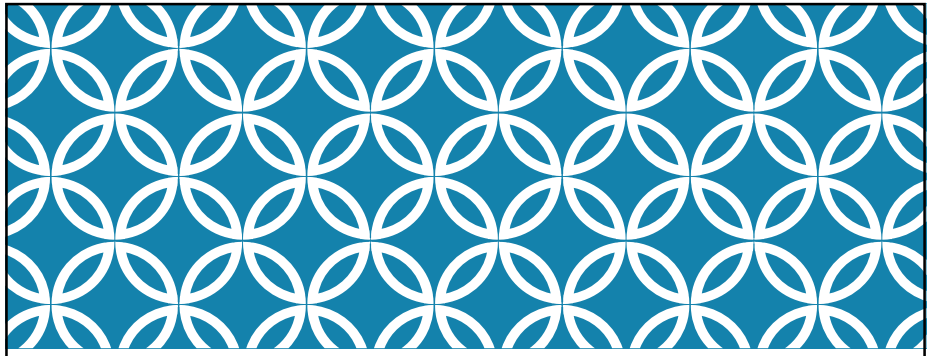


CHAPTER 10 ANIMATION

hungtanle@0913030731

WHAT IS ANIMATION ?

Animation is the process of making the illusion of motion and the illusion of change by means of the rapid succession of sequential images that minimally differ from each other.

WHY 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.

WHY WE CAN MAKE ANIMATION?

Animation is possible because of a a biological phenomenon known as *persistence of vision.* The psychological phenomenon called *phi.*

- An object seen by the human eye remains chemically mapped on the eye's retina for a brief time after viewing.
- Combined with the human mind's need to conceptually complete a perceived action.

This makes it possible for a series of images that are changed very slightly and very rapidly, one after the other, seem like continuous motion.

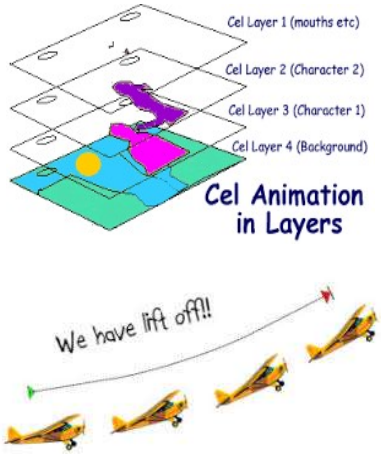
ANIMATION TYPES

Cel animation

Cel animation: is based on changes that occur from one frame to the next.

Path animation

Moves an object along a predetermined path on the screen



CEL ANIMATION

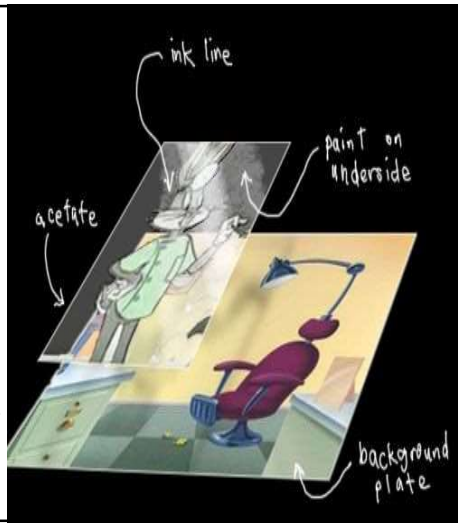
Made famous by Disney

24 frames per second therefore a minute may require as many as 1,440 separate frames.

Cel stands for celluloid which is a clear sheet with images drawn on them.

The celluloid images are place on a background that is usually stationary.

The background remain fixed as the images changes.



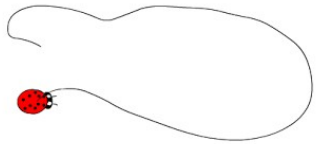
PATH ANIMATION

The path can be a straight line or have a number of curves.

Starts with *keyframes* (the first and last frame of an action).

The series of frames in between the *keyframes* are drawn in a process called *tweening*.

