Participant Handbook

Sector
Media and Entertainment

Sub-Sector
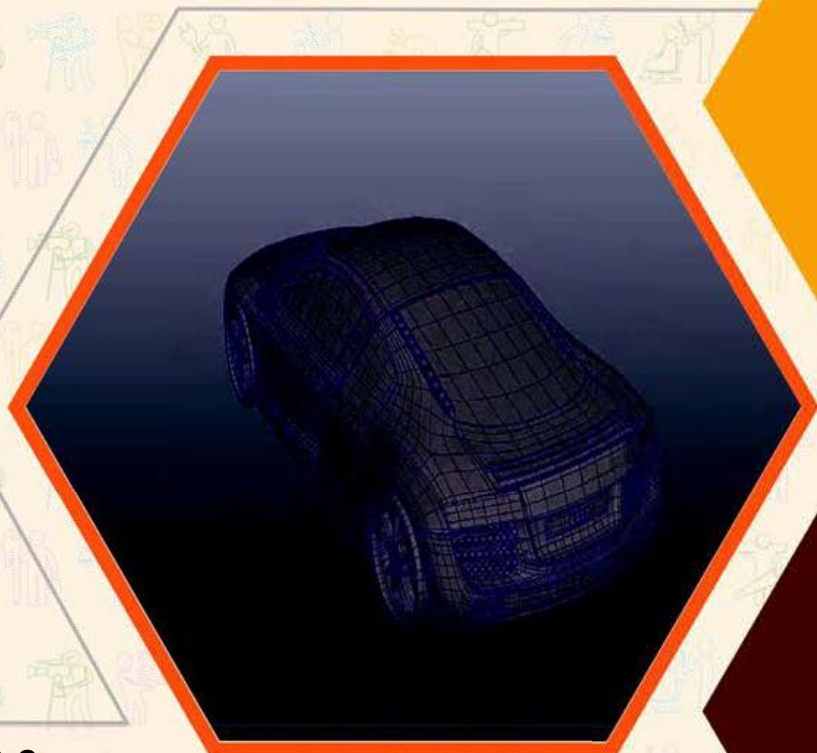**Animation, Gaming**

Occupation
Asset Creation

Reference ID: **MES/Q2501, Version 3.0**
NSQF level: 4

Modeller

> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO
QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

MEDIA AND ENTERTAINMENT SKILLS COUNCIL

for the

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/ Qualification Pack: '**Modeller**' QP No. '**MES/Q 2501 NSQF Level 4**'

Date of Issuance: **January 27th ,2022**
Valid up to: **January 25th ,2027**
* Valid up to the next review date of the Qualification Pack
  *Valid up to date mentioned above (whichever is earlier)

Authorised Signatory
(Media and entertainment skills council)

Acknowledgements

About this book

This Participant Handbook is designed to enable training for the specifiic qualification Pack(QP). Each National Occupational (NOS) is covered across Unit/s.

Key Learning Objectives for the specifiic NOS mark the beginning of the Unit/s for that NOS.

- Interpret the script/ brief/ storyboard
- Prepare computer generated models
- Test computer generated models
- Maintain workplace health and safety

Symbols used in this manual:

Symbols Used

| Key Learning Outcomes | Steps | Time | Tips | Notes | Unit Objectives | Exercise |

Table of Content

1. Introduction and Orientation

Unit 1.1- Introduction to Media and Entertainment Sector

Unit 1.2- Key Words

Key Learning Outcomes

Upon culmination of this module, user would be able to:

* Understanding script/brief / storyboard
* Developing Models by Virtual assistance
* Checking the functioning of Models
* Abiding by statutory safety compliances

UNIT 1.1: Introduction to Media and Entertainment Sector

Unit Objectives

The completion of chapter will enable:

1. Importance of media and entertainment.
2. Role and responsibility of Modeller.

1.1.1 Media and Entertainment Sector in India

In today's digitalization era, the last decade has seen a massive development in the Indian media and entertainment industry. Growing rapidly at 13.9% CAGR and contributing to about 1.7% GDP supported by the increasing popularity of digital advertising which is churns a whopping INR 414 billion every year and more, celebrating its position by being the 14th largest industry in the world.

This sector is one of the strong industries supporting the Indian economy by having over 700 television channels and over 200 FM stations, constituting to the largest production houses globally and leading the film industry internationally.

The Media and Entertainment industry is sustainably growing with the support of the Indian Government that consciously takes initiatives like providing institutional finance to the film industry, digitalizing the cable network and recent increase of FDI limit to 100% in DTH and cable parameters. Today, this industries employment is at 14% to country.
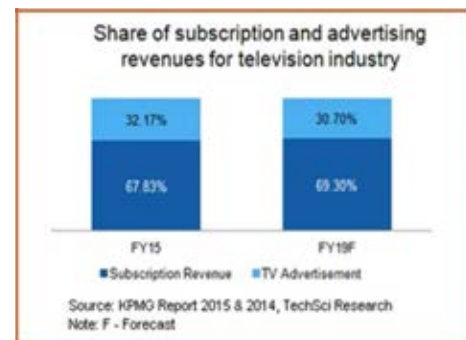
Fig.1.1.1: Advertising revenues for TV industry

1.1.2 Employability in Media and Entertainment Sector

The performance, growth and profits of media and entertainment industry depends on the economic structure of the country. The progressive support states to increase employment opportunities to 1.3 million by 2022 from 0.4 million in 2013

*The film industry of India accommodates the highest workforce in the above statistics at 25%

*The growing media and entertainment industry supports about 0.46 million workforce and is estimated to grow at 0.76 million by next year.

*The media and entertainment industry has many niche sectors that demand skilled labour, currently CAGR is recorded at 13% but projected to grow with 1% increase comprising of 1786 billion within a year.

*The highest employers remain the Film and Television sectors attracting employees from various walks and classes. The variety of channels and sub stations keep attracting workforce caused by rapid digitization
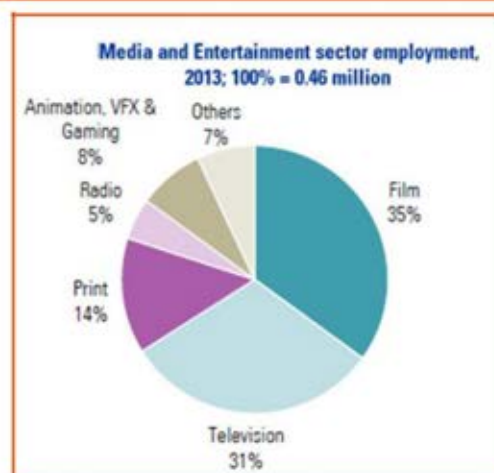
Fig.1.1.2: Media and Entertainment Employment in 2013

Sub Sector	Employment (in Millions)		
	2013	**2017**	**2022**
Television	0.14	0.28	0.64
Print	0.06	0.07	0.13
Radio	0.02	0.03	0.04
Animation, VFX and Gaming	0.02	0.03	0.04
Films	0.16	0.24	0.44
Overall Sector	0.4	0.65	1.3

Fig.1.1.3: Employement in Different Sectors of Media and Entertainment

1.1.3 Evolution of Media and Entertainment Sector

The initial start into entertainment was with Satellite Broadcasting over sound alone, bringing Radio into action in India with the Radio Club commencing in 1923 while the Britishers ruled us.

* The most connected medium and the influential one since British Raaj was the All India Radio that started operations in 1936.

* DD Network, the beloved Doordarshan started television operations in 1959, September 15th

* The Indian government began licensing private companies to start their own radio stations on Indian Broadcasting

1.1.4 Major Subsector and Segments

*Advertising plays a crucial role in sustaining the performance of media and entertainment industry, as the revenue collected with advertising mediums supports and grows the overall economy

* The industry does not rely so much on foreign materials and produces most equipment, appliances and systems in house. A minor portion of exports may include antennas, cables and satellite boxes

Fig.1.1.4: Media and Entertainment Sector

- The industry is specific to cultural and ethnic backgrounds, and is organized around specific hubs that specialize in output for a given population segment. For example, the Mumbai film industry (Bollywood) is a key film hub in the country. A similar hub also exists in South India.
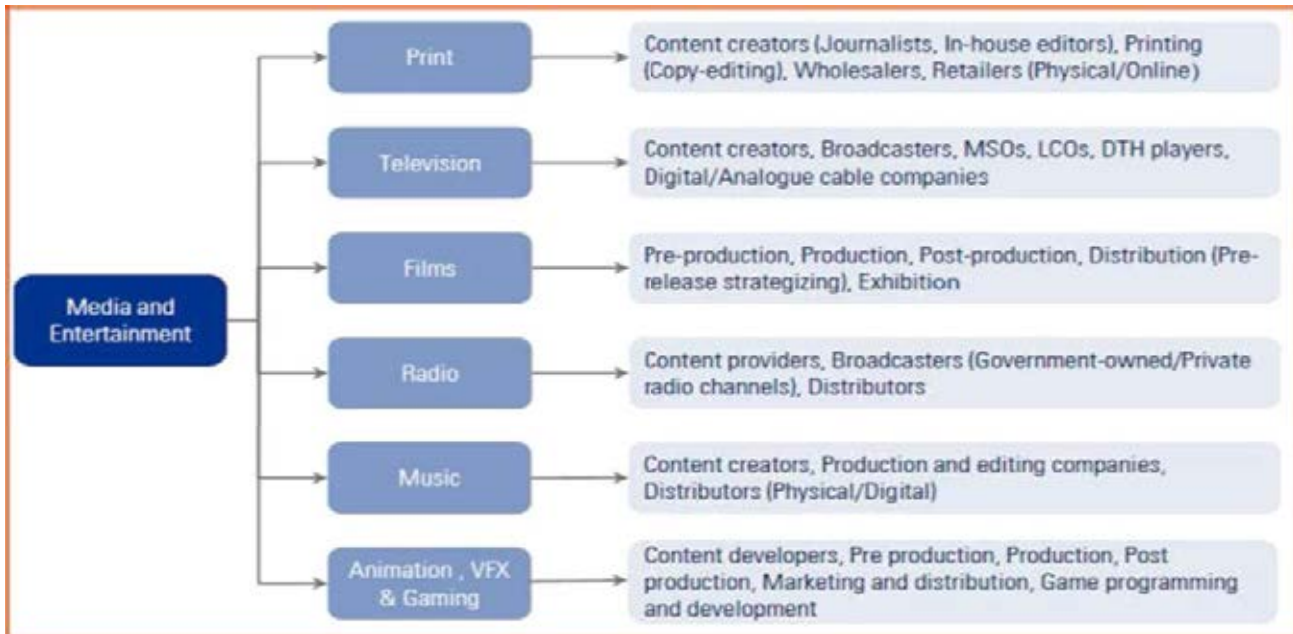

Fig.1.1.5: Media and Entertainment Sector Growth Rates in 2013

1.1.5 Role of Modeller

Key Responsibilities
To design, draw, create and re model virtually assisted sketches, tools, characters and symbols by working closely with Supervisor.

Skill Set Requirements
Duties may be characterized by attention to detail and vivid imagination that helps design innovative human anatomy related structures and characters with the help of softwares like 3D Studio Max, Maya etc. The requires artistic creativity to enable perfect capture of human expressions, emotions and body language apart from basic structure of body.

Competencies
* Good flair with usage of computers, toolbars, and basic operating system commands like Open, Save etc.

Role Description
* Ability to build 3D animated models using given reference and ensuring accuracy of design
* Research on design to support or enhance given CGI project
* Working under the Production or Art Designers by being technically vigilant to their requirement, being reliable by creating easy to rig or animate models
* Understanding the final outcome or further requirement to team to enable providing Texture Artists and Riggers to easily work on the models by enhancing them with accurate light and depth.
* Conceptual understanding of instructions given by Department heads via storyboards or layouts to smoothen the outcome process
* Flexibility to work all roles on smaller projects and to work in a team with bigger projects that require detail attention to rigging, textures and lighting.
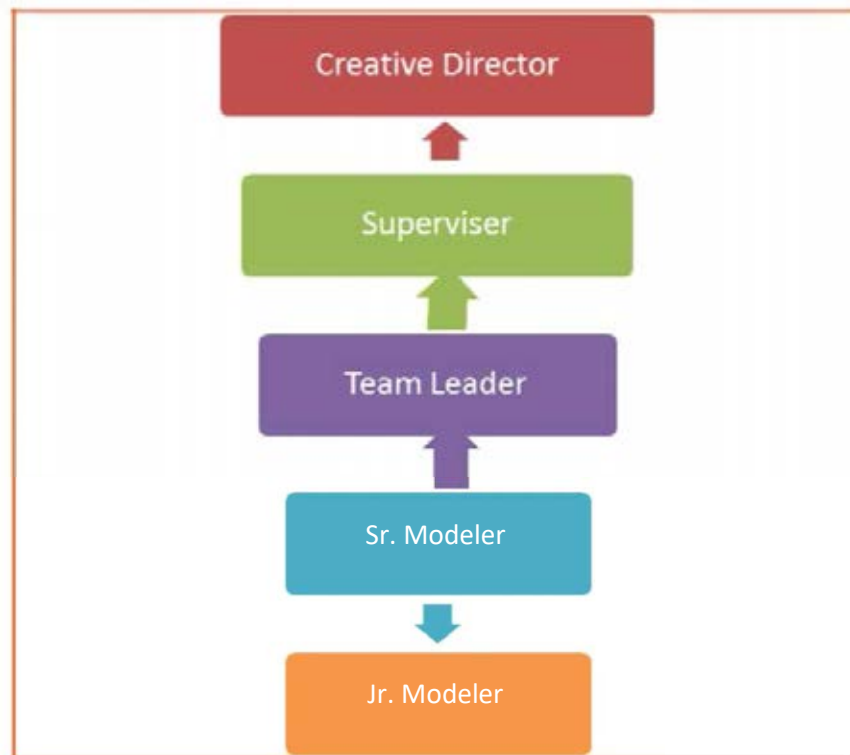
1.1.6 Career Progression of Modeller

Fig.1.1.7: Career Progression Path of Modeller

UNIT 1.2: Key Words

Unit Objectives

The completion of chapter will enable:

1. Familiarise with technical terms associated animation

1.2.2 General Key Words used in the Book

- Animatic: when images in a series are placed together creating a storyboard, added later with effects, sound and dialogs is called Animatic
- Compositing: A combination of several images into a processed single frame is compositing
- Composition: the placement of model in accordance with background and camera
- Creative brief: an outlining guide that provides an accurate summary of expected work like expectations, audiences, planned objectives, expected turnaround, budgets, parameters, investors etc.
- Key Frame: The main frame poses to begin and end frames with
- Modelling: The design process of creating characters that are three dimensional using software applications for same
- Rendering: the conversion into 2D images from 3D images by applying three dimensional effects is called rendering
- Rigging: It facilitates movement in images as required by placing joints wherever necessary to a static image
- 2D Animation: A flat image as, drawn on paper, in two dimensional environment but using specific software to create movement
- 3D Animation : a three dimensional images that create life like experience that support the human eye as in like reality, like Xbox or Sony PlayStation games
- Animation: A rapid movement of images using frames to create movement controlled by time, motion and speed.
- Anticipation: Pre-empted or pre conceived movement as designed by the Artist
- Aspect Ratio: the width to height ratio of the picture
- Background Painting: The background to the character also known as backdrop to enhance images and motion
- CGI: Computer Generated Images
- Clean up: Recreating image artwork on 2D images
- Computer Animation: Using virtual and digital technology and applications that facilitate animation process on computer.

- Frame Rate: the speed at which frames move in series
- Graphics Tablet: Creating drawings or sketches on the monitor
- Pixel: Smallest component of an image like a small dot defines the resolution of the image
- Raster: Horizontal lines that contain pixels that is used to form an image on CRT
- Rotoscoping: a placement of back ground video while frames are in motion
- Title Cards: Words or sentences appearing during scenes with no audio movies
- Tween: Animation process occurring between key frames
- Vector: A mathematical control which produces cleaner, smoother images and manually controllable effects and sizing using vectors rather than pixels
- CEL: A plastic sheet that is a that confluence with the background, outline, character, object or effect made of cellulose acetate or cellulose nitrate that can have inked or xerographical images that are coloured by hand or serigraph process.

Notes

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2. Animation Requirement

Unit 2.1 - Fundamental and Principles of Animation and Modeling

Unit 2.2 - Life Drawings: Human Anatomy Fundamentals

Unit 2.3 - Animation Production Process

Unit 2.4 - Create Hookup Poses and Animation

MES / N 2501

Key Learning Outcomes

The chapter will enable understanding as below

- Descriptive guidelines to animation

- Familiarise with modelling.

- Character sketching and Drawing of human anatomy.

- Production concepts and their applicability to each project.

- The various techniques available for animating objects.

- Understanding various elements that influence the final art work.

- Enact and emote.

- Learn to create hook up poses and animation.

UNIT 2.1: Fundamental and Principles of Animation and Modeling

Unit Objectives

The completion of chapter will enable:
1. Key rules and techniques to animation.
2. Familiarise with modelling.

2.1.1 Principles of Animation

The movement of images by using several frames to correspond the live movement of design through time and vision. A basic movement like a tree swaying to a complex one of a tree growing from a plant can all fall under Animation design

Everything moves in some way, from the fast, flitting firefly to the old and eternal mountains that, in the timescale of their own existence, slide and creak and edge their way forward. Movement connects all things and movement defines all things. Humans, especially, are defined by how they express their individual being through movement. From the nervy to the aggressive, from the passive to the arrogant, from the fit to the ailing, all human nature is expressed by the way it presents itself in pose and action. How true is the adage "actions speak louder than words"for the Modeller! Though all actions are individualized, the actual process of movement itself is defined by specific laws and principles that are immutable and universal. These principles of movement are the foundation upon which all animation is based, whether that movement is drawn by hand, sculptured in clay, or generated by a computer. Animated action is produced by projecting a series of different positions in a fast, continuous presentation to create the illusion of movement. The real secret of animation is to position each in animate moment in such a way as to make that illusion real, impactful, and filled with believable character for the viewing audience. It's really that simple, and really that hard!

Animation has defined its own principles over the years. Although most of these principles emerged from the traditional 2D world of animation, most definitions, terminologies,and principles of movement can be applied to all of animation's disciplines. Many of these principles will be covered in detail and more specifically in the sections on 2Dand 3D animation, but here is an overview of elements and factors of both. These principles are:

1. Squash and Stretch
2. Anticipation
3. Staging
4. Straight Ahead Action and Pose-To-Pose Action
5. Follow Through and Overlapping Action
6. Ease In and Out (or Slow In and Out)
7. Arcs
8. Secondary Action
9. Timing
10. Exaggeration
11. Solid Drawings
12. Appeal

Squash and Stretch

The tool that will require mastering as provides volume and weight to character. It helps define facial expressions and emotions. The level of use is determined by the style of picture or feature. A shorter picture requires broad stretch whereas an expression requires subtler one. This is used in all animation frames and designs from speaking, to walking to a simple box moving.
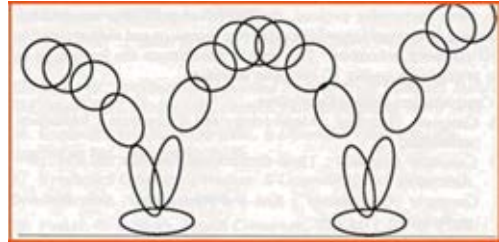
Note:

* Volume of character does not change
* Using as per different characters, materials and models
* Change as required but not change style
* Fast action can be smoothened with Expanding/stretching tool

Usage:

Understanding scale tool to determine up or down dimensions

Anticipation

If an action is to be at all dynamic in its movement and poses, the process of anticipationis important. The law of anticipation says that if an object is going to move forward,it must first move backward a little. Or, before moving
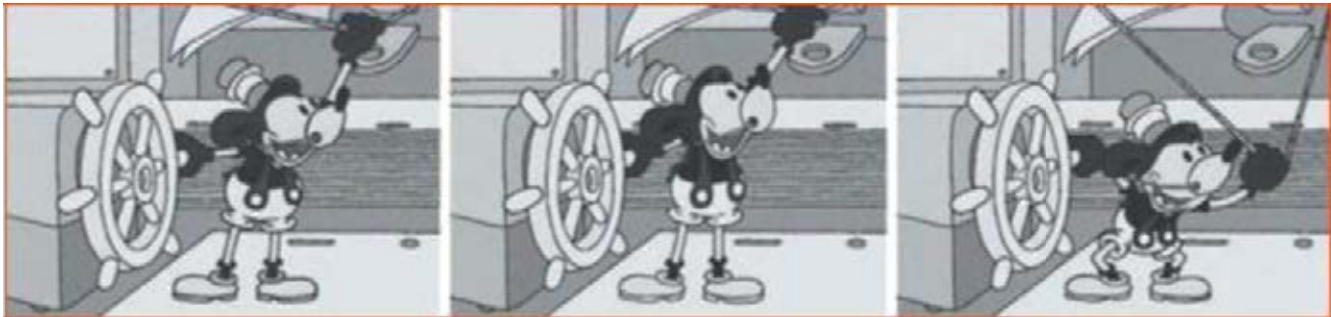

Fig.2.1.2: Anticipation Examples

to the right, it needs to anticipate this by starting to move to the left a little. Similarly, if a character is to jump upwards, it must first squash down a little.

