both the position of its legs and its height, so that you can have a better chance of putting the camera angle back in its original position.

Post-production

Post-production is the last phase in Stop motion animation. There are two steps involved in this phase, which are discussed next.

Importing and Editing the Images

After taking the required pictures, you need to import them in computer for editing. You need to have an editing software to edit these images and create an animation. You can also add special effects to the animation at this stage.

Viewing the Final Result

The last and the most important step is to view your final animation. This helps you in finding if there are any shortcomings or mistakes in your animation. If you find any shortcoming at this stage, you can revert back and fix it.

3D Animation

3D animation is an art of creating moving images using computers. The process of creating 3D animations involves modeling or shaping objects in a scene, applying material, lights, camera, animating the 3 dimensional objects and finally rendering the scene to view the final output.

There are different stages of 3D production pipeline. These stages are discussed next.

Stages of 3D Production Pipeline

The creation of a 3D animation undergoes a workflow process to organize things. The workflow process is divided into three broad stages: pre-production, production, and post-production. These stages are discussed next.

Pre-production

Pre-production is the first and the foremost phase of the production pipeline for computer graphics. It involves organizing all reference materials, layout drawings, and all model sketches. In this phase, the estimated budget for the project is set. Also, the plan for next stage, the production phase, is created in this phase. The pre-production phase involves the following three steps:

Writing a Script

The first step is to write a script. A script acts as an initial blue-print for animation.

Creating a Storyboard

A storyboard is a further elaboration of script. A script is divided into scenes, and the scenes are further divided into shots. Each shot is sketched on the panel of the storyboard. The story boarding is a process of creating drawings in order to know how the animation would look like. The storyboard visually appears like a comic book.

Some of the important things that the storyboard helps in finalizing are as follows:

- (a) What and how many characters are in the frame, and how are they moving?
- (b) What are the dialogues of the characters?
- (c) What is the duration between the last and current frames of the storyboard?
- (d) Where is the camera located in the scene?

The creation of a storyboard helps you plan an animation shot by shot, and all this information helps in making an effective and systematic animation.

Creating Conceptual Art and Design

After storyboarding, the conceptual art and design is done for all characters. In this process, different poses of the characters are drawn on a character sheet. Generally, the poses are taken from the front, side, and an angle called 3/4 view. Sometimes, clay sculptures of the characters are created for better idea. The props and sets are identified from the script and storyboards, and then they are sketched on model sheets. The better the conceptual art is visualized, the easier it will be to model and texture a character.

Production

After the script, storyboard, conceptual art and design is approved, the project enters the production stage. In the production stage, models are created referring the storyboard, model sheets, and conceptual art. The production stage is divided into different steps: modeling, texturing, rigging, animation, and rendering. These steps are discussed next.

Modeling

The production of a 3D animation begins with the modeling process. It is the process in which 3D objects are created with reference to the conceptual arts and design in the scene by using different tools available in the software. To create 3D models from 2D drawings, the 2D drawings or sketches are imported into the software. Next, based on these designs, 3D models are created.

Modeling is done according to the position and requirement of the model in the scene. For example, if a table is required to be modeled for a scene and it has to be shot from a distant place, then it does not need much detailing. However, in case of close-up, the model needs to have as much of details as possible.

The modeling phase is further divided into three different steps: character modeling, background modeling, and props modeling.

Character Modeling: The character modeling involves modeling characters that include organic forms such as humans, animals, cartoons, and so on. Most models need to be deformed during animation. Therefore, you need to create them in a manner so that they can be deformed easily and naturally.

Background Modeling: The background modeling involves modeling buildings or interiors, mountains, rivers, or anything required for a scene. You may also need objects such as chairs, benches, lampposts, glasses, and so on for the background. Note that greater the amount of detailing required for backgrounds, slower will be the speed of rendering. Therefore, you need to take it into consideration while creating the background. To avoid delay due to rendering, you can create simple models, and apply textures such that they look realistic without applying greater details.

Props Modeling: The props modeling involves modeling of props in a scene. Props are the things that the character uses in a scene. It may be a sword, a purse that the character holds, or a car being driven by a character. If the character is not driving the car, and it is shown in the background, then the car comes into the background modeling. However, if the character is driving it or sitting in it, then it is a part of props modeling.

Texturing

After 3D models are created, you can apply textures and maps to them to define their surface appearances. Texturing determines the properties such as color, transparency, sheen, bump, and so on. Materials such as glass, metal, concrete, water, plastic, or fabric help in giving an object realistic look.

Lighting and Effects

After the texturing is done, the next step is to apply lights and camera to the 3D scene. Lighting helps in controlling the appearance of shadows and highlights. You can also add camera in the scene to capture a specific point from the view.

Animation

Animation is a time-consuming yet an important process of production pipeline. As per the requirement of an animation, models are setup. For example, for character animation,

first you need to create a skeleton and then rig them (discussed in detail in later chapters) to make the character move.

Post-production

Post-production begins after setting up and animating objects in a scene. The post-production is a process in which all elements are joined together to create the final animation. The post-production is divided into three steps: rendering, compositing, and editing.

Rendering

Rendering is the process of generating a 2-dimensional image from a 3-dimensional scene. This process helps in visualizing the lighting effects, materials applied, background, and other settings in a scene.

Compositing

It is the process of combining multiple video inputs into a single video track. During this phase of postproduction, you can add special effects, including 2D particles and blur effects. Other functions that are handled by compositing tools include color correction and preparing video for output in specific formats. Compositing can significantly affect the final look of the project and is considered as an integral part of 3D animated scenes.