Tweening requires calculating the number of frames between keyframes and the path the action takes, and then actually takes, and then sketches a series of progressively different outlines.



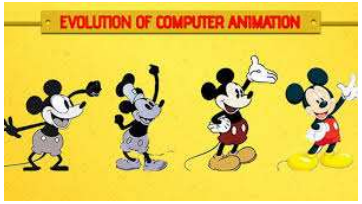
COMPUTER ANIMATION

Typically employes the same logic and procedural concepts as cell animation

You can usually set your own frame rate

At 15 frames a second the animation may appear jerky and slow

2-D animation can be an acceptable alternative to the expense of creating video



3-D ANIMATION

Animating objects that appear in a three-dimensional space. They can be rotated and moved like real objects. **3D animation** is at the heart of games and virtual reality, but it may also be used in presentation graphics to add flair to the visuals

3-D Animation involves three steps:

Modeling – the process of creating objects and scenes

Animation – the process of defining the object's motion

Rendering – the final step in creating 3-D animation.

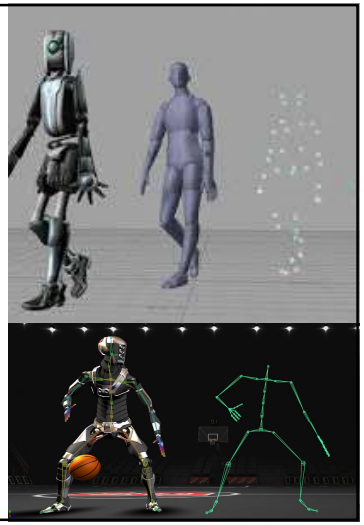
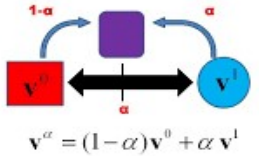


Image Warping

- Keyframe animation:
  Interpolation of state vector:

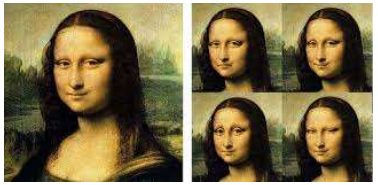


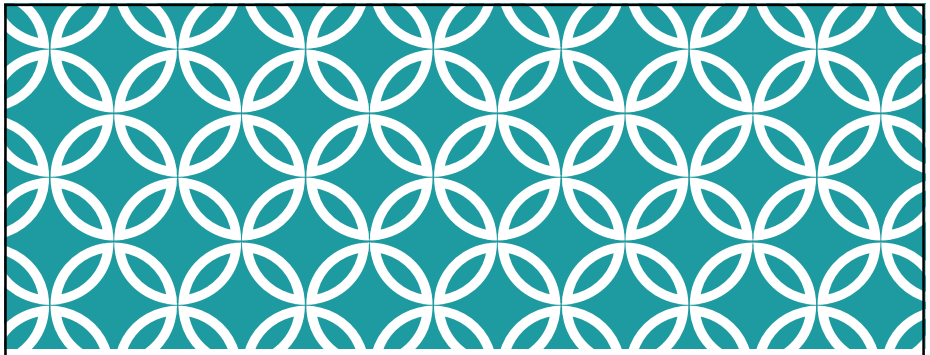
$$\mathbf{v}^{\alpha} = (1-\alpha)\mathbf{v}^{0} + \alpha\,\mathbf{v}^{1}$$

Morphing is the process of blending two images into a series of images

Warping allows you to distort a single image

Virtual reality (VR) creates an environment that surrounds the user so that they become part of the experience.





ANIMATION TECHNIQUES

ANIMATION TECHNIQUES

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.

Techniques

- Traditional animation
- Stop motion animation
- Computer animation
- Mechanical animation
- Other animation styles, techniques, and approaches

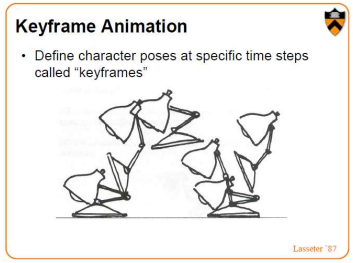
KEY FRAMES

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 to animate.