As the character goes to pull down on the rope, he lifts it up a little first to anticipate the major downward action.

Anticipation always gives an important counter point to the main action. It teases the audience into believing that a character or object is moving in one direction when, in fact, it ultimately moves off in the other. This trick, therefore, adds further punch to the ultimate intended direction of the movement.

Timing of anticipation is important too. The best anticipation is sometimes incredibly quick, at other times incredibly slow. How many times have you seen a cartoon character wind up really slowly, almost imperceptibly, then suddenly speed across the screen in the opposite direction? Sometimes we don't even see the run, just the

blur or speed lines, or a cloud of dust, that get sucked along behind.

Consider a character pushing himself away from his desk, as shown below. The windup to the action would be him slowing-in to the end anticipation moment, where his body moves forward and his leg bends like a tightly wound spring. Then, suddenly, he pushes back and away from the desk, pushing hard on his leg, slowing-out as he does so. The effect is all the more powerful and convincing simply because of his slowing squeeze into the

Fig.2.1.3

anticipation position, then his accelerating faster and faster as he pushes away from the desk. Ultimately, it is the timing and the anticipation that makes this all work so well.

Anticipation dictates that if a character is to move backward, it has to move forward first.

Staging

When staging a number of shots that are derived from a single, large location, I prefer to sketch out a master shot of the full location, including the figures in it, first. This enables me to get familiar with its layout, size and the relationship or various settingsand characters involved (see the figure at the top of page 276). I believe that one of the biggest failings in animation is that a great background design is created and then the figures are just dropped in with no thought of style, framing or location. Similarly, with unimaginative camera work when different shots are required. By doing a master sketch of everything first, you will see the various elements that can be played with, as well as the possible camera angles that will be better than just the wide shot, mid shot,
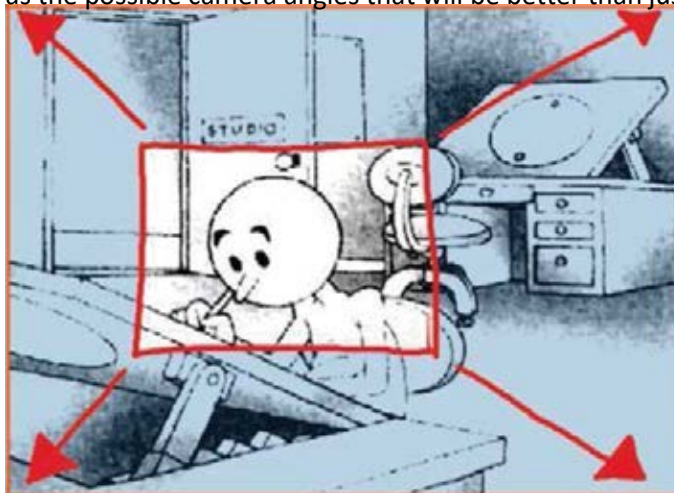

Fig.2.1.4: Anticipation dictates that if a character is to move backward, it has to move forward first.

and close-up from the same viewpoint. It is much easier to do this with 3D animation, as once the environment and the character models are established, you simply place those characters and move the camera freely until the perfect shots are established for each scene.

If animating within a complicated setting for a particularly large number of scenes, I may even build a simple cardboard cut-out version of the set and its characters. This becomes a valuable source of reference that I can study from all angles when seeking interesting ways of staging and framing action scenes. In inventing new

Fig.2.1.5

and creative shots around a location, especially with two or more interacting characters, you must never forget essential film techniques such as not crossing the line, maintaining action continuity, etc.

The same action can be framed in many different ways; look for unique & interesting ways to stage your action.

Straight Ahead and Pose to Pose Animation

Straight ahead drawing follows a direct detailed process from end to end of a scene whereas Pose to Pose draws each relevant pose animation and then goes into detail of each as required. Both allow impromptu innovation and design as size, volume and depth can be determined in selected pictures however in P2P the senior artist can give over work to assistant as the charting and keys are planned, this way all drawings need not be done by him alone. P2P allows more time for animation planning. A combination of both methods is used for animation.

Follow Through and Overlapping Action

Animation has to record a lot of detail movements. Sometimes the torso is constant but other parts of the body are in movement, like the arms, legs, hair, clothes etc. For eg: When Tom is chasing Jerry his four legs are in rapid movement. This is a follow through animation. A type of Drag action is when the parts of characters body do not synchronize with the body moving. Like the eyes of Roger Rabbit move out of the body and stay fixed on a particular thing, or imagine a dog chasing a car but when his body starts to run his ears and legs are still following, this effect is created using multiple frames per second and called Overlapping Action, these help create a real effect on character movements

To note: Action remains continuous and does not end to create good animation
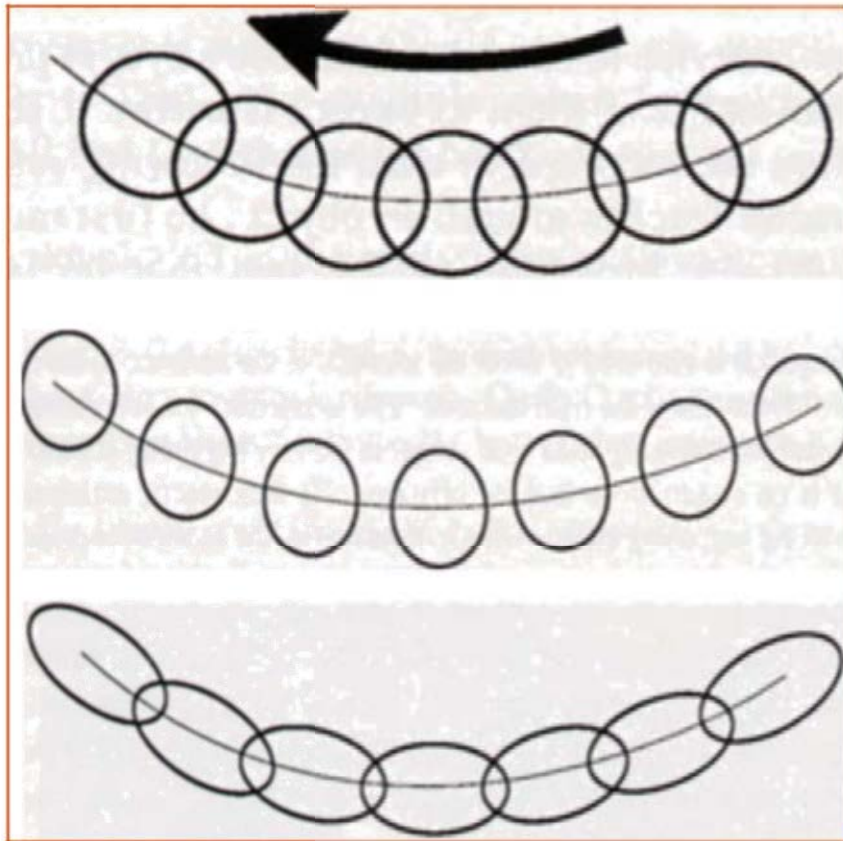
Fig.2.1.6: Overlapping Action

For Example:

- Hand throwing ball continues past release point
- To open door, reach for door before you finish walking

Keys:

- Table animation: lead and drag points
- An action should never be brought to a complete stop before the next begins

Flexibility in movement is not just a matter of character structure and capability. Factors in the movement of secondary objects, such as clothing, hair or props, can give an additional believability to the action. For example, when a character with long hair turns his or her head, there will certainly be some kind of distortion or delay to

Fig.2.1.7

the motion of the hair. (Except in the case of TV anchors, whose hair is glued down with copious hair spray, of course!) Normally, as the head turns, the hair will delay somewhat. Then, when the head stops its turn, the hair will not only catch up but will most probably continue beyond the head stop position, only to return and settle down eventually where the head is, as in the figure directly below. The longer, more fluid and more flexible the hair is, the more there will be a diminishing back and forth in the hair's action. This is known as overlapping action.

Here, the character's head and body has just stopped moving but the hair continues to swing and settle using a fluid, overlapping movement that will keep the scene alive and believable.
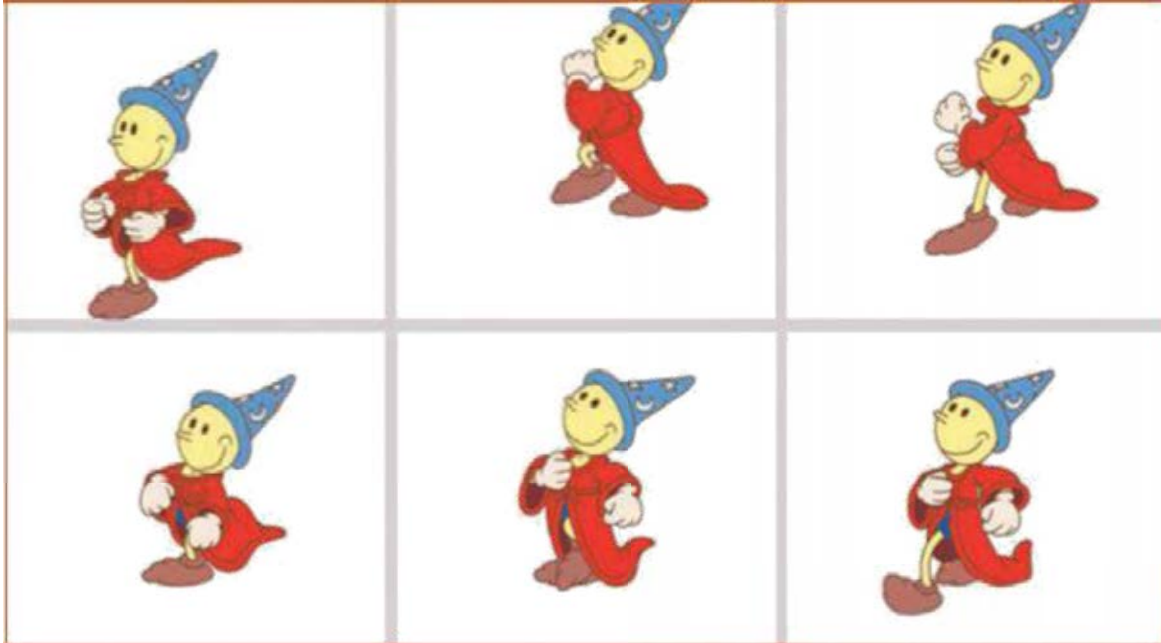

Fig.2.1.8:

Overlapping action also occurs on clothing. Again, it is entirely unrealistic that a character's clothes will move in exact accord with their body. For an extreme example, consider a running character with a long flowing coat, as shown below. While the character is in motion, the coat will flare out behind him. However, when the character stops, the coat will tend to keep on moving in the direction of the run, wrap itself around the character and swing forward, then will flop back and eventually settle into a static position.

Here, note the stretching of the cloak as the character moves forward and down the steps. Then it bunches up as the character loses his forward momentum and prepares to take the next step.
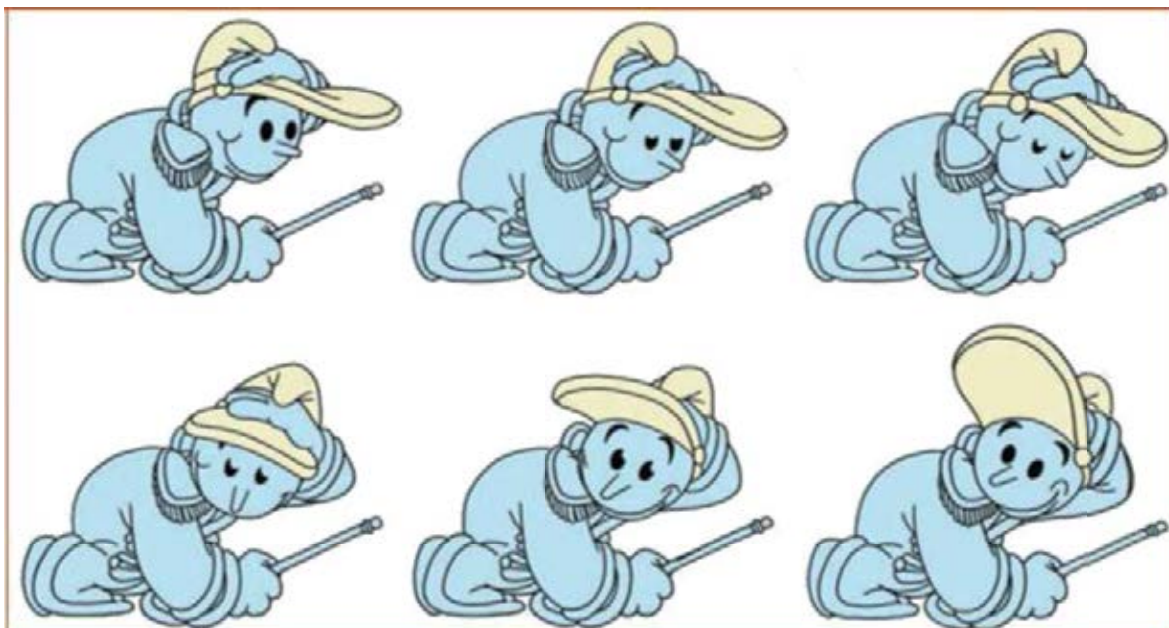

Fig.2.1.9

Overlapping action can occur with props too, such as a character waving a handkerchief at someone on a departing train. As the hand comes down on the wave, the handkerchief will drag behind it. However, when the hand rises again, the handkerchief will tend to drag behind downwards, the effect of gravity and the hand's momentum. Then, when the hand descends again, the handkerchief will pass it and rise upwards again, always a beat behind the hand's action, and so on. The same overlapping effect will occur on a whip being cracked and a horse's tail when at a gallop, etc. In this more subtle example, note the slight overlapping action on the brim of the drum major's hat.

Slow-Out and Slow-In

A great deal of movement requires either acceleration or deceleration in its action as nothing really moves evenly, except maybe machines. You will have to develop the ability to think of this chart-wise and accomplish it animation-wise. Nothing explains this process better than the classic bouncing ball. Almost every animation tutorial in the world starts with the bouncing ball principle. However, like every cliché in life, its greatest value lies in its familiarity and soundness of principle. A bouncing ball encompasses all the elements that the Modeller needs to know in relation to action that speeds up and speeds down. The rubber ball also embraces the four other factors of timing—structure, shape, volume, and flexibility—together with one other important factor that affects the way all things move, gravity.

The bouncing ball effect, illustrated in the figure below, is simple to describe. A rubber ball is thrown up, then lands and bounces high, then lands, then bounces not quite as high, then lands, then bounces even lower, etc., until it is out of energy and comes to rest. The principles described in this simple action define most of what animation is about.
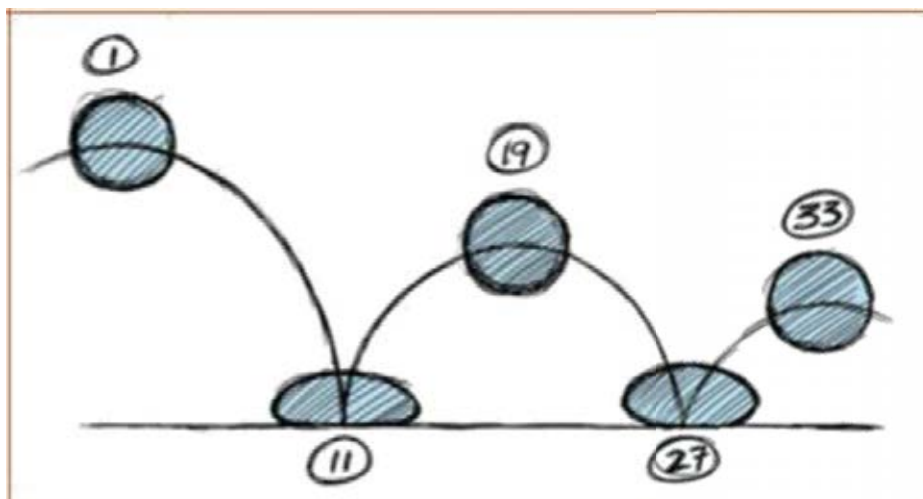

Fig.2.1.10: The standard bouncing ball.

When thrown, the ball will accelerate into the air then slowly come to almost halt in midair as the forces of gravity exert an effect on it (1). Stopping for barely a moment, gravity will drag the ball back down to Earth again,

accelerating as it does so. Then, hitting the solid ground (11), the ball will squash then spring upwards again. It will not rise as high as the first time, because the ground hit will have killed some of its velocity and the force of gravity will not allow it to climb or accelerate as much as the first time. It will again slow to a halt (19) and then accelerate downward again, where it will hit (29) and bounce up again (37), actually several times, each bounce successively smaller and smaller, until it finally comes to a halt.
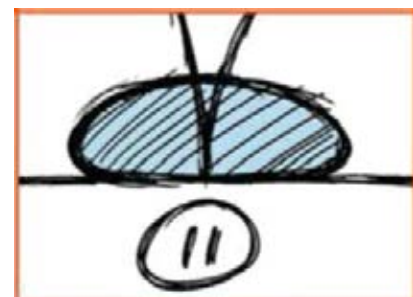
Now how can this be defined in a chart? First we have to isolate the key positions, the high points of the bounce and the low hit points. Note that, *Fig.2.1.11* at its high point, the ball is perfectly round but is distorted at the hit point,

as seen below left. When the soft, rubbery matter of the ball hits the hard, unyielding ground, its velocity causes it to squash in one plane and spread out in another. (Remember, the volume of any object remains the same

whatever distortion happens to it; volume only lessens if the object splits orparts break off.)

The distortion associated with the rubber ball's hit position is known as squash. Showed in fig 2.1.11 Now, if it was a bowling ball hitting a trampoline
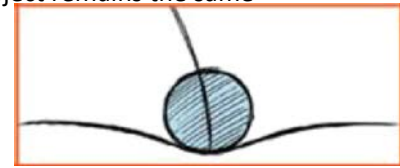
Fig.2.1.12

or soft grass, the opposite would happen, as shown below, the surface would give and the ball shape would remain intact.

If the bouncing object is harder than the surfaceit hits, the surface will give way instead of the object. Now consider the speed of the ball's ascent and descent. As the ball moves from its highest position, it will accelerate from what is essentially a stopped position to a fastmoving one, as gravity drags the ball towards the ground faster and faster.