Editing

Editing is a process of changing the sequence of shots or trimming the duration of shots of a given animation. The editing process is performed to improve the synchronization and timing of an animation clip.

RESOLUTION

The resolution is the size of an image in the form of horizontal and vertical pixels. The horizontal and vertical pixels are normally given in the form of #x# for example, 640x480. Higher the resolution of an image, better will be its display.

The final render size is adjusted according to the output medium for which you are creating the animation. Some of the standard resolutions are explained next.

VGA (Video Graphics Array)

The resolution used for VGA is 640x480. It is the standard computing resolution and is still a popular television resolution for tape output.

NTSC D1 (National Television System Committee)

The resolution used for NTSC D1 is 720x486. It is the standard resolution for television broadcast in North America.

NTSC DV

The resolution used for NTSC DV is 720x480. It is very similar to NTSC D1 and is the typical resolution of digital video cameras.

PAL (Phase Alternation Line)

The resolution used for PAL is 720x526. It is the standard broadcast resolution used in European countries.

HDTV (High Definition TV)

The resolution used for HDTV is 1920x1080. It is the emerging television standard.

1K Academy (1K refers to 1000 pixels across)

The resolution used for 1K Academy is 1024x768. It is the lowest permissible resolution for film production at Academy ratio.

2K Academy (2K refers to 2000 pixels across)

The resolution used for 2K Academy is 2048x1536. This resolution is used for most computer graphics studio output and it gives the best size to performance ratio.

4K Academy (4K refers to 4000 pixels across)

The resolution used for 4K Academy is 4096x3072. It is a high resolution and therefore, it is used for highly detailed shots.

ASPECT RATIO

The aspect ratio is the ratio of the screen's width to its height. The aspect ratios also have some standards that are discussed next.

Academy Standard

The aspect ratio of Academy Standard is 4:3. It is the most common aspect ratio. The width is 4/3 times of the height. This Academy Standard aspect ratio is also used for NTSC (National Television Standards Committee) television aspect ratio.

Widescreen

The aspect ratio for Widescreen is 16:9. It is the most frequently used aspect ratio for 35 mm films. When a film with this aspect ratio is displayed on television, horizontal black bars appear above and below the picture, so that the edges of the picture are not cropped off.

Anamorphic Ratio

The aspect ratio of Anamorphic ratio is 2.35:1. In Anamorphic ratio, a lens known as anamorphic lens is used to capture images upto 35 mm. When an image is played with a projector having an anamorphic lens, the image is projected upto a width of 2.35 times its height.

FRAME RATE

Frame rate is defined as the number of frames played per second in an animation. It is written as fps (frames per second) in short. The following are some standard frame rates for media:

1. NTSC- 30fps
2. PAL- 25fps
3. Films- 24fps

Before starting any animation project, it is important to know at what frame rate the animation has to be played. Playing a 24fps animation at 30fps results in a slow moving animation. Similarly, playing a 30fps animation at 24fps will create a faster moving animation and it also results in skipping of some frames.

PHYSICS

To start an animation project, it is necessary to have some basic knowledge of physics. You should be aware of how objects behave in the physical world, so that you can use that knowledge to animate the objects so as to give them a realistic effect. The Newton's Law of Motion and the concept of momentum are explained in brief.

Newton's Laws of Motion

There are three laws of motion proposed by Newton. These are listed next.

1. An object remains in its existing state, motion or rest, unless an external force is applied on it. This force is called inertia.
2. If the object has more mass an object is, more force is needed to accelerate or decelerate its motion.
3. Every action has an equal and opposite reaction. For example, when you strike a ball on the ground, it bounces back with the same force.

All the three statements plays an important part in the final look of an animation and you should always keep these principles in mind while creating an animation.

Momentum

The momentum is defined as the product of the mass of an object and its velocity. If the object is in motion, it means the object has momentum. If the object is heavy, or is moving faster, then it will have more momentum as compared to a less heavy or slow moving object. For example, a small bullet moving with high velocity can cause great impact on the wall. Similarly, a slow moving heavy loaded truck can cause heavy damage to the car, since it has more mass. When a moving object hits another object, irrespective of whether another object is moving or not, the momentum is transferred between them. In other words, if something hits an object, then the object will move if sufficient momentum is transferred to it.

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

- Which of the following device was used to produce movement by sequential drawing in earlier days?
 - Phenakistoscope
 - Telescope
 - Digital video device
 - Flip book
- In which year was the Motion Picture film introduced?
 - 1880
 - 1890
 - 1900
 - 1990
- Which of the following movies was the first full-length movie?
 - Humorous phases of funny faces
 - Snow White and the Seven Dwarfs
 - Alice in Wonderland
 - Steamboat Willie
- _____ was the first person who made the animated movie named “Humorous phases of funny faces.”
- _____ is an art of moving objects and characters with the help of computers.
- When a moving object hits another object, moving or at rest, the momentum is not transferred between them. (T/F)
- The time director schedules the timing between the poses. (T/F)
- The aspect ratio is the ratio of the width to the height of the screen. (T/F)
- In storyboarding, pictures are synchronized with the sound track. (T/F)
- The momentum is defined as the addition of the mass of an object and its velocity. (T/F)

Review Questions

Answer the following questions:

- Which of the following stages is a part of the 3D production pipeline?
 - Pre-production
 - Production
 - Post-production
 - All of these