ROTA SCOPING

Rota scoping 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.

MOTION CAPTURE

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.

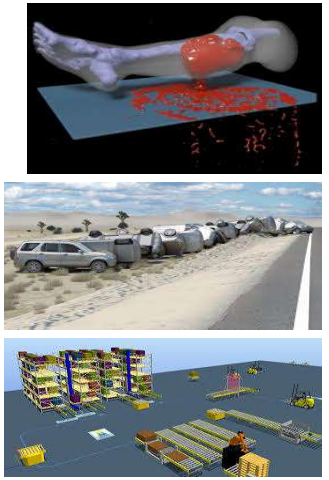
Motion capture is pretty popular with the animators mainly because some of the commonplace human actions can be captured with relative ease.

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.



TRADITIONAL ANIMATION

2D Animation: Used traditional techniques
3D Animation: Neglected traditional techniques.

1. SQUASH AND STRETCH

Teaches basic mechanics of animation.

Defines rigidity of material.

Important in facial animation.

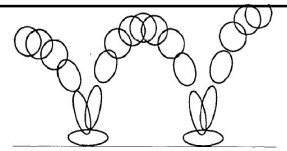


FIGURE 2. Squash & stretch in bouncing ball.

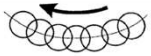


FIGURE 4a. In slow action, an object's position overlaps from frame to frame which gives the action a smooth appearance to the eye.

FIGURE 4b. Strobing occurs in a faster action when the object's positions do not overlap and the eye perceives seperate images.

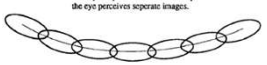


FIGURE 4c. Stretching the object so that it's positions overlap again will relieve the strobing effect.

2. TIMING AND MOTION 3 . ANTICIPATION

Gives meaning to movement.

Proper timing is critical to making ideas readable.

Examples:

1. Timing: tiny characters move quicker than larger ones.

2. Motion: can define weights of objects.

Preparation for an action

Example:

Goofy prepares to hit a baseball.

4. STAGING

A clear presentation of an idea.

Some Techniques:

1. **Use motion in a still scene or use of static movement in a busy scene.**
2. **Use of** silhouettes (to the side)

5. FOLLOW THROUGH AND OVERLAPPING ACTION

1. Follow Through

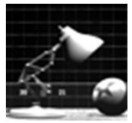
Termination part of an action.

Example: after throwing a ball

2. Overlapping Action

Starting a second action before the first has completed

Example: Luxo Jr.'s hop with overlapping action on chord.



6. STRAIGHT AHEAD ACTION AND POSE-TO-POSE ACTION

1. Straight Ahead

Animator start from first drawing in the scene and draw all subsequent frames until the end of scene.

2. Pose-to-Pose

Animator plans actions, draws a sequence of poses, in between frames etc.

7. SLOW IN AND OUT

Spacing of inbetween frames to achieve subtlety of timing and movement.

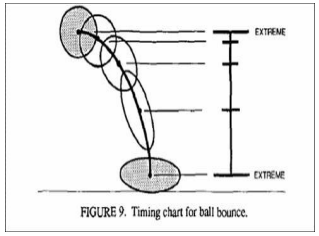
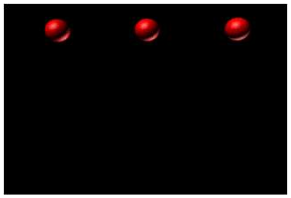


FIGURE 9. Timing chart for ball bounce.

1. 3d keyframe comp. Systems uses spline interpolation to control the path of an object.
2. Has tendency to overshoot at extremes (small # of frames).



8. ARCS

Visual path of action for natural movement.

Makes animation much smoother and less stiff than a straight line.

9. EXAGGERATION

Making it noticeable the essence of an idea via the design and the action.

Needs to be used carefully.

Example: Luxo Jr. made smaller to give idea of a child.

10. SECONDARY ACTION

Action that results directly from another action.

Used to increase the complexity and interest of a scene.