In the old cartoon tradition, speed was often donated by lines trailing behind an object (called "speed lines") but Modellers discovered that stretching the object along its path of action (left) gave a better effect of speed, because it simulates the blur you would see in a frozen live-action film frame.

This attempt at blurring by distorting the animation is known as stretch. Many of the old cartoons showed extreme examples of squash and stretch, although today this is reduced somewhat, especially for the more naturalistic approaches of computer-generated 3D action. Stretching the object conveys speed as it moves in that direction.
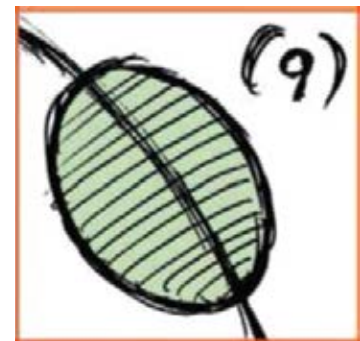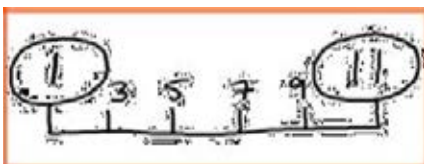

Fig.2.1.13

Fig.2.1.14

If there was no change in velocity, the chart would look like this.

In betweening the ball to show squash and stretch will result in a more natural and believable bouncing scene.

Fig.2.1.15

If the velocity of the ball is even and not accelerating or decelerating (which is impossible), the charting would look like the chart at top left.. But in reality, the movement is not even when the ball is accelerating downward. The chart at top right shows the more realistic inbetween positions.

The more drawings there are, the slower the action will appear. Therefore, with the bulk of the positions spaced out like this at the top of the move, the effect will be to have the ball start slowly and get faster as the positions spread out.

If the velocity of the ball is even and not accelerating or decelerating (which is impossible), the charting would look like the chart at top left.. But in reality, the movement is not even when the ball is accelerating downward. The chart at top right shows the more realistic inbetween positions.

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Once the ball has hit the ground and it bounces up to the next high position, slowing as it does so, the chart would look like the one at right. This time, the inbetween positions are bunched up at the end of the action, ensuring that the velocity of the action slows down as it begins to reach its zenith.
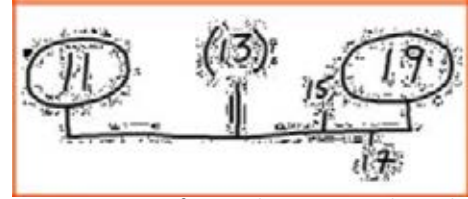

Fig.2.1.16: Using fewer inbetweens at the end of the action slows the motion.

From this position, a new chart that requires the ball to speed up towards the next hit position will be created, although as the ball is progressively losing height during the bounces and as each lower bounce will occur in less time, the inbetweens within each chart will tend to become less and less in total.

The action in the figure below, animated on twos, will give a really sharp snap to the bounce, as well as a certain amount of hovering in the air. However, were this to be smoothed out more by animating it on ones, I would be inclined to not inbetween the moves from 11-13 and 27-29, as the resultant snap from the squash position on the

ground and the next position up in the air will keep the necessary dynamic required for a strong hit as the ball lands on the ground.
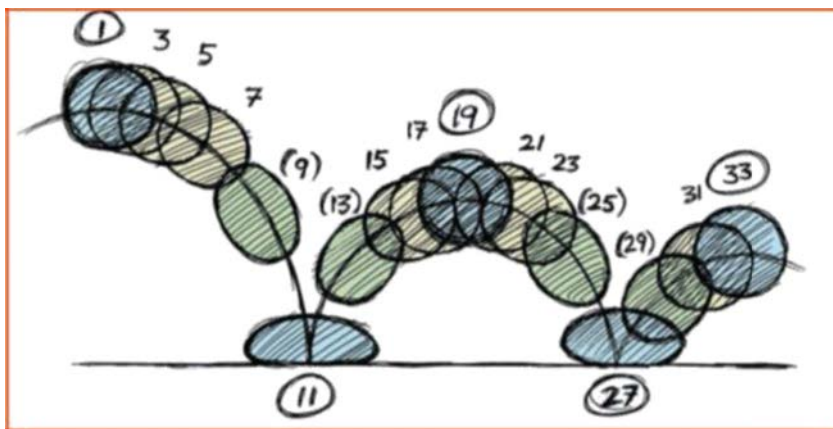

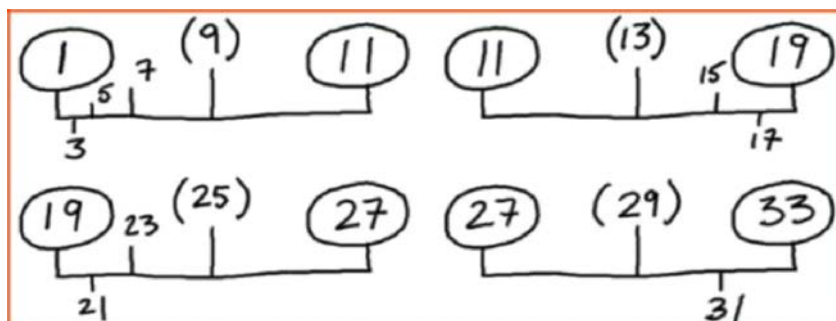Fig.2.1.17: The full bouncing illustration.

Fig.2.1.18: The final charts for the bouncing action.

A more complete bouncing ball sequence, based on the full bouncing illustration above and animated on twos, would be charted as seen above.

In animation terms, the charting of a movement that accelerates from one key position to another is called slowing-out and the charting of a movement that has an object slowing down towards the next key is known as slowing-in.

Arcs

General curve element is used to create realistic body movements, even our arms and legs

dont move straight or dont follow a perfect pattern, curves give the character a linear flow. For Eg : eating a bowl of soup
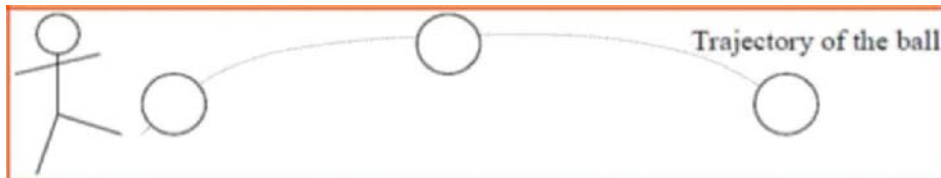

Fig.2.1.19: Kicking a ball

Secondary Action

Actions have different emotions and dimensions and must work simultaneously. A secondary action defines or enhances the main action, it is also a supportive element to better the character movement. Imagine a Cop chasing a thief with a gun in his hand. In this the Cops legs are in fast athletic action, while his arm holding the gun is pointed at the thief from time to time and his expression is focussed, sweaty and angry. The Legs running are the primary movement whereas the arms, the emotions, neck movement are Secondary Actions

Fig.2.1.20: Cord movement

For example:

• Cord movement

• Facial expression
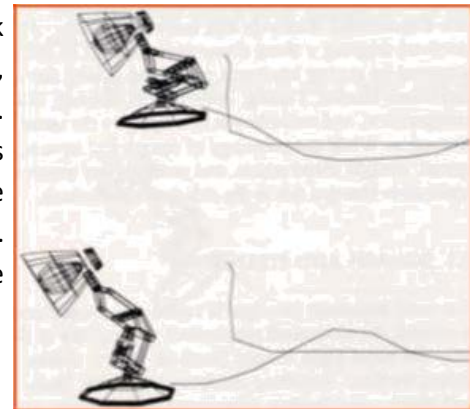
Keys

۴ Needs to be subordinate to primary action

Timing

The right timing is the most important factor of animation. Time is the constant played around with to create the wanted effects on characters. Apart from slow and fast, time also determines accuracy to movement
For Eg: A dog wagging his tail
A slow left to right movement of tail means relaxed
A fast movement means attention or listening
A very fast movement means excitement

Fig.2.1.21: Head

Exaggeration

The dramatic effect is given to certain characters to exaggerate their impact. Some broadened, wide stretches create good effects than the simplest monotonous effect on characters. Sometimes creativity must overrule logic keeping sense in mind to create a strong impression of that frame. An exaggeration of eyes size or head turn gives more appeal to film

Solid Drawings

The conventional method of drawing is also used in animation. Where the depth, structure, volume, expressions etc. is determined on paper before giving it a two/three or four dimensional effect. A two dimension is the drawing which is flat, three dimensions identify the movement whereas time lapse or time movement is four dimensions

Appeal

Agreeable Attractiveness is crucial to any animation. Usually cartoons spring to our mind when we think of animation but only the funny characters is not just the essence, there are angry, villainous, friendly, different types of emotions and personalities that create a feature. You may be the best artist, with crisp drawings and lighting but you if fail to capture the right emotions of character the personality might not be attractive enough. Similarly an inappropriate texture may kill the effect. The right combination of techniques used with the right timing will hit the emotional yet mental chords of the audience. The excessive or least use may create the wrong idea as compared to the storyboard. Earlier cartoons were mere flat frames and images placed on back to back strings, it is important to evolve with demand and get more detailed appeal.
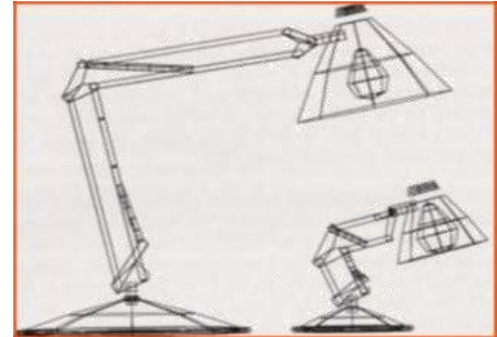

Fig. 2.1.22 Appeal

2.1.2 Modeling Process

Amongst the various design techniques used today, there are three most popular ones most commonly used :

1. **Polygonal modeling:** A Polygon has many point edges that can be connected using dots on the computer, it also has many sides that can help rendition better. Vertices in the 3D platform create a polygonal mesh that are used in singular or multiples curve shapes and are flexible to design

2. **Curve modeling:** Digital non planar curves are used with points that help determine structure based on the applied weight to points that comprise the curve circumference. The focus is not maneuvering effect through points that do not intersect

3. **Digital sculpting:** A recent entry into animation and fairly new to use, however widely accepted at this earlier stage due to its flexibility and dynamic nature. This not only uses polygonal, curve technology modelling but creates high resolution image back ups to track changes with data mapping. Methods allow artistic approach as vertex positions can be set up, adjustments can be made to then set locations also a new topology to correct or change finer details. Some techniques use voxels that refrain polygonal stretching while some use triangulation to maintain surface smoothness.

2.1.Key 3D Modeling Terminology

Polygon geometry

Used to create smoother surfaces and are frequently used shapes in animation however excessive use of geometry is required to get higher smoothness.
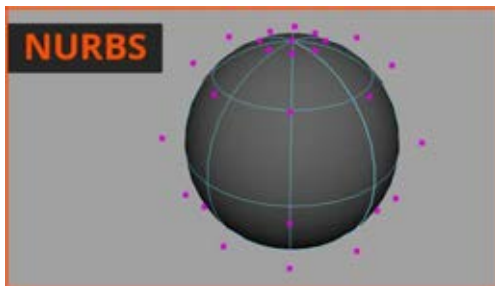

Fig.2.1.23: Polygon geometry

NURBS surfaces

A surface defined by four sides having points that can be controlled to be used to create extreme smooth images and do not require as many points as polygonal geometry does. Non Uniformal Rational b-spline is one of the common geometrical methods.

Fig.2.1.24: NURBS surfaces

Subdivision surfaces

Known as Non Uniformal Rational Mesh Surface, commonly referred as Sub divisional surfaces is a combination of NURBS and Polygonal geometry using mathematical calculations to smooth surfaces automatically
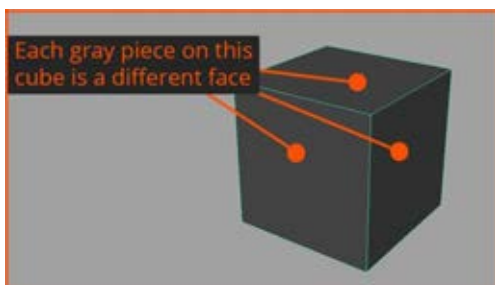

Fig.2.1.25: Subdivision surfaces

Faces

Faces are the visible sides to a polygon that can be worked on. When three or more points are joint they cover blank space left..

Fig.2.1.26: Faces

Vertex

These are connecting points across ends of polygon that one joining create faces. It is the smallest component in a 3D polygon and joining of multiple vertices a work model is created that leads to the final shape creation
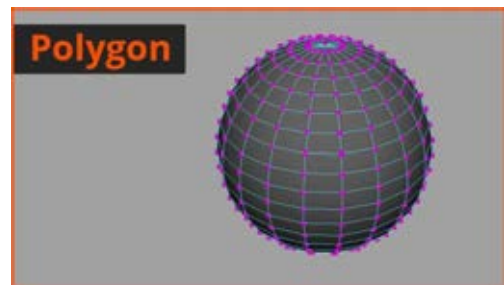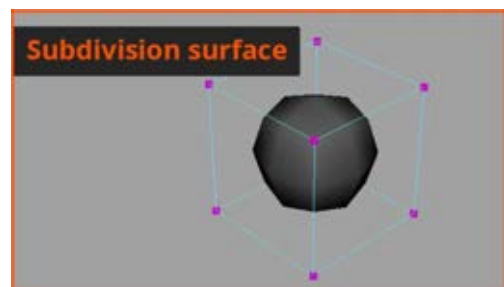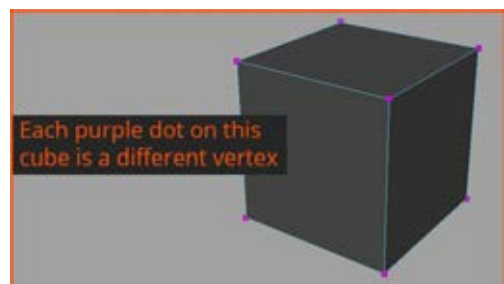

Fig.2.1.27: Vertex

Edges

They connect vertices and define the shape of face. They can re design the structure of models. Together Vertex, Edges and Face determines the shape of polygon
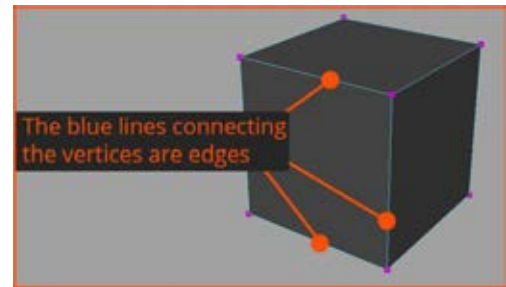

Fig.2.1.28: Edges

Fig 2.1.29: Topology

Topology

The area surrounding the shape, defining the flow and position is called Topology. In all techniques of geometry it's the topology that sets the type and tone of the shape used whether face or edge

Triangle

When modeling, triangles area unit generally a polygonal shape sort usually avoided. When making advanced meshes, triangles tend to cause a problem once subdividing geometry to extend resolution, and when a mesh are malformed or animated.
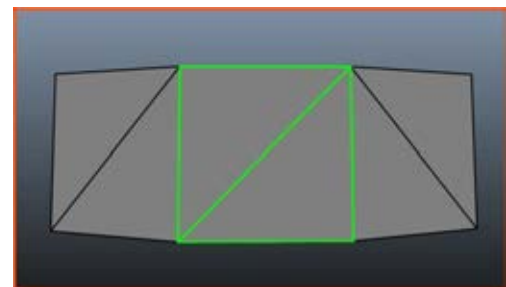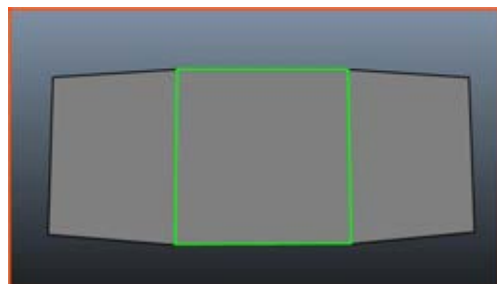

Fig.2.1.30: Triangle

Fig.2.1.31: Quad

Quad

Four edges connected perpendicularly by four points is a quad shape. This gives a great topology to deform models and preferred highly amongst 3D creators.

N-Gon

It has five faces ideally as is a polygon made by connecting 5 edges, it poses a difficulty while texturing more specifically during deformation

Fig.2.1.31: Quad

Extrude

Extrude means extra protruding features that allow excess shapes to be placed over the 3D polygon and create characters as desired. The additional extrusions can be edited as per any other geometrical shape.
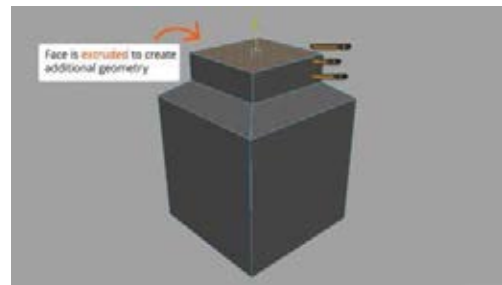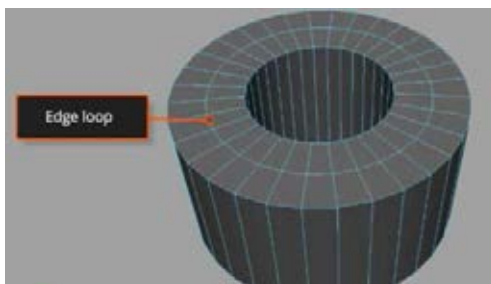

Fig.2.1.32: Extrude

Fig.2.1.33: Edge Loop

Edge Loop

A ring is created by joining multiple edges by the first edge to connecting the last in a loop. These create mesh that use hard edges facilitating deformation in the right resolution

Beveling

Rounding the edges of a mesh is called Bevelling. It is useful to transform computer generated look as most objects have curved edges. Beveling creates a new face by expanding vertices

Fig.2.1.34: Beveling

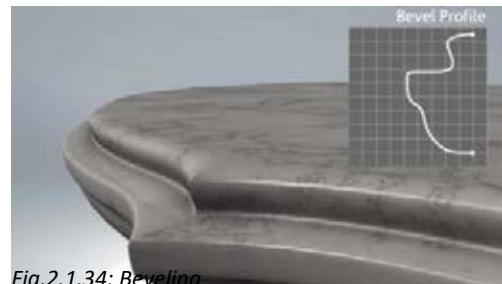*Fig.2.1.35: Pivot point*

Pivot point

Pivot means main point where the movement can be controlled. This can be placed anywhere on the model to create rotation, scale or moves. For eg: when placed on the hinges of the box, allows opening closing movement

Normals

Enables light maneuvering over objects, normal help 3D animation shade objects rightly on the geometry.
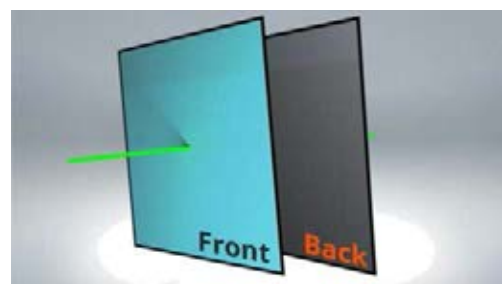

Fig.2.1.36: Normals

Instances

Every image/object or model will require duplication or back up however a simple computer duplication will increase rendering time as each model will have to be duplicated. Instance is a process pf multiple duplication or series duplication that is time effective and efficient
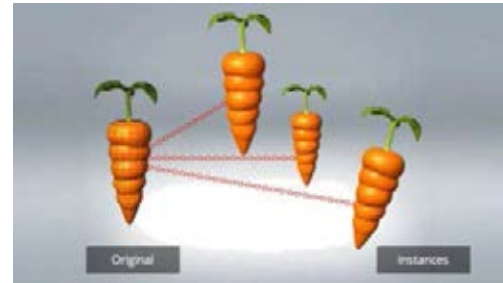
Fig.2.1.37: Instances

Fig.2.1.38: Construction History

Construction History

You will use different techniques and tools on your model to get the desired result, for instance you may use stretch or bevel tool, to understand the different tools you have used in order or sequence is what construction history does

Digital Sculpting

Organic models may be difficult to give desired results with the use of vertices or edges however digital sculpting deals with this issue by creating traditional meshes that are better equipped. You can pull or push outlines, creates details like creases or bends without having to select vertex or edges. Often Maya is used to create low resolution images that are exported into Zbrush or Mudbox to create those finer

Fig.2.1.39: Digital Sculpting

UNIT 2.2: Life Drawings: Human Anatomy Fundamentals

Unit Objectives

At the end of the unit, you will be able to:

Life Drawings: Human Anatomy Fundamentals

2.2.1 Facial Expressions

Expressions form the character of the model where unsaid things are communicated. Facial expressions communicate leaps if captured correctly. The first thing to draw our attention are ones expressions. The eyes, nose, mouth even eyebrows convey feelings. The face is an important nonverbal communication component.
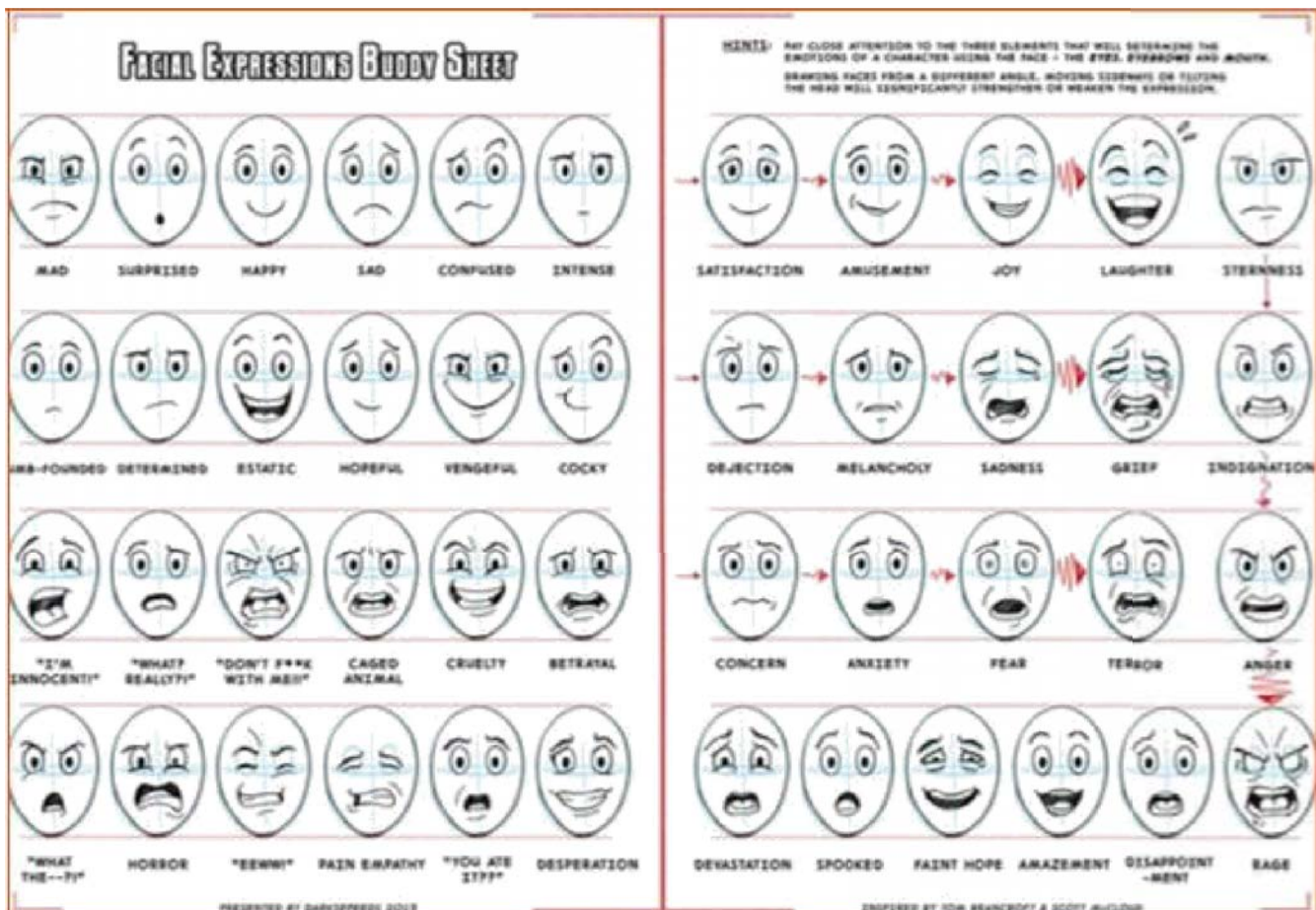

Fig.2.2.1: Facial Expressions

Eyes

They say the eyes behold the maximum experience, they have the ability to change the entire created model. The eyelid, lashes and the pupil changes can alone create different expressions. Even the eyebrow lines are subtle conveyors, for eg a slender woman's eyebrows will be thin and sleek whereas a brawn man's eyebrows will be thick
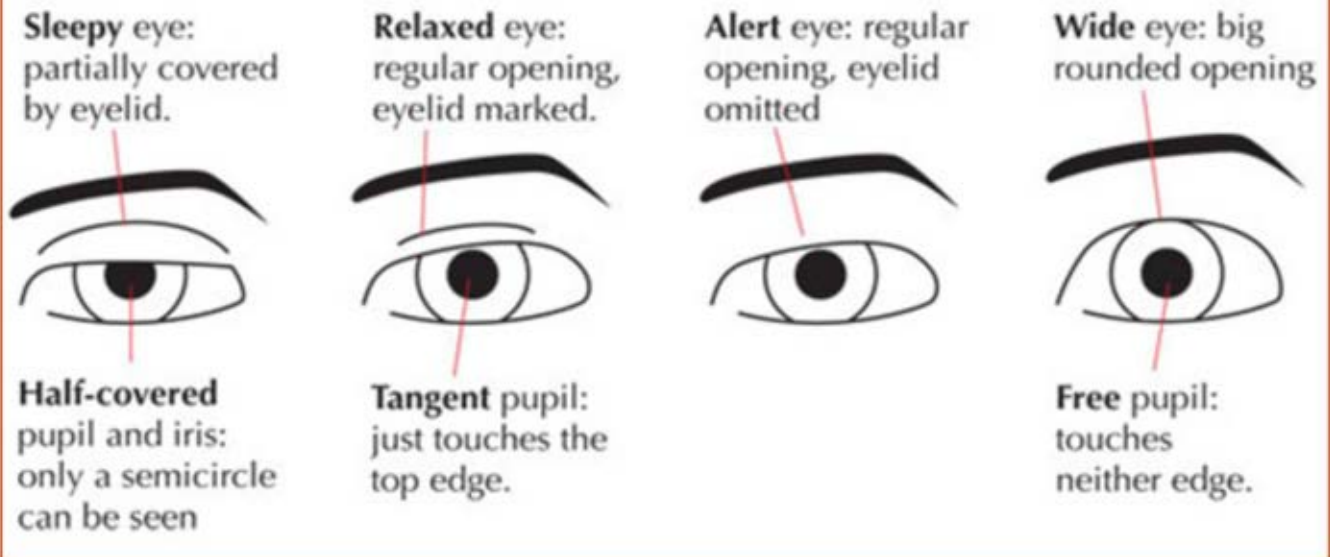
Fig.2.2.2: Eyebrows

Mouth

This area plays with curves and is the second attention getter after the eyes. As detailed as types of lips, teeth structure, tongue can create different emotions. For eg a toothless babys smile will be different to a child with braces. Below are explanatory pointers on Curves of lips
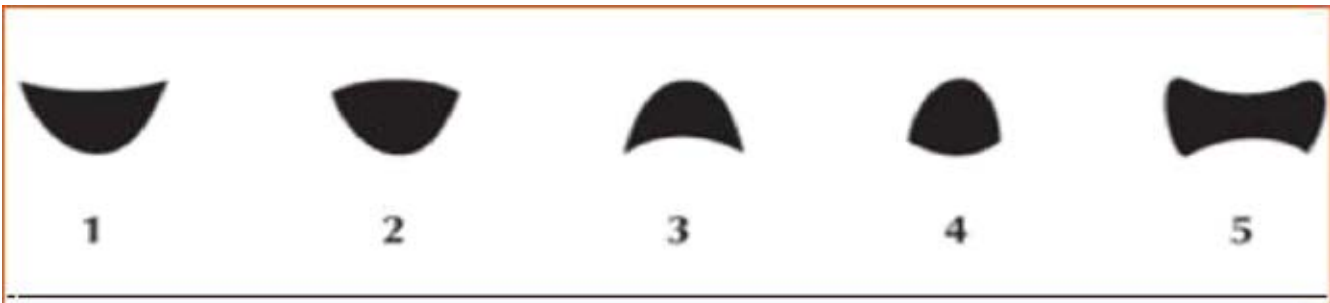
Fig.2.2.3: Lips move

- Both Up denotes happy
- Both down denotes sad, upset
- Upper down, lower up, mouth slightly open denotes laughing, happier can also mean astonishment when the jaw is open.
- Both pressed together denote suspicion, anger

Nose

The nose may not convey emotions as strongly as eyes or mouth but it forms an identification feature of the character you want to create. Subtle factors like nostrils flaring, sneezing wrinkles etc. create actions.

Emotions

Below are detailed types of faces for understanding

The Relaxed Face

This is where the facial features remain constant without extreme alterations to them

The Surprised Face

Fig.2.2.4: Relaxed Face

Is usually along with other actions, but a mild surprise to show emotions is *Fig.2.2.4: Relaxed Face* by rounding features like the eyes and eyebrows. This can also show shocked emotions but eyes have to get bigger with dilation of pupils.

Curious   Surprised   Puzzled
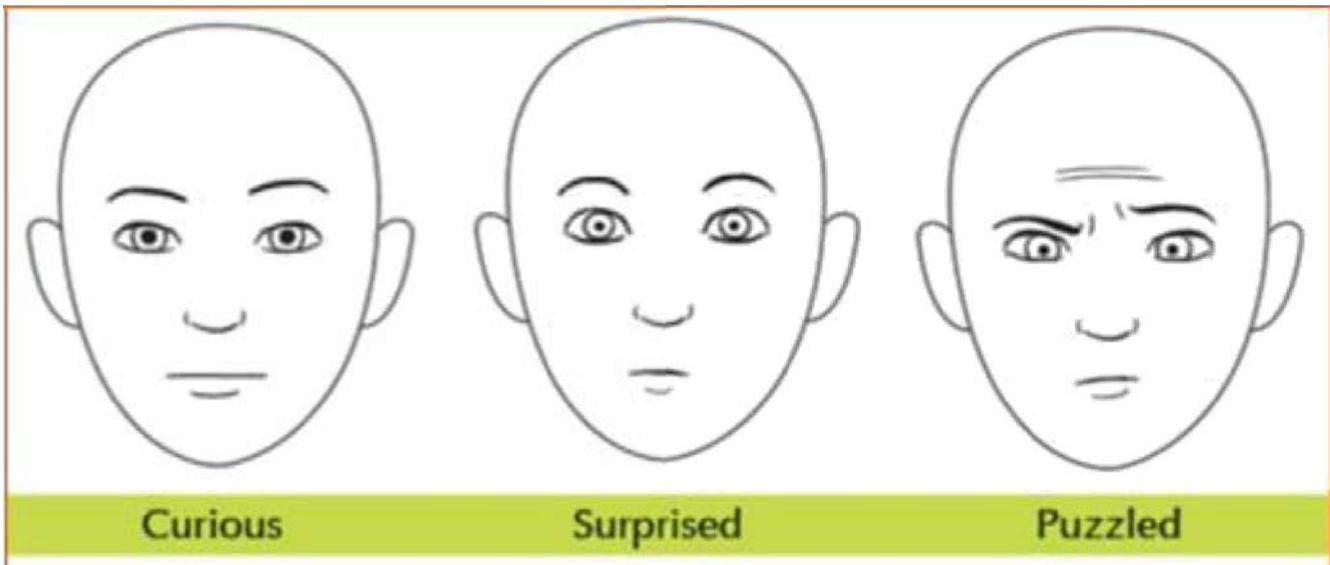
Fig.2.2.5: Surprised Face

The Smiling Face

Characterized by facial features curving up.

Smile   Real smile   Grin
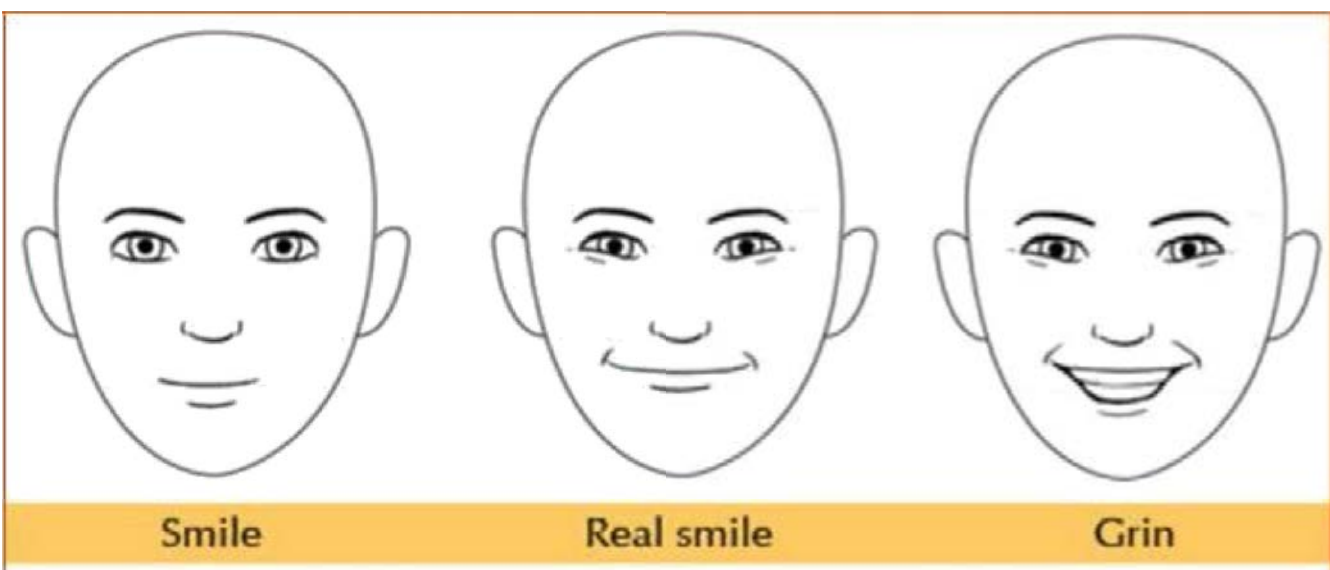
Fig.2.2.6: Smiling Face

The Angry Face

States strong emotions that are harsh and is showed bye creasing the eyebrows, the more we contract them in middle the more angrier the face. The pupils get darker.
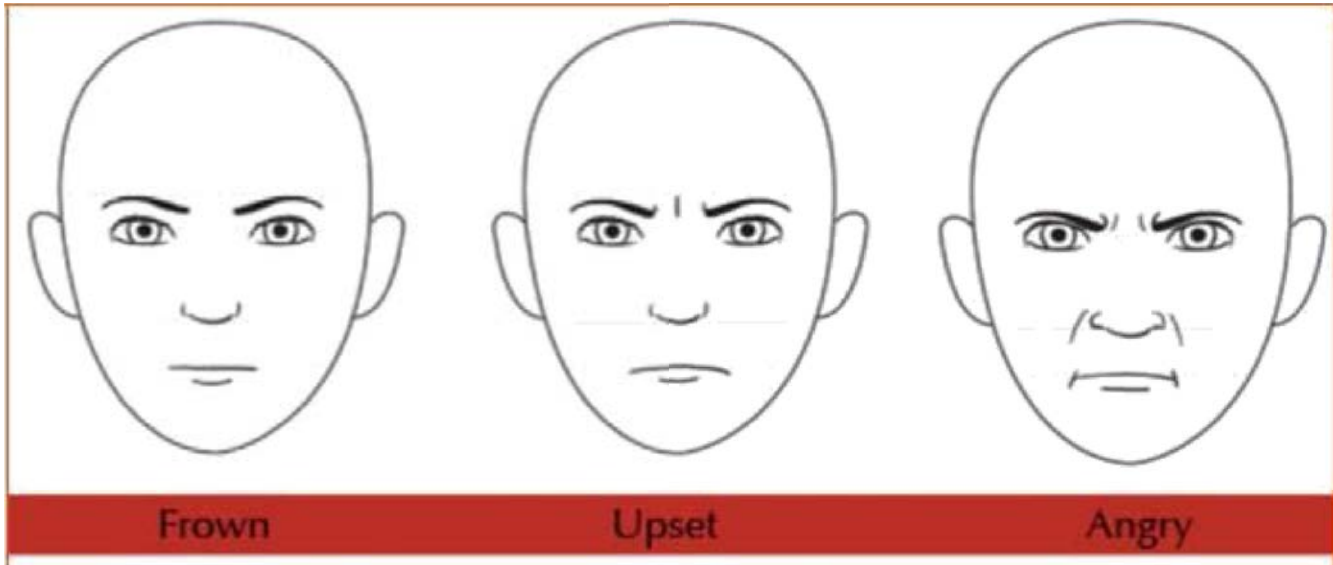
Fig.2.2.7: Angry Face

The Sad Face

All the curves are downwards in this, the brows, eyes look down, lips also curve downwards. With complimenting body like drooping shoulders add effects
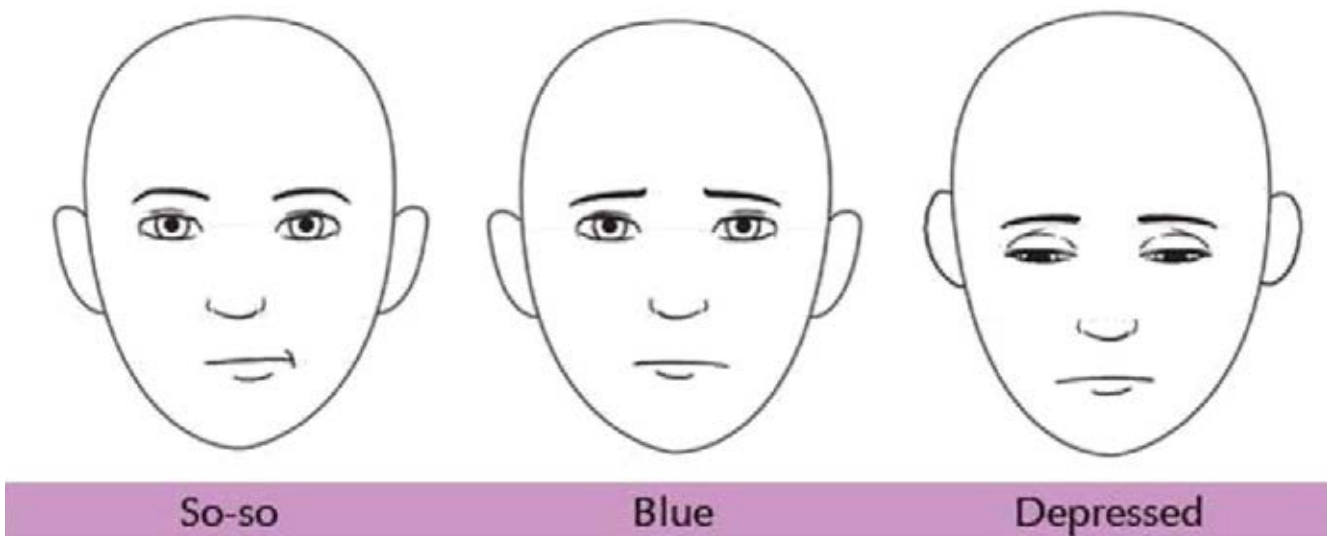
Fig.2.2.6: Sad Face