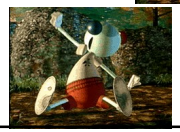
Example:
Body movement is the primary action, facial expression is the secondary action

11. APPEAL

Refers to what an audience would like to see.

Character cannot be too simple (boring) or too complex.

Examples:
Avoid mirror symmetry, asymmetry is interesting.

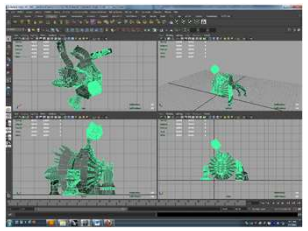


COMPUTER ANIMATION

WHAT IS COMPUTER ANIMATION?

Computer animation or CGI animation is the process used for generating animated images by using computer graphics.
The more general term computer-generated imagery encompasses both static scenes and dynamic images, while computer animation only refers to moving images.
- Wikipedia

For 3D animations, objects (models) are built on the computer monitor (modeled) and 3D figures are rigged with a virtual skeleton.



WHAT IS 3D ANIMATION?

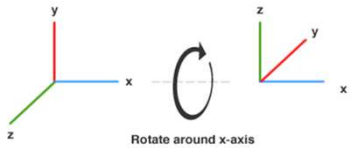
Then the limbs, eyes, mouth, clothes, etc. of the figure are moved by the animator on key frames.

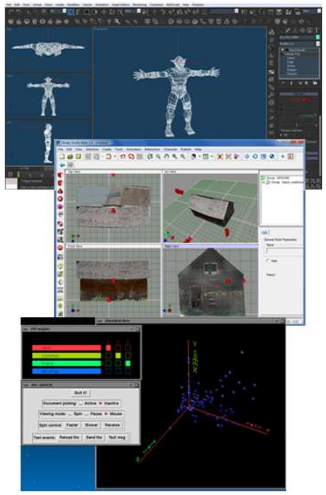
The differences in appearance between key frames are automatically calculated by the computer in a process known as tweening or morphing.
Finally, the animation is rendered.

THE 3D WORKSPACE

All 3D animation software programs have a similar workspace layout. It is based on 3D Cartesian Coordinate space.

We call this X, Y, and Z. At the centre origin = 0,0,0. The Axes runs through this point perpendicular to each other where we can designate the exact location of any point in space relative to the origin.





THE 3D WORKSPACE

All 3D animation programs function this way, It does not matter which one, the layout might differ but all work the same way.

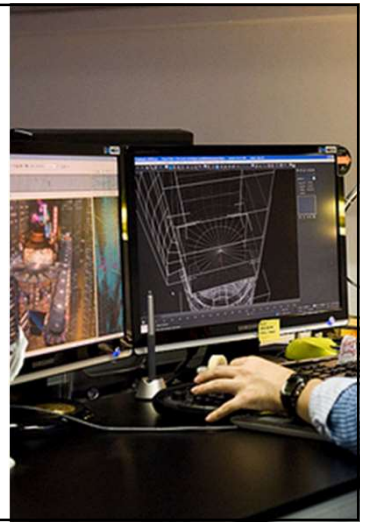
THE 3D ANIMATION WORKFLOW

THE 3D ANIMATION WORKFLOW

Typically, follows along these steps:

- **Modeling**
- **Materials/Texturing**
- **Lighting**
- **Keyframing/Animating**
- **Rendering**

But in some cases you can model, keyframe, animate then add materials, textures, light and render. It depends on your project and what you feel works best for you.

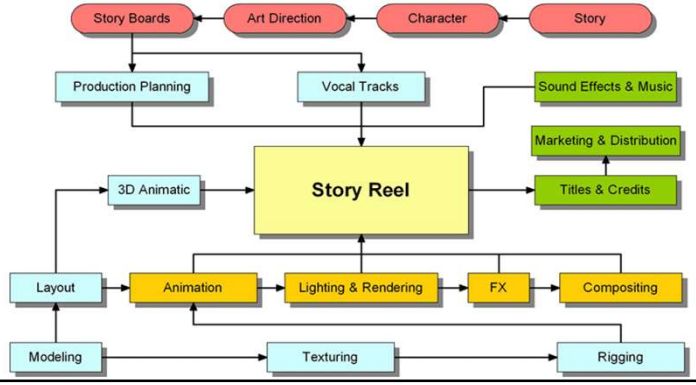


THE 3D ANIMATION WORKFLOW

- Big animation studios can have 100's or 1000's of people around the world working on one project.
- This requires a lot of planning at each stage and is known as the pipeline.
- Think of it like an assembly line.