Body Expression

Body language is major component to nonverbal communication, even though expressions are controlled by body can convey subconscious thoughts or emotions. They will add on to character sketch. The hand gestures make a good difference if used correctly. Below are a few expressions to note:
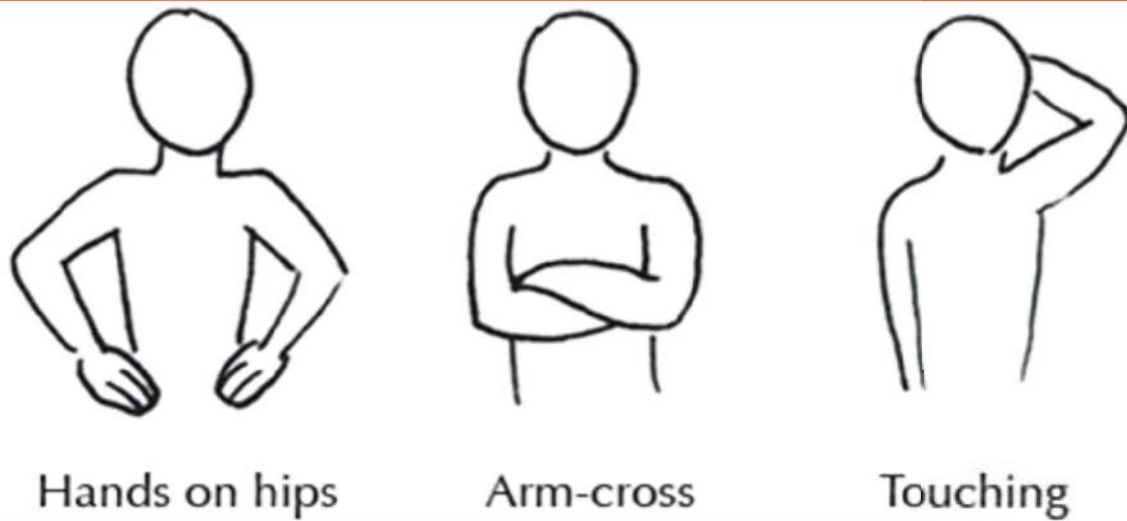
Fig.2.2.7: Body Expression

Hand on Hips:

Arms positioning is pushes ahead from elbows, palms flat on waist downwards shows sign of power and confidence, similarly folded hands on waist show informal thinking or threatening

Arm-Cross:

Hands crossed on top of other ending under shoulders, shows negative connotations like defense, not interested, closed mind. Also shows anxiety around people, it's like wrapping self-up in arms

Touching oneself:

Conscious playing with hair, touching the face, straightening clothes, scratching head or nose, grabbing ears, moving legs or changing position mean uncertainty, nervousness or social anxiety

Assignment

Step 1: Practice various body types to explore more nonverbal actions
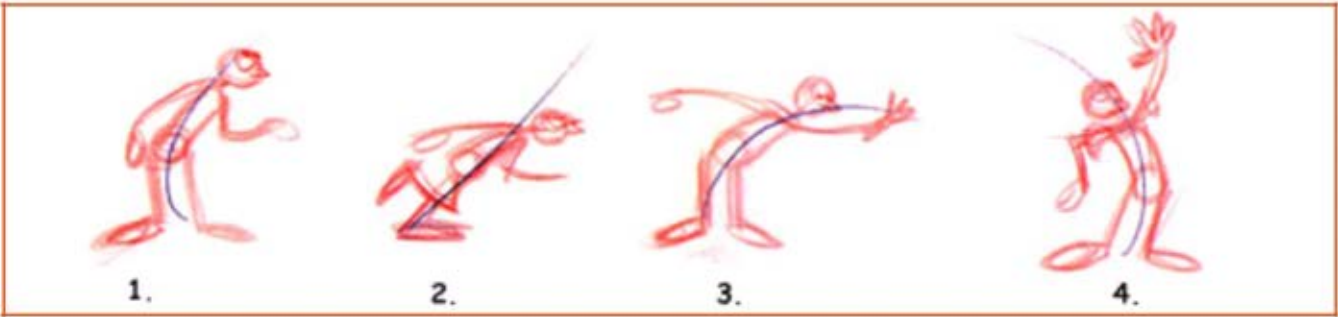
Step 2: Create thumbnails and create a story or scene with upto 5 drawings with different expressions on same character.

Step 3: Always draw around Line of Action, to keep posture accurate to emotion
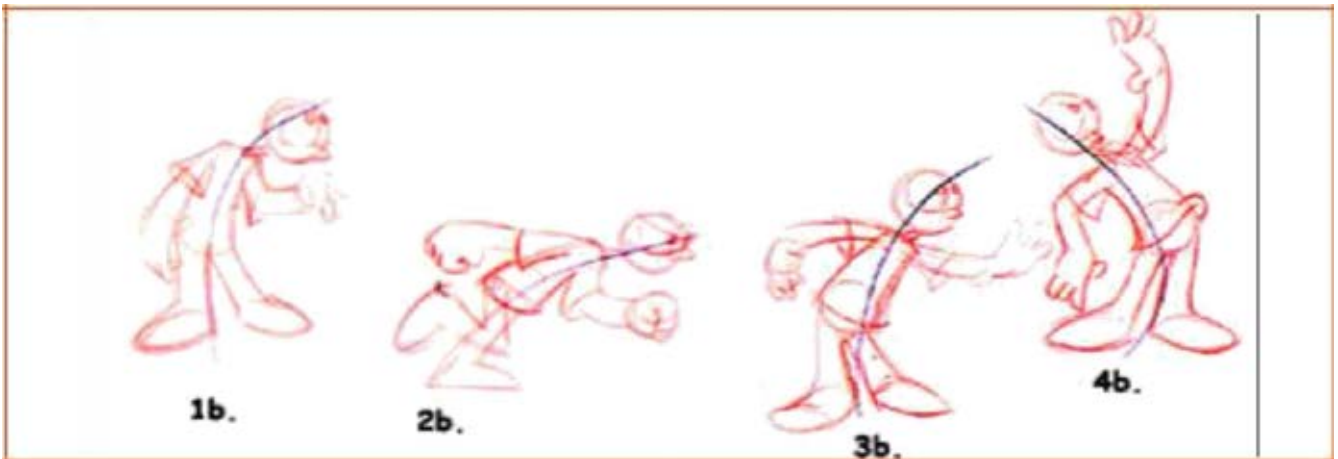
Step 4: A simple readable outline creates a good posture, the silhouette should be deciphered from any angle

Step 5: Once the Pose, line and Expression is set then add other elements to enhance the same, like the arms, hair etc.
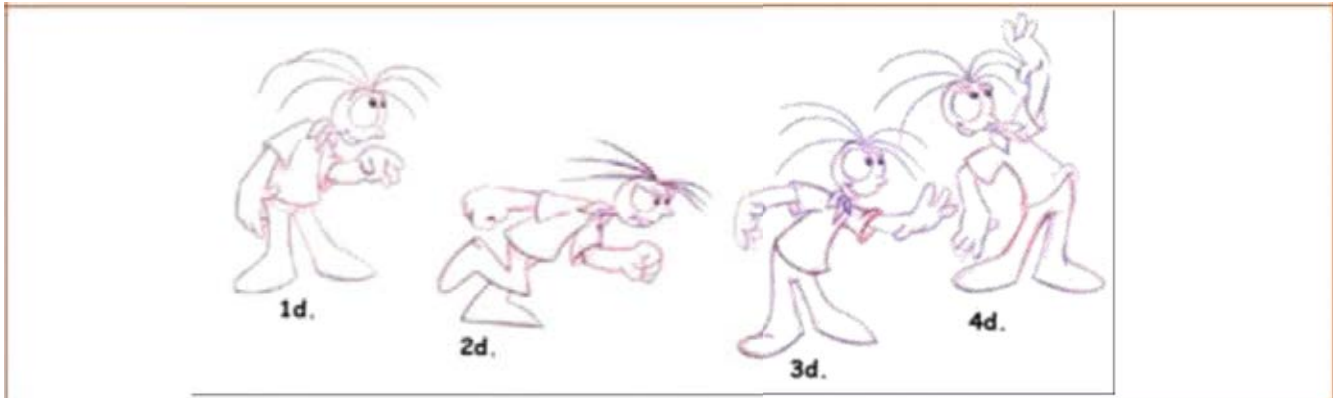
UNIT 2.3: Animation Production Process

Unit Objectives

The completion of this module will enable:

1. Principles of Production as per projects.
2. The various techniques available for animating objects.
3. Understanding Intellectual property rights.

2.3.1 Introduction

Animation has reached corners and is evident in our daily lives, one cannot miss animation spread around. You visit a mall or drive on the highway, wherever there are screens you will encounter it. Perhaps its a blinking brand name on billboard or a kitten playing with a dog, or its playing counter strike and finding it so real on system. Like any business animation is the need of someone with capital to invest. Animation requirements vary and so does the cost to it, like starting from time to idea, to script to design, especially the production requirements like technology, equipment also determine pricing. Below are important stages of production and factors that affect pricing and time

2.3.2 Pre- Production

The initial stage where planning takes place that dictates the course of the animation. There are even dedicated companies coming up in this sector. Pre production makes the process of film making structured and timely thus controlling costs

The Idea: Every animation film, clipping or video is based on an underlying thought. It might be a single line that may have clicked to write a story on or a complete book. But to get the idea into effective outcome is important. Even a proverb pen is mightier than a sword can be an idea. The individual's budget is crucial to what method will be used to animate, a CG or Flash. Sometimes stories develop over years, sometimes it takes minutes, and to create them is costs nothing but creativity.

The Script: The narrative written document of the entire story sequence is called the script. The writer captures the essence of thought into elaborate writing, which describes characters, locations, camera framing and dialogues. The director then classifies it into scenes and shots. A shot is a single take and a scene is an entire setting or combination of shots. It can take days or months depending on the length and upto 10% production cost is given to writing

Fig.2.3.1: Idea

The Storyboard: A visual imagery of the script is created like a comic book where several panels illustrate scenes, character position and camera focusing. The production begins on approval of storyboard as both time and cost are affected if it needs major changes, minor changes can be required and are worked on throughout the production. Storyboard is the base to building. It can take upto a week to month to create and costing is usually per page or panel besides hourly rates of artist/writer

Fig.2.3.2: Storyboard

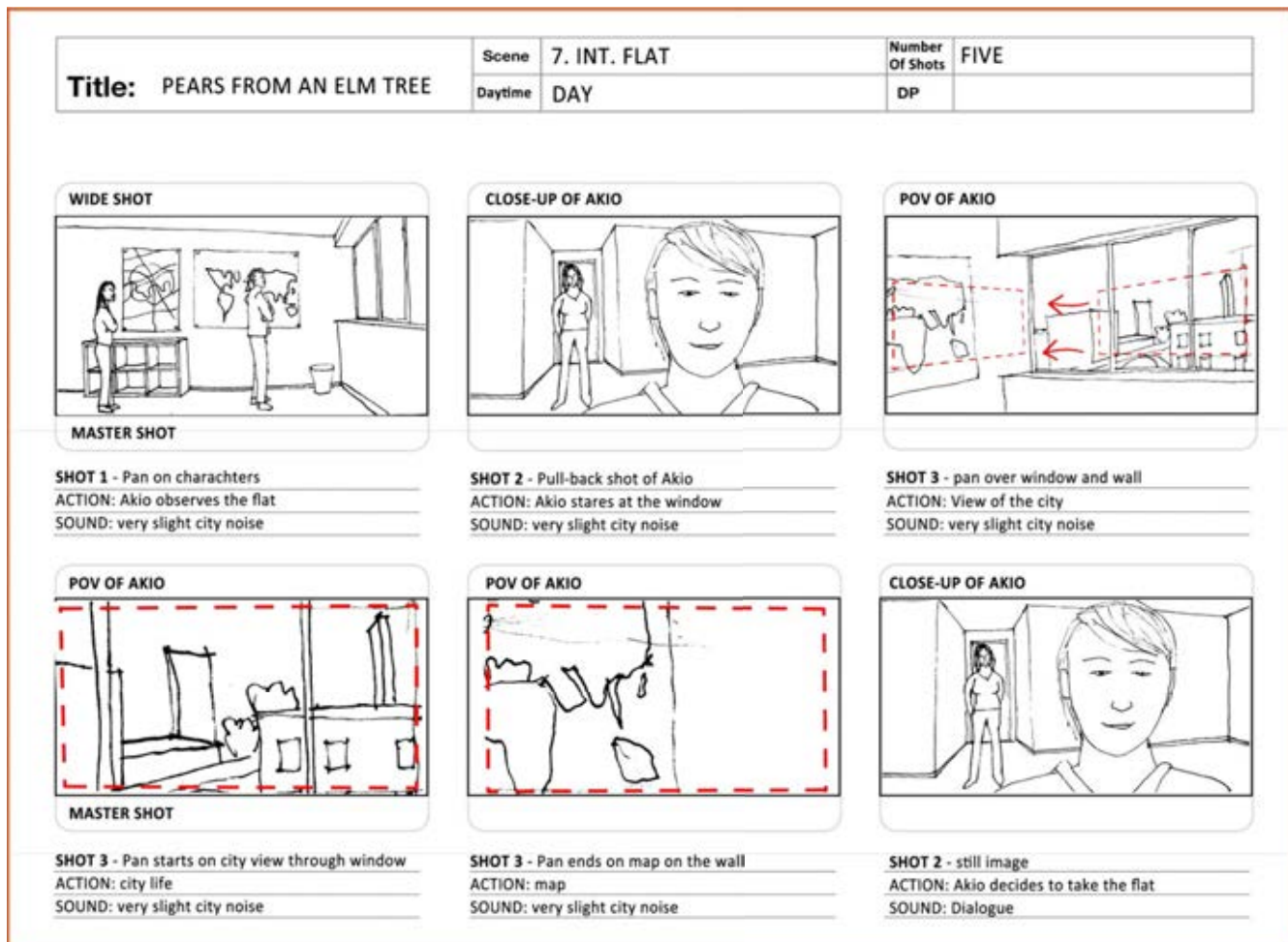**The Animatic:**

To understand the look and feel of storyboard, sound and dialogues are edited on panels, this makes easier changes if required. The Animatic works as a guideline to final in understanding the actual animation required for it. It may take upto weeks to put panels together along with edit and is based on budget of client. This is also charged per second/minute on hourly labour costs.
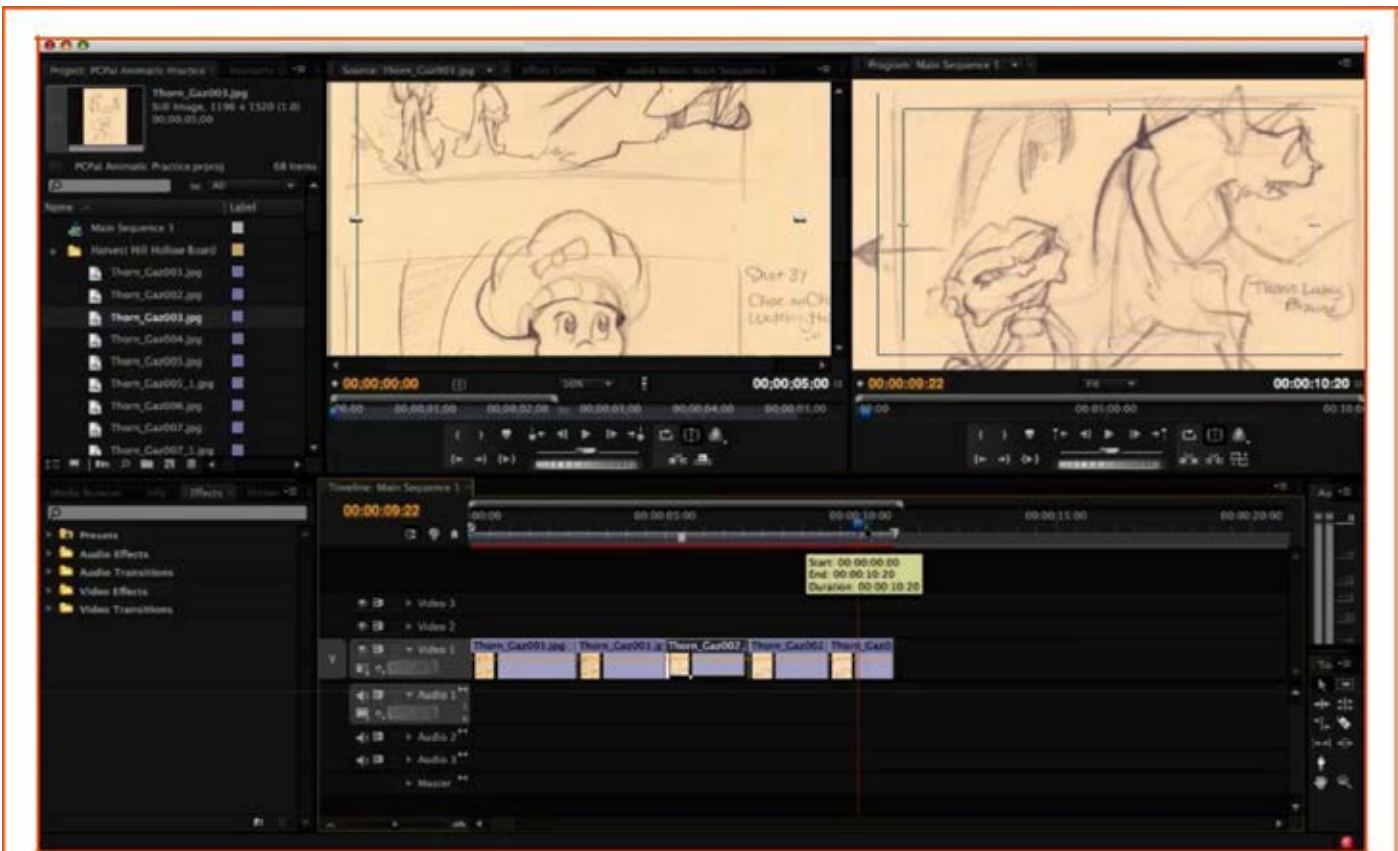
Fig.2.3.3: Animatic

The Previsualization:
A widely used technique by using digital stand ins or dummies to figure camera angles, lighting, frames, environment or movement in 3D space before actually starting the final product. This technique is used in 3D animation and features, to curb costs involved as changes can be done and issues be resolved before beginning the final work. It takes upto a month for a 1 minute commercial and cost per second/minute on hourly labour costs.

The Design:
Design is a vast concept that includes sets, costumes, location environment to props to backgrounds. Design is a continuous process as it adds value, hence it needs to be worked real time as well to understand ambience. Design is sculpted digitally where concepts are painted to get the feel. It's charged as per page or element and hourly labour costs.

The Modeling:

- **2D (Limited):**
  Basic character postures and poses are created in a way that when worked on can give a dimension to 2D as well. The human anatomy can be dissected into layers of elements.

- **3D:**
  Various techniques to model like 3D scan, geometry re work, wire framing a mesh are used on 3D elements if any in production. Sometimes characters are made as puppets with clay or pop decorated with hair or clothes. Environments can be created using wood or paper. This takes up to two weeks to months depending on details. It's charged per model made or on hourly rate of work
  .

The Rigging:

- **2D (Limited):** A

   The characters body must be in puppet like separated elements, the arms, legs, hands etc. Like the wrist is connected to the forearm, which joins the elbow then the shoulder. These joints have pivot points that can be adjusted or rotated as required.

- **3D:**

   3D mesh bends and folds are used to create bones, hair, muscles, eyes and clothes once the character model is made. It is tedious and intricate to get the desired outcome. Stop Motion: Armatures are used to hold clay or mesh models that are nothing but aluminum or wire skeletons. The characters feet are bolted to the set that allows free movement. This is the crucial yet challenging part and requires time depending on complexity of 3D model. It is charged per model or on hourly rate.

The Texturing:

- **2D:**

   Textures can be complex or simple depending on the model, simpler ones are flat using gradient textures but complex ones need to have ability to move with the model.

- **3D:**

   Texturing is colour, gradient, hand painting or digital imagery. Even photographs can be digitally used as textures, this enables innovative surfaces and designs. Lighting behavior like reflection, shadows and bouncing off is also texture control.

- **Stop-Motion:** Gradience or textures are hand done on puppets and models.

- **Time Involved:** Texturing takes anytime between minutes to months to create depending on simple colouring to complex creation. It is charged per model or on hourly rate of artist.

- **Cost Involved:** Based on a per model or per hour of work charge.

2.3.3 Production

Once the script is finalised, the design and storyboard approved the final work towards its creation starts. Usually begins at slow pace but picks up momentum and is fastest at the end. The time frame and cost depend on how much effort and attention went into pre production.

The Layout

Layouts are based heavily on Illustrations than the storyboard alone.

- **2D:** A hand painted background is used wherein the animation character must be within that background which later will be painted.

- **3D:** Usually done during pre visualization, models and characters are placed in 3D space with camera to understand motion and give better modelling opportunity to designers.

Stop-Motion: The use of puppets already has models ready for camera movement, as they are on the actual set, they need correct lighting to get the plot for camera motion. Once the plot and angle is set a computer controlled rig handles complex camera movements capturing single frames dynamically. .

- **Time Involved:** Layouts take anywhere between days to month and cost based on per hour, per model and hourly charge of work .

- **Cost Involved:** Based on a per drawing or per hour of work charge.

The Animation

- **2D (Classical):** The character positions set the pace for key drawings and points of action. Once they have been finalised drawing in between are done to smoothen. movement. A pencil test is done where rough sketches of above are tested. Once approved the rough lines are erased and blended with the background. Then lights, textures and effects are added, this prolongs the animation process however flow and motion are best with the classical approach.

- **2D (Limited):** Very few drawings are done and worked around digitally to copy the classical method. Many images are pasted on top of each other and are manipulated to create fluid movement. Like eyelid blinking with eyelash curling. The hands and legs are attached like puppet and computer is used to create movement in character. Automatic smoothening in-betweens are used by help of software making production faster and Money efficient.

- **3D:** A 3D character after rigging can be moved around virtually just like a manual puppet. It uses computer language like coordinates and slider controls to Maneuver the character. Smoothening changes and positioning occurs automatically within the software. It is defined by realistic output and quality

- **Stop-Motion:** Since using puppets they are shot single frame by frame like traditional drawing method. Due to it being live on the set, any wires, mesh or support cables need to be rigged to achieve real character action and animation. Eg flying that work against gravity).

- **Time Involved:** The time frame depends on the number of motion frames, since its detailed even cost efficient work can be a lengthy production. Cost is calculated per second of film or per drawing as per animation type.

- **Cost Involved:** Usually based on a per second of film charge, although limited 2D animation may be per drawing

The Rendering

Rendering means using computer technology to auto create frames in the digital spectrum. Since every software requires some amount of rendering, computers are programmed to auto calculate to produce final image. Due to which it can be done quickly within a week even for a high definition 3D image. Simpler images can be done in seconds. The charge for work idcS per GHz charge.

- **Time Involved:** Depending on how complicated the calculation of the 3D scene is or how massive the finished images are, anywhere from seconds to weeks.

- **Cost Involved:** Based on a per GHzh charge.

2.3.4 Post - Production

When the final scripting, animation and rendering is done the details are then added like audio, special effects, dialogues etc. to complete it. It's like chiseling a made sculpture to perfection .

The Effects

a Effects vary from glowing insects to flying airplanes, to creating shadows or adding glittery backgrounds, sometimes as simple as expanding backgrounds or making night turn day, even elemental 2D effects like air, water, fire as used in combinations. Usually since images are drawn in 2D adding effects by hand paint or draw becomes easier than 3D however time can be determined by how much detail is required. Per second cost or per hour wage rate is given for this.

The Compositing

Compositing just like name suggests is layering several images into final work. Although it is the end process, the right effects occur through compositing, just like removing green screens, color correction and rotoscope masking sound basic the task is of art. Placing a Jaguar in the center of empty ground to making a 2050 skyline credits to compositing artistry. Ideally green screens make compositing easier

The Editing

Editing is a continuous process and works through pre to post production editing each scene in detail and final minute touches. From animation to rendering through compositing editor is at constant work to re check update and edit fresh shots. It is time consuming even though done since the beginning, progresses slower in the end than beginning.

The Audio

Sound is a crucial part as it adds the mood and feel, scratch audio is like dummy audio that is added to understand the effect And setting time. Well known professionals are considered as 70% movie is conveyed through final audio. Song writers, composers and Sound engineers work together to write, play the score and mix in efficiently. Some sounds or songs take over months to finalize, depending on how particular the requirements is. Since its from dummy to performance to final it can take from weeks to years' time to make. It is charged per sound or hourly labour rate for Sound, whereas engineers charge per hour, composers charge per hour or per mixt.

2.3.5 Choosing an Animation Medium

Animation is a great way to communicate stories, however it may not always be the only option as it takes time and costs higher.

Hence choosing the right medium for requirements makes this easier. Especially for cartoon books, fairy tales and fables it works best to keep the essence. 2D classical animation is drawing by hand and based on artists character creation and skill. Every frame is hand crafted hence more natural than technology bound. Although production is time consuming as there is no rigging, yet preferred by few. It starts a lot earlier to production and due to time taken costs much higher. On the other hand Limited animation is perfect for budgeted clients, as software's make inking, painting easier by inbetweens automatically. A single drawing is rigged a piece and becomes technologically easier, time saving as fewer drawings are required. Rendering 2D images is detail work as many layers can slow down compositing to get final image

2.3.6 Requirements and Specifications of the Project

Each project is a well thought process and below are guidelines used for approach

- IT team is to define a requirements document that details all business and functional requirements for the project, its gives the necessary outline of project
- Design guidelines and necessaries are set forth in the document detailing how to design the project
- Then phases are outlined and timelines are given to them and added in the document
- the schedule is discussed and set forth to underline how what and when of the project in the document
- Test plans are used as best practice for every phase to check achievement and completion parameters that set the right pace and keep checks throughout by cross referencing
- The final stage decides how well the plan has been executed as per document, against test parameters and documented goals, most importantly it checks if project fit well as per timeline and budget

Vague Requirements

An animation is a continuous process, hence regardless of recording milestones, plans, phases and tests window for additional changes, recommendations and corrections will be there. A constant feedback from client, understanding their business model and updating systems accordingly can plan their future view to project accordingly. Effect of changes on system users, mapping to initial idea and key specs should be broken down in simpler corrections. This helps clarity to both parties .

2.3.6 Animation Techniques

Animation is rapid moving images with least distinction creating illusion of structure and motion that are static in nature but dynamic in viewing:

1. Traditional animation
2. 2D Vector based animation
3. 3D computer animation
4. Motion graphics
5. Stop motion
6. Claymotion
7. Puppets
8. Cutouts
9. Silhouette
10. Action Figure/Lego
11. Pixelation

Traditional Animation

Traditional animation uses traditional technique of drawing by hand on translucent papers with coloured pencils. Each drawing is made on separate sheet that make upto frames. Test are done with rough images to check how many frames would be required as timing is crucial, and audio must fit correctly with animation. It is tedious and takes longer to execute, as only once inbetweens are cleaned does team move to production where each image is photographed. Eg Tarzan, Snow White, Alladin

Fig.2.3.5: Traditional Animation

Fig.2.3.5: 2D Animation

2D Animation

Its produced on flat surfaces also known as vector animations. It uses computer technology to generate 2D images just like traditional techniques but digitally drawings not physical.

3D Animation (CGI, Computer Animation)

3D animation is more complex as it requires thorough computer working knowledge and software expertise. Traditional animation skillset was of craftsmanship as each frame was individually worked on, with CGI or computer animation even though each frame is worked on digitally a lot of effort is minimized and tools to further enhance can be utilized.

Fig.2.3.6: 3D Animation

Fig.2.3.7: Motion Graphics

Motion Graphics (Typography, Animated Logos)

Example forms are typography and animated logos. Motion graphics differs in a way to others as there is no character or story and used in multimedia projects, it is for commercials and marketing promotions where just logo or text is in motion. Like explainer videos, tele promos and app commercials use flat images that are given movement along with audio

Stop Motion

A single photograph is used by moving it slightly and photographing it once again, doing this for several times to create illusion of motion, stop motion is using sequential photographs with physical materials to create action rather than traditional drawing by hand. Both photograph frames and time them in animation. The process is time consuming as photographs need to be moved by minute inches to create the right flow

Fig.2.3.8: Stop Motion

Fig.2.3.9: Claymation

Claymation

This involves making clay or play dough characters on wire frames or mesh that can be easily manipulated

Armikrog and Neverhood are advanced claymation techniques using metal structures for strong support to dough

Puppets

Use of puppets as is by changing their facial expressions as required, they can be manipulated within the rig it stands on

Fig.2.3.10: Puppets

Fig.2.3.11: Cut-Out

Cut-Out

Cut outs use cardboards or paper to create characters and shooting them from the top angle of camera, the base is moved around to create movement illusion.

Silhouette

Stands for shadow animation, where cardboard or paper cut outs are used only in black and the backgrounds are white, it is rarely used in today's time.

Fig.2.3.12: Silhouette

Fig.2.3.13: Action Figure

Action Figure/Lego

Using play figures like GIjoe, Lego to by creating movement in them with softwares, here characters are already constant. It is popular on social media videos, especially Youtube.

Pixelation

Use of people against green screens and creating unreal imaginative backgrounds and animation around them. It uses method of stop motion to take photographs but its better controlled as objects are real people

Fig.2.3.14: Pixelation

2.3.7 Observe, Act and Emote

Creating natural and credible emotions is necessary to create believable animation. Good animated emotion can add a great deal of drama to the scene and create an interest in the people watching the animated film. Emotion lies not only in the facial expression of the cartoon character but also in the body language.

One of the ways to communicate emotion in animation is by making sure we are creating a thinking character. It is important to pass on the idea that the thoughts of the animated character urge his farther actions and movements. The anticipation principle of classical cartoon animation can be used to create believable and emotional animation in 2d as well as in 3d environment.

- It is important to create eye and head movement preparations before creating the body movement itself. The eyes should move first since they are responsible for the upcoming movement of the body and are the window to character's soul, thoughts and emotions.

- Head movement comes seond in the line. If this principle of animation is not carried out and the body moves before the head and the eyes, the action will not look like it was initiated by the character but by some other force and is opposed to the character's initial thoughts. Creating a thinking character is the first step to giving life to the personage.

- emotions can be conveyed with time taken by person, a stressed individual will do things in a hurry and no structure, whereas a secured person will show calmness and discipline in arrangement   .

- even eyebrows communicate volumes where squeezed in the middle show by suspicion, anger and funny expression.

- To create more realistic and living eyes it is important to remember that their surface is always moist and reflect light and it is important to deliver that in the material of the eye surface or the drawing of the eyes.

- Eyebrows also play an important role in communication and emotional expression. Raised eye brows often symbolize surprise and astonishment as well as uncertainty and confusion.

- Lowered eye browse symbolize deception or annoyance. Eyebrows can evoke anger, sadness, fear and other various emotions that human body can communicate.

It is important to understand that most of the communication in the world we live in is not verbal communication. An Modeller is obligated to understand the role of emotion in animation, remember that almost every part of the body can be used to communicate and use this knowledge in the process of animating cartoon characters.

2.3.8 Intellectual Property Rights

Intellectual property rights (IP) stands for the copyright of an idea, or creation by human intellect in fields of:

Art
Literacy
Design
Images
Symbol
Inventions

It is an outcome of human intelligence and Creativity. In Artistic genre books, music, paintings, movies, programs and performances have safeguard of copyright. Properties under production, manufacture fall under patents and trademarks. This enables creators to protect their product from being replicated. A documented transfer and permission of rights is required to re-create the idea into other forms like movies. In production arena, the producer needs to have necessary finance and licenses to purchase these rights and detail agreement to allow specific flexibility. He then hires a writer for adaptation of written stories or scripts which have IP right attached to it. The writer creates a brief and screenwriter creates screenplay. An option agreement is signed between the owner and the producer that allows recreating the work into animation or feature, commercials etc. for a specified period wherein the owner is paid an agreed fee to utilize his work as adaptation.

UNIT 2.4: Create Hookup Poses and Animation

Unit Objectives

On completion of this module you can:

1. Enact and emote.
2. Create Hookup Poses and Animation.

2.4.1 Hook-up Poses and Animation

Hook up pose is the in between hold between movement of character from one scene to another. To ensure that the pose is fluid and matches without errors frame to frame. Hence pre-production plays an important role, as sroryboarding needs to ensure that cartoons have no continuity errors

Before animation begins. Animation is vast and requires many designers to be working on different frames, nothing guarantees matching apart from hook up poses. This matters in shot to shot but not in cut to scenes See the below instance to understand errors in fluidity of scenes:
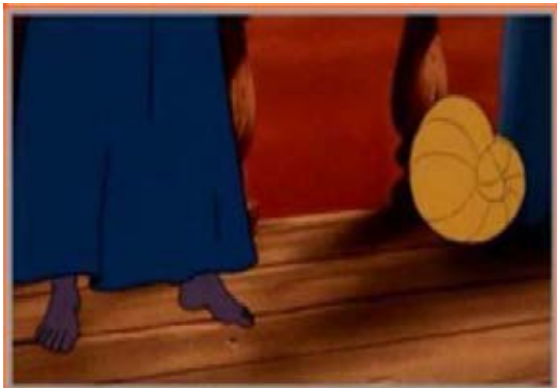
Fig.2.4.1(a): The Hook-up Pose
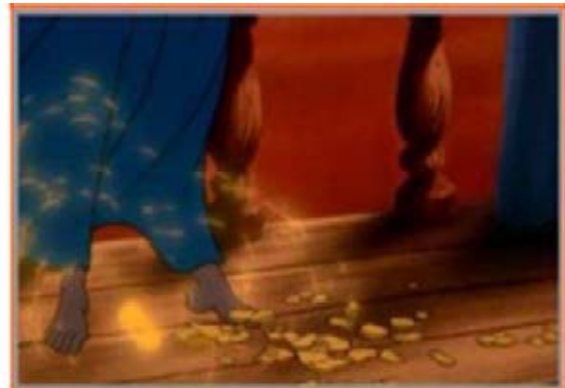
Fig.2.4.1(a): The Hook-up Pose - Errors

Little mermaid is with bare feet and then is wearing shoes.
Learning : proper written costume follow has to be made,even though can be missed in seconds.

Fig.2.4.1(c): The Hook-up Pose - Errors

Fig.2.4.1(d): The Hook-up Pose - Errors

Check one more! Ursulas pose in the first and nexf is complete different even the hold on Ariel has changed. The speed totally makes viewers overlook this.

Then Ariel being a mermaid is fully dressed when Ursula attempts jumping over the railing, then next we see Eric watching over the ocean.

Cuts to Ursula forcibly taking Ariel but now the mermaid has changed attire.

Fig.2.4.1(e): The Hook-up Pose - Errors

Fig.2.4.1(f): The Hook-up Pose - Errors

Aproper reasoning could have been applied here by showing clothes floating after they jump or being torn in

A proper reasoning could have been applied here by showing clothes floating after they jump or being torn in the drag

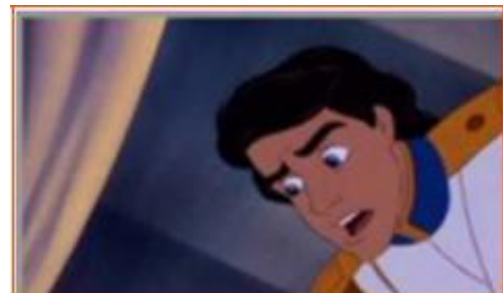*Fig.2.4.1(h): The Hook-up Pose - Errors*

Fig.2.4.1(g): The Hook-up Pose - Errors

See some more

Ariel in water has got legs and doesnt have clothes to cover them.

She then tries to wriggle them, in the next scene the angle has changed from wide to short!

Check further scenes where poses remain different in frames!

Fig.2.4.2(a): The Hook-up Pose - Errors

Fig.2.4.2(b): The Hook-up Pose - Errors

More hook-ups

Ariel realizing she has no pants has legs for the first time. She starts to lift her foot.

Fig.2.4.2(c): The Hook-up Pose - Errors

There's the hook-up cause (in the action notes you'll label it the 'start pose' as well). once more it's not excellent (we see toes) however it works just fine.

Fig.2.4.2(d): The Hook-up Pose - Errors

Here's the real action of the scene – her lifting her foot. But if we started here, it wouldn't match up with the previous wider shot. Make sense?

She wiggles her toes, laughs, yada yada yada and then looks off screen at Scuttle's voice.

Fig.2.4.2(e): The Hook-up Pose - Errors

Fig.2.4.2(f): The Hook-up Pose - Errors

Cut wide and see how her create hooks-up. The opposite two very little guys don't matter as a result of they weren't in the previous scene. We're only concerned with Ariel's create. This can be just for a handful of frames.

Scuttle is flying and looking to land in one scene and Ariel pose changes again.

Fig.2.4.2(h): The Hook-up Pose - Errors

He then lands on her leg directly in next scene and camera trucks in to see that they are both in the initial Ariel position.

When noticed minutely we can see errors in hook up poses

Fig.2.4.2(g): The Hook-up Pose - Errors

Fig.2.4.2(i): The Hook-up Pose - Errors

Notes

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3. Prepare Computer Generated Models

Unit 3.1 Create Prototypes/Pilots for Testing

Unit 3.2 Produce 3D Animation, Pipeline and Modeling

Unit 3.3 Creating, Manipulating and Viewing Objects

Unit 3.4 Viewing the Maya 3D Scene

Unit 3.5 Polygonal Modelling

Unit 3.6 NURBS Modeling

Unit 3.7 Animation

MES / N 2502

Key Learning Outcomes

On completion of this Unit will enable you:

1. Constructing a prototype

2. Familiarise with the pipeline, schedule and timelines of the projects.

3. Preparation of 3D animation end-products using Maya Software.

4. Familiarise with the concept of pipelining and modeling.

5. Create 3D primitive objects.

6. Select objects for manipulation and editing purposes.

7. Move and rotate objects using your mouse.

8. Application of 3D animation techniques on Maya Software-Viewing the Maya 3D Scene.

9. Identify and use of camera tools.

10. Familiarise with the overview of workflow.

11. Application of 3D animation techniques on Maya Software-Polygonal Modelling.

12. Application of 3D animation techniques on Maya Software-NURBS.

13. Application of 3D animation techniques on Maya Software-Animation.

UNIT 3.1: Create Prototypes/Pilots for Testing

Unit Objectives

On completion of this chapter one can:

1. Create Prototypes/Pilots

2. Familiarise with the pipeline, schedule and timelines of the projects.

3.1.1 Introduction

Based on the requirement of project, its creative brief and client specifications with technical compliance the Designer needs to create a prototype/pilot project for testing. The final model must comply with the idea of final outcome on guidelines given by art Director and should perform on animation with consistent movement and manipulation.