- Each stage has its own team with its own set of supervisors called technical directors (TD's).
- These TD's oversee the work and ensure quality outputs and report back to VFX supervisors, who report to the director and so on.

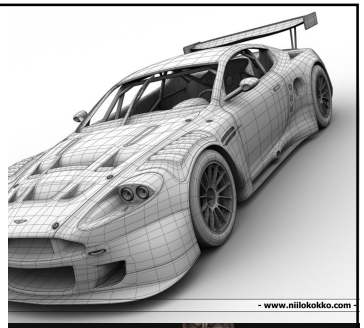
THE 3D ANIMATION WORKFLOW



MODELING

Modeling:
This is like actually making a physical object but in a 3D virtual space. Typically, modeling would start with primitive mesh objects such as spheres, cubes, cones and cylinders. You can modify them by extruding, merging, bevelling, subdividing, etc.

You can also draw lines, make shapes and do sweeps, bend, twist, boolean operations… the list is endless!



MATERIALS/TEXTURING

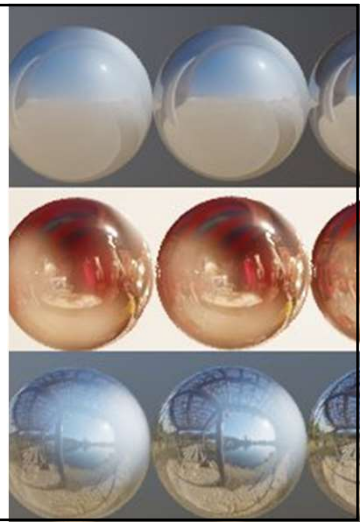
This is putting on the flesh or covering the object. This is done by means of mapping. Types of mapping are UV, spherical, planar and procedural which is manipulating colour information on the object.

This is where the object begins to take on more realistic looking characteristics.

LIGHTING:

Lighting:
This is part of creating the right atmosphere and environment. Default lighting is called Ambient lighting but there are Spot, Sun, Point and Diffuse which is the light emanating from the object like a reflection.

For example, Specular light and reflection refers to the highlight and can be adjusted to make an object look dull or shiny.



KEYFRAMING/ANIMATING:

Here is where the object comes to life, like puppetry for living things or simulating weight and gravity. There is also particle animation like fire, smoke and fireworks.

A keen sense of how motion acts on an object and living things takes time and skill to master.

KEYFRAMING/ANIMATING

It usually starts with rigging an object or putting the skeleton in. The action of joints influencing each other is called Inverse Kinematics (IK).
The action of joints influencing the object is called weighting. If not done properly, it can look weird and distracting.

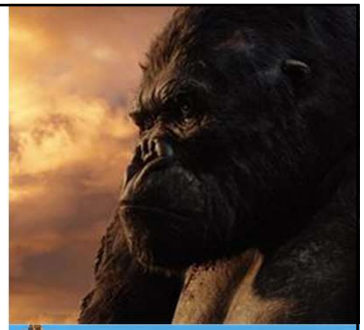
If done properly, can be indistinguishable from real life.

THE 3D ANIMATION WORKFLOW

RENDERING

This is creating the finished product. In some cases there are other processes like compositing, colour correcting and editing that use the rendered elements.

Output to file formats, resolution, and shading (computing processes that add even more realism or cartoon look and feel).



THE 3D ANIMATION WORKFLOW

THE 3D ANIMATION WORKFLOW

THE 3D ANIMATION WORKFLOW

CONCLUSION

3D Animation can be expensive to produce, time consuming, takes various skills and talent.
But can be rewarding in making your visions come to life in striking ways.

Research, learn all you can and keep learning, there are new trends emerging everyday..