3.1.2 Create Prototypes/Pilots for Testing

Create Prototypes for testing

A prototype is an initial idea to understand how final medium will function during production. Its build with specifications by client to give look and feel and to change accordingly, and a glimpse of current system. This helps understand functionality and system requirements.
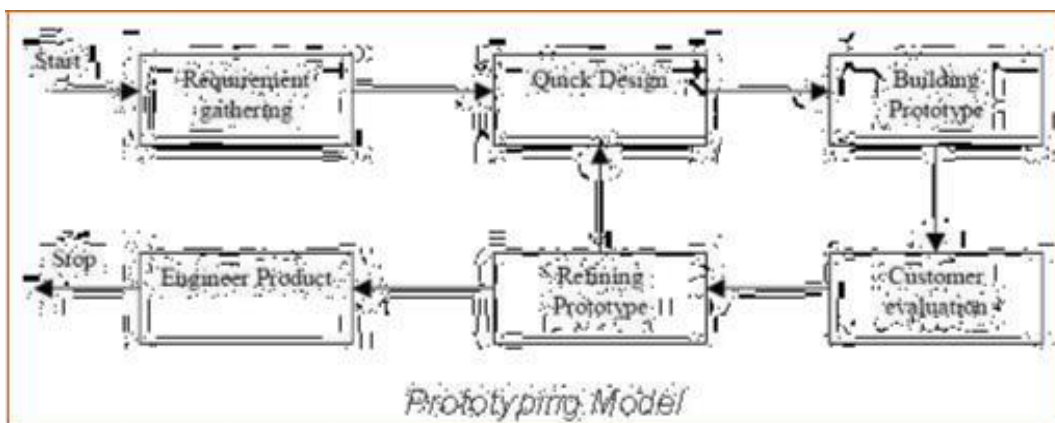
Prototyping Model

Prototype model diagram**:**

- Advantages of Prototyping
- Client in depth understanding
- Good involvement as a dummy working system is showcased
- Timely corrections
- Speedy approvals
- Quick error identifications
- Touch and Feel helps understand better
- Faster validation leads to project implementation

Disadvantages of Prototyping **:**

- Earlier creation leads entire repair for single error
- Extensive application of system distorts originality
- Full system use to creation leads to missing out on application unfinished
- Not sturdy feedback and concrete analysis

When to use**:**

- For excessive involvement of clients
- Web interfaces and Online Applications work best as have maximum interactions and system integration requires least supervision to Modellers
- Requires constant feedback to correct and improve hence users must be actively accessing the system, hence human interfacing is excellent

Note that polycounts, mesh compatibility and movement capacity should be checked for accurate adaptability to final display, ensuring working when animated and performance remains same.

3.1.The Pipeline, Schedule and Timelines

A well-made timeline helps check achieved parts of plan and sees pending milestones, it's a shot of core responsibilities for the entire expanse of project.

Five key steps are undertaken while making a project schedule and Time Management Knowledge function enables using the same however work closely with supervisor for supporting information

Step One: Identify Activities

First start by defining required actions to complete the project, includes products and deliverables both component to Work Breakdown structure, furthermore dividing into core activities. The scope of responsibility is necessary and incase not clear a briefing or team meeting should be done prior making the schedule. You can also assign activities to make schedule in parts to deliver this final plan. Regardless a commitment to timely implementation must be done for the delivery phases.

Step Two: Sequence Activities

Assuming you have a scope ready, you have already broken down requirements you will identify the task relation and dependability on each other. Careful analysis will help you identify this task by task. This identification makes a difference to you start and finish timeline.

Step Three: Resource Estimation

Resource estimation is identifying available team work force for your project, since industries undertake multiple projects no member can be 100% focused with just one task. Use the standard Gantt chart in Microsoft project, select available team member from Resource names column for each task. The more precise and smaller you cut down bigger projects the easier its allocation and follow up is.

Step Four: Activity Time Duration

Estimating required time for completion in days, weeks or months by right understanding of time taken for broken down tasks and estimating completion in fixed units, flexible timed work, and important completion. The correct selection determines the final project outcomes.

Step Five: Schedule

The final step to define schedule with timelines, workforce, structure and allocation. Planning of schedule ensure better accuracy to estimates and completion

Resource levelling is a feature in Microsoft project that helps determine realistic dates and assigned resources. However manually you better understand specifics of your team and time turnaround. Also excess of low assigning of tasks can be corrected.

UNIT 3.2: Produce 3D Animation, Pipeline and Modeling

Unit Objectives

On completion of this Module, you will :

1.   Produce 3D Animation, Pipeline and Modelling

2. Familiarise with the concept of pipelining and modeling.

3.2.1 The Maya User Interface

Maya

Amongst the many tools for software interface Maya is a leading one that helps generate 3D models. It has tools and editors that enable creating, animating and rendering 3D objects, also effects and scene manipulation can be done with this.

3.2.2 Starting Maya

Starting Maya

Double click on Maya icon on desktop or select from Microsoft (2000 or XP) Professional Start menu from Programs to Autodesk to Maya 2008 (Complete or Unlimited), on IOS select on desktop or in the Dock, else in the Apple finder go to application and browse. In Linux if not on desktop type Maya in shell window

Learning the Maya interface

- Work with menus.

- Use the Status Line buttons.

- Access the Shelf.

- Explore the Channel Box and Layer Editor
- Understand controls, commands and help lines
- Learning Quick secrets

A program developed by Autodesk, Maya enables creation, editing, animation and rendering with a single software. Different Maya softwares have updated features that differentiate them and allow you to create your own animated 3D scenes where you can render them into scenes or images. Advanced software even has Fluid effects, Costume and Hair effects. There is a Personal learning edition that is available for free whereas the Commercial and Complete version are chargeable. The primary learning helps you practice rendering and animation. With the ease being provided to animate the application has many tools, buttons and controls across the screen. Regular use gets you familiar with the groups. The top is the Shelf which has button rows headed by the Status Line, to right is Channel box having attributes related to selected object. Below it is Layer Editor. At the bottom of screen you have the Time slider and Range slider that let you animate between frames. You can type commands into the Command line and the Help line. The Toolbox and Quick Layout is on the left.

The agility of the software lets you follow different commands for same outcomes, the more familiar you get the easier you can create. Once you learn shortcuts you can become an Advanced user. A quick way to access is by the hot keys or right clicking in interface. Also a set of commands according to you can be created for shortcuts, menus and icons

3.2.2.1 Work with Menus

Always begin with main menu as a beginner, they have text lists and easy to learn. Explore the submenus that are small arrows at end of menus.

Changing Menu sets

Using the drop down list at the extreme left you can customize menu sets. You can select from Rigging, Animation, Rendering etc and change as required. Each has an associated hotkey, like F5 for FX. You can check them right next to menu that is opened and customize them in Hotkey Editor. Find the same with Windows, Settings to Hotkeys menu. Using them makes it easier and faster to use interface. The first six commands are present in all sets, File, Edit, Modify, Create, Display and Window.

Fig.3.2.1: Figure 1-1

Viewing Keyboard Hotkeys

Several menu commands have a keyboard hotkey listed to the right of the menu, as shown in Figure 1-2. Pressing these hotkeys on the keyboard executes the command. Hotkeys provide a quick and easy way to execute a command, and learning to use them will make you much more efficient. You can customize hotkeys using the Hotkey Editor, which you open with the Window, Settings / Preferences, Hotkeys menu command.
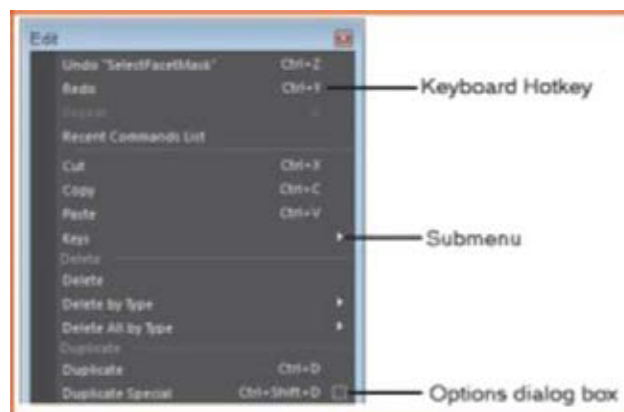
Fig.3.2.2: Figure 1-2

Accessing Option Dialog Boxes

There is options dialogue box that give you changeable parameters, included as small boxes on right in some menus. Available with Apply buttons and constant commands that remain the same till next use. Use the reset button in Reset Setting to erase parameters set.
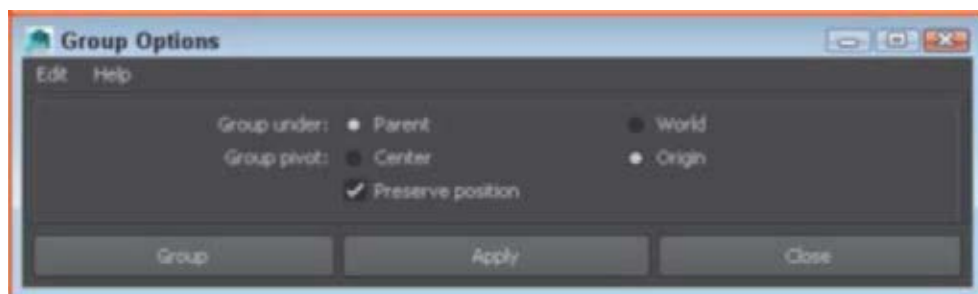
Fig.3.2.3: Figure 1-3

Using Tear-Off Menus

Tear off menu functions as a separate panel by dragging it wherever required on interface to use. Every menu has this option at top of it. It requires space to move and may cover work you are doing if extensively open. To help size it does not display hotkeys.
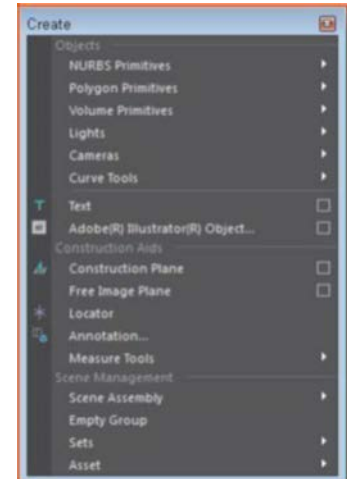
Fig.3.2.4: Figure 1-4

Tools versus action

Tools can be used multiple ways and times but actions only once. The last tool is shown in the bottom of toolbox to check. Tool settings can be opened by double clicking on any tool and setting parameters that will remain constant till changes next. You can use Reset button which is at top of Tool settings.
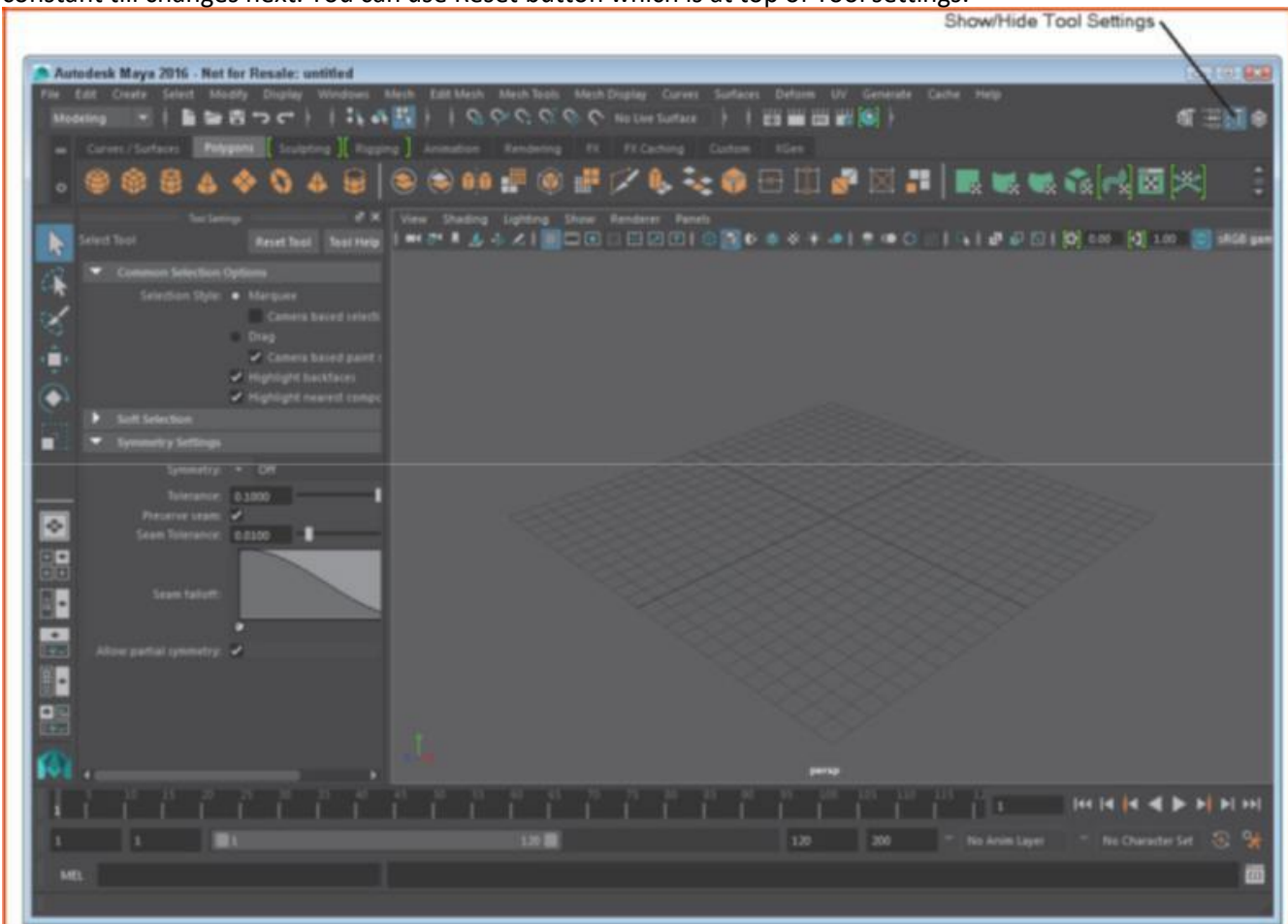
Fig.3.2.5: Figure 1-5

Tutorial 1: Creating Polygon Sphere

1. **Step 1:** From create menu, select submenu polygon primitives to then click on Options icon to open dialogue box.

2. **Step 2:** click on Apply button, a single sphere object will appear on workspace.

3. **Step 3:** Exit the box with Close.

4. **Step 4:** Go back to Cone Menu in Submenu Polygon Primitives. A cone will appear over sphere.

5. **Step 5:** On pressing key 5 objects appear shaded and resemble crystal ball.

6. **Step 6:** To Save, go to File and Save Scene As.
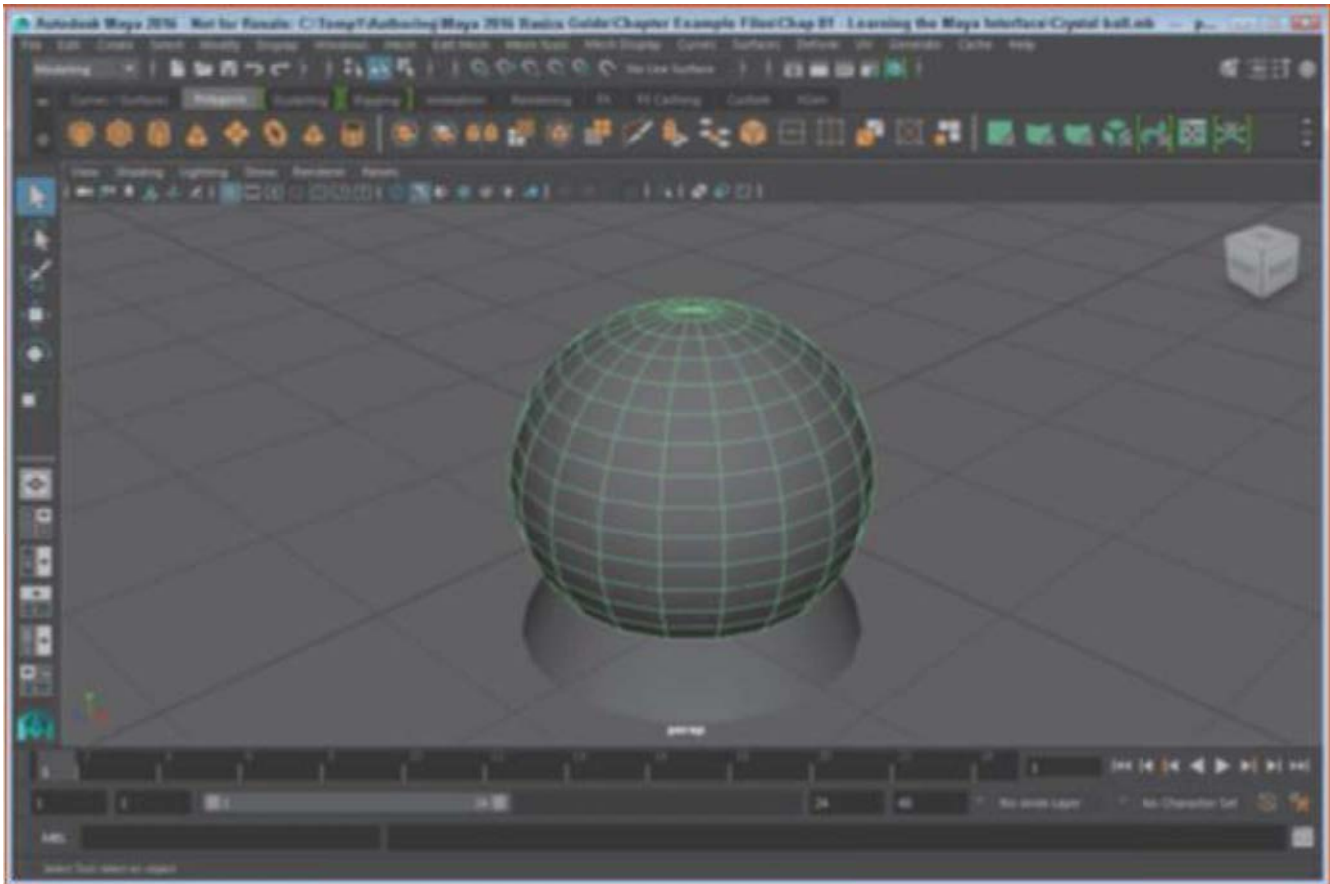
Fig.3.2.6: Figure 1-6

3.2.2.2 Use the Status Line Buttons

The Status Line is at top having buttons that can't be customized however you can hide the line itself. Divided in groups called Menu Set List, File Buttons, Selection Mode Menu, Selection Mask buttons, Snapping Buttons, History Buttons, Rendering Buttons, Transform fields and Editors buttons
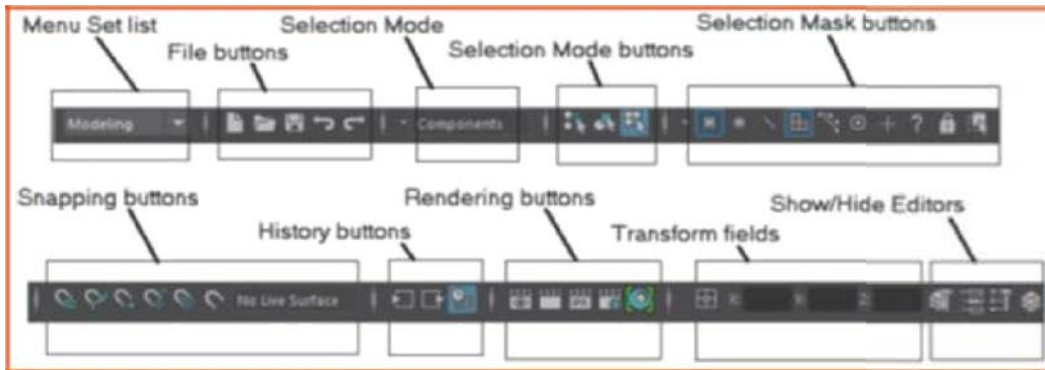
Fig.3.2.7: Figure 1-7

Using Help

When you need assistance understanding tools on Status line, just hold mouse cursor on any tool, automatically a texted explanation will pop up making interface easier. You can change this Pop Up settings in Window, Settings and Preferences menu

Fig.3.2.8: Figure 1-8

Cursor Cues

The cursor changes when interface buttons have pop up menus and while using certain tools, a small menu is shown in icon next to cursor. You can right click to access them.
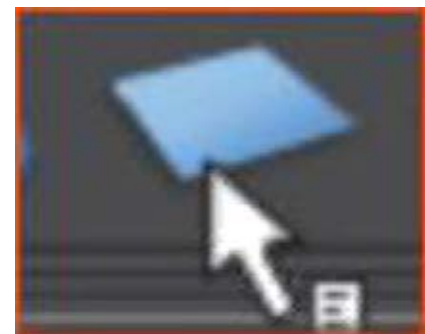
Fig.3.2.9: Figure 1-9

Expanding and Collapsing Icon Button groups

Click on the vertical lines that divide each groups to Show Hide tools. Click to hide and click the same line to show.

Fig.3.2.10: Figure 1-10

Opening and Saving a Scene

Open and Save buttons placed at right of Menu selection open File Box that you can select file names and location of or see the saved file. A newly saved files name will display on the title bar.
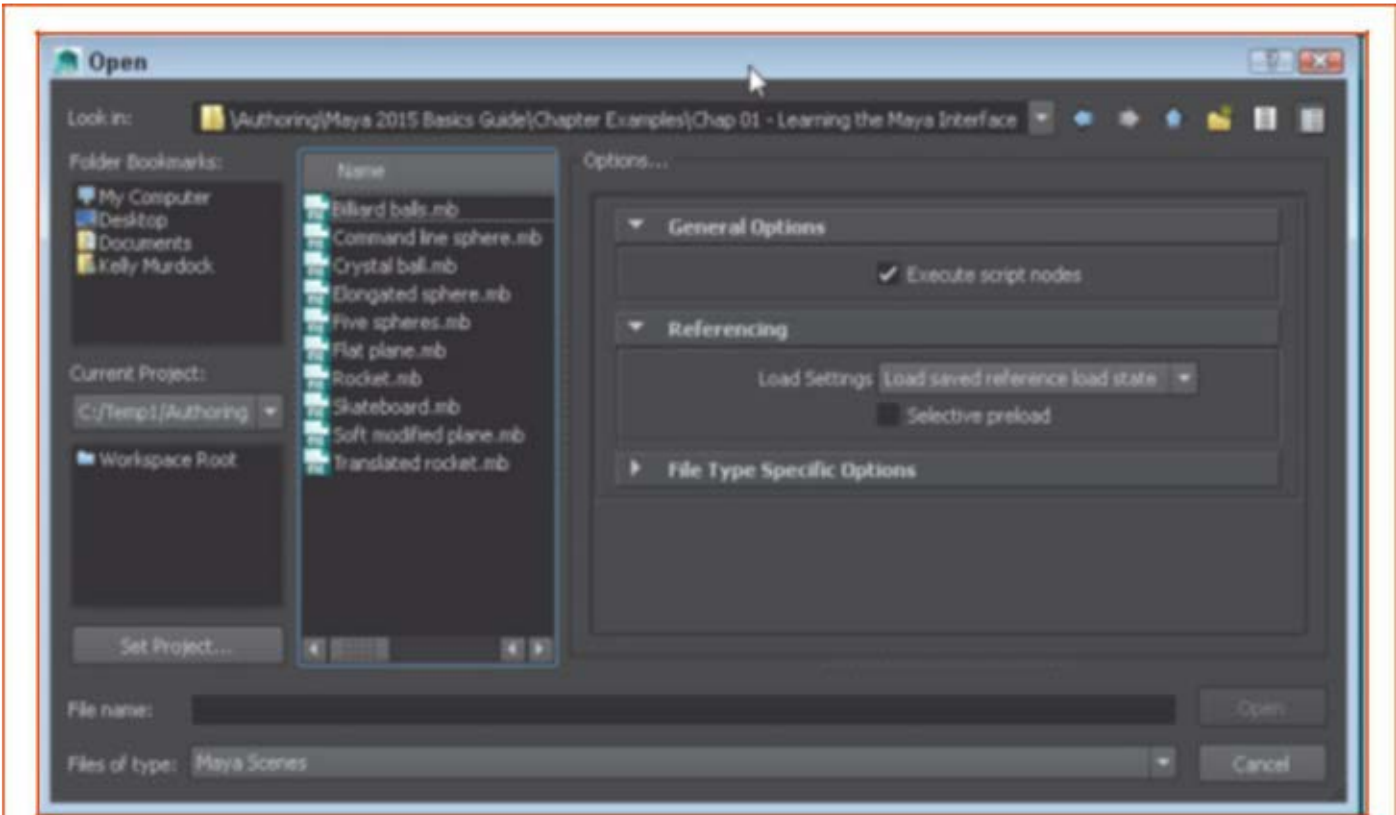
Fig.3.2.11: Figure 1-11

Opening Editors

Four sidebar buttons are always visible and used to show or hide either of panels including Chanel Box, Attribute editor, Tool Settings and Modeling toolkit covering different aspects like attributes, configured settings and animated keyables respectively. Channel box is also known as Layer editor
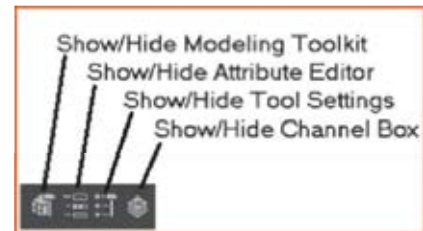
Fig.3.1.12: Figure 1-12

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Showing Hiding Interface elements

Right click and hold cursor button on dotted line on the top right or left of Status line. Holding cursor on Show Hide shows Interface elements, where using Display, UI Elements you can show hide menus.

Fig.3.2.13: Figure 1-13

Tutorial 1: Open a File

1. **Step 1:** place cursor on left corner of status line till pop up shows Open Scene
2. **Step 2:** Click to open dialog box.
3. **Step 3:** Go through and locate directory
4. **Step 4:** Click on file, Open button to access on Maya   .
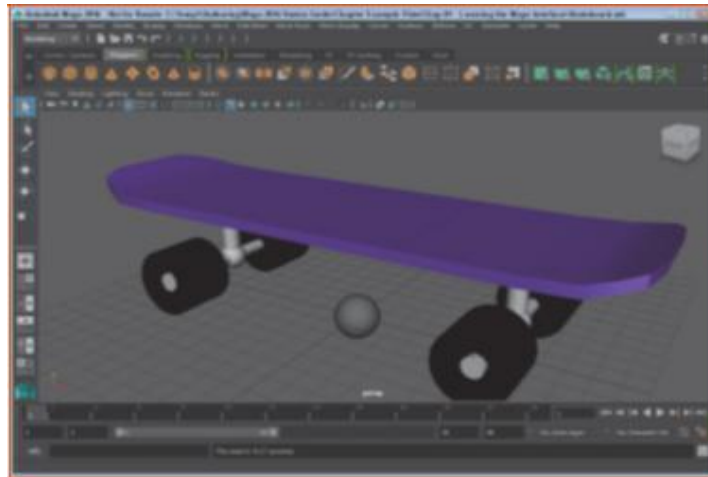
Fig.3.2.14: Figure 1-14

Tutorial 2: Save a File

1. **Step 1:** Move cursor over Status line buttons to left end to get Save Current Scene Pop up
2. **Step 2:** two merged worked on files will replace the one layered on automatically.
3. **Step 3:** To save New File/ Scene go to File, Save as

Tutorial 3: Maximize Interface

1. **Step 1:** Minimize status line by right clicking on dotted double line on left end.
2. **Step 2:** Hide Chanel Box, Shelf and Toolbox by right clicking on dashed double lines.
3. **Step 3:** Right click on double lines at bottom of interface to select each.
4. **Step 4:** Select Display, UI Interface, and Status line to get Status line back.
5. **Step 5:** Select Display, UI Elements, and Show UI elements to get others back.

Fig.3.2.15: Figure 1-15

3.2.2.3 Access the Shelf

The Shelf has many panels of buttons as you can seen below

Fig.3.2.16: Figure 1-16

Using the Menu

There are two menus on the Shelf, one is an arrow other is a small tab. You can create new shelves, delete shelves and customize shelves. You can hide them as well by turning option off in Shelves Menu.

Creating and Deleting Shelves

Click on create new shelf and a dialog will open to name the shelf, which will appear at right bottom of tabs. Click on Delete shelf by selecting current menu to delete it

Fig.3.1.17: Figure 1-17

Adding icons and Menu commands

Click on Ctrl Command and Shift keys together to add menu command. You can move icons with Centre mouse button to add or delete by dragging to delete shelf icon. The middle mouse button can also be your scroll. If none use Ctrl command and left mouse click to use as same.

Adding layout and scripts

You can customize layout by selecting Panels, Panel editor from Panels menu. Select custom layout in Layout tab and then click Add to shelf button. Also drag scripts buttons with middle mouse click to drop into shelf will show as MEL (maya expression language).
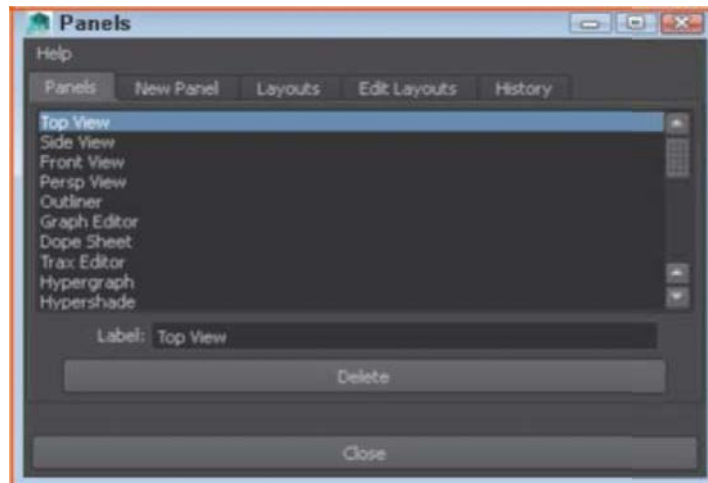
Fig.3.2.18: Figure 1-18

Using the Shelf Editor

The Shelves menu includes an option that will open the Shelf Editor dialog box. Using this editor, shown in Figure 1-19, you can reorder and rename the tabs and shelves, edit the icons within each shelf, and change the settings for the shelves.
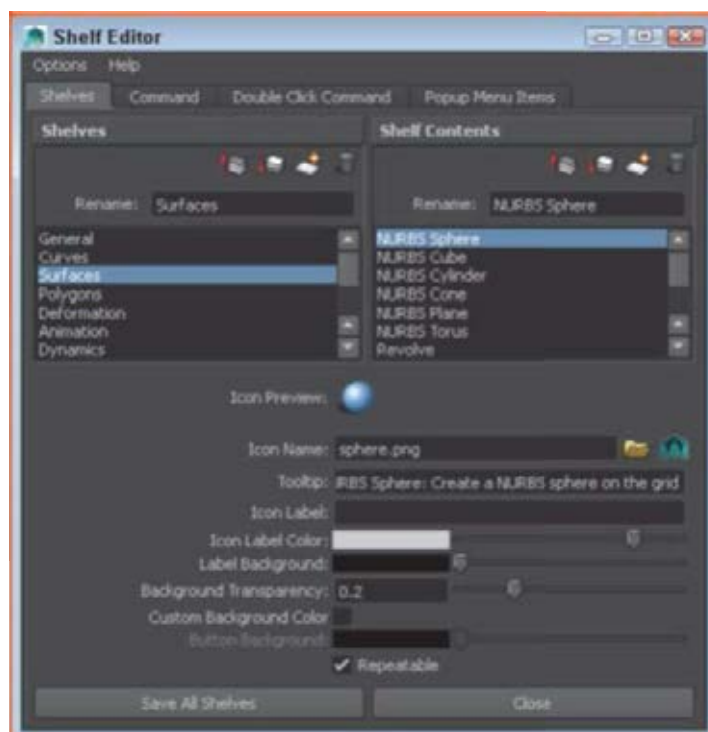
Fig.3.2.19: Figure 1-19

Tutorial 1: Create a New Shelf

1. **Step 1:** on shelf menu select new shelf.

2. **Step 2:** enter name for shelf in dialog box.

3. **Step 3**: click ok, new tab appears on right end

Tutorial 2: Populate a New Shelf

1. **Step 1:** click on MyShelf to activate.

2. **Step 2:** click on Ctrl and Shift keys on keyboard to Create, NURBS Primitives, polygon. A new polygon will be added.

3. **Step 3:** add other primitive objects.

4. **Step 4:** open panel editor from panel menu.

5. **Step 5:** Select layout, click add to shelf button.

6. **Step 6:** Drag move tool to the Shelf.

7. **Step 7:** Save all Shelves from Shelf Menu.
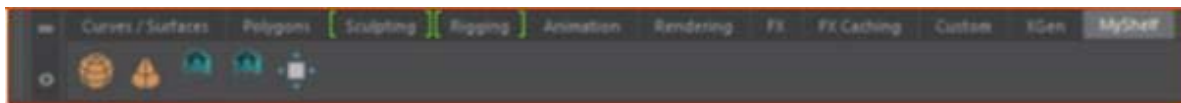
Fig.3.2.20: Figure 1-20

3.2.2.4 Explore the Channel Box and Layer Editor

Channel box displays attributes of selected objects. These are usually numbers but can be colour as well. You can change these values by selecting them and changing to new values by pressing enter to freeze.

Fig.3.1.21: Figure 1-21

Selecting Attributes

Click on the title to select attribute to highlight it, select multiple attributes by using Ctrl key command with clicks.

Using Channel Sliders

Change slider settings to Slow, Medium or Fast by using buttons on top of Channel Box, change values by selecting attributes, and sect linear or hyperbolic settings. Use number commands like +=2 in attribute field to change radius value. Lock an attribute by choosing lock attribute in channels menu, similarly unlock the same way.
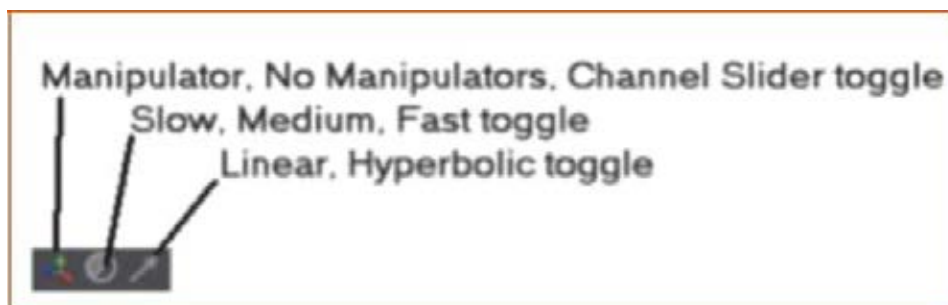
Fig.3.2.22: Figure 1-22

Locking Attributes

Locked attributes cannot be changed. You can lock an attribute by selecting it and choosing the Lock Selected menu command from the Channels menu. Locked attributes will be appear "grayed out," as shown in Figure 1-23. Unlock any locked attributes using the Channels, Unlock Selected menu command.
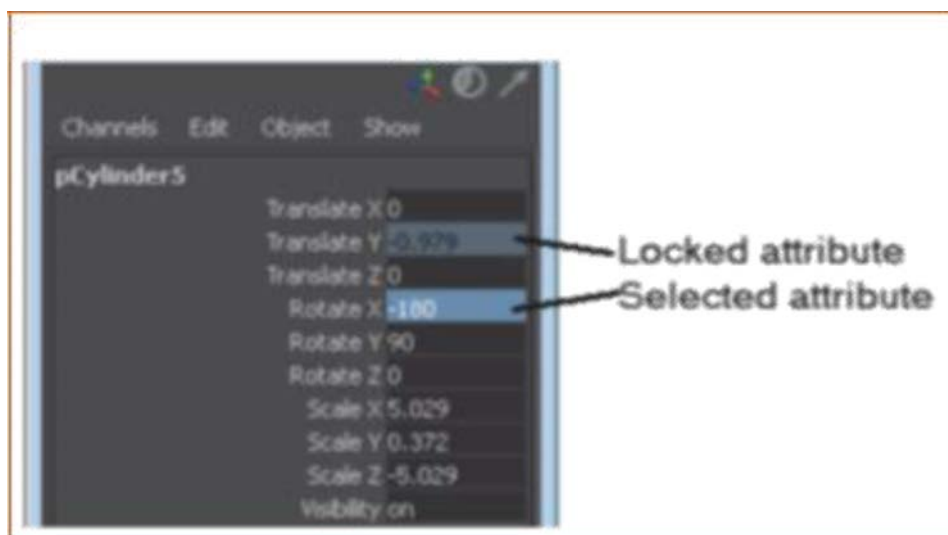
Fig.3.2.23: Figure 1-23

Adding and Deleting Layers

The Layer editor helps in creating new layers and deleting them too. This divides scene elements and layers to give them a name, type and colour. Even if layers are deleted their objects remain.
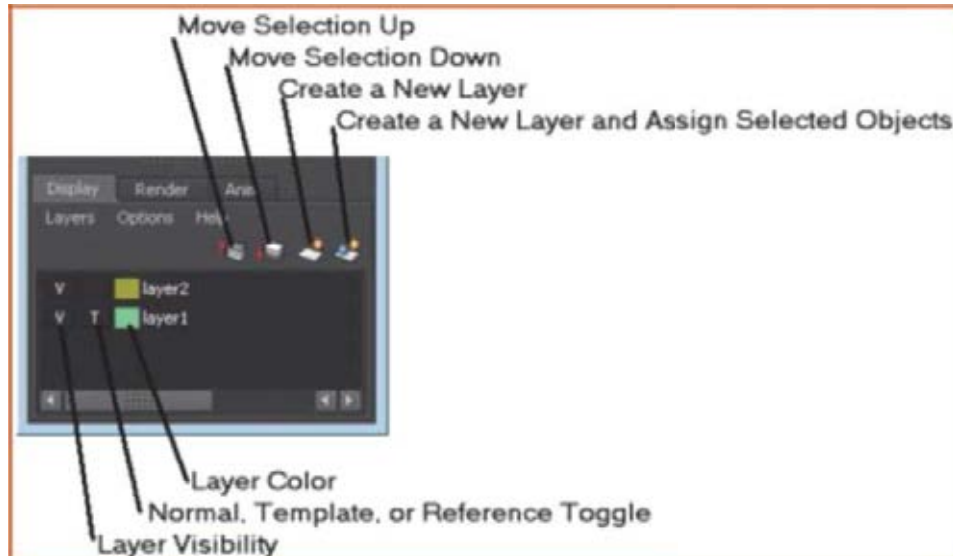
Fig.3.2.24: Figure 1-24

Adding Objects to a Layer

You can add selected objects to a layer by right clicking on that layer and selecting Add Selected Objects from the pop-up menu. You can also use the Layers menu to select all objects in a layer and to remove objects from a layer. Objects assume the layer color when unselected.

Hiding All Layer Objects

You can hide Layer objects by clicking the first column in the Layer Editor. This column sets the visibility for the layer objects and is a simple toggle button that you can turn on or off. The letter V appears when the layer objects are visible and the column is empty when the layer objects are hidden.

Freezing All Layer Objects

The second column can be set to Normal, Template or Reference. The letter T appears in this column when the layer is a template. Template layers cannot be selected or moved while they are templates. References are proxy objects that stand in for complex objects. The third column is the layer color. Double-clicking on this column (or on the layer name) opens the Edit Layer dialog box, shown in Figure 1-25, where you can select a new color, change the layer's attributes, or change the layer's name.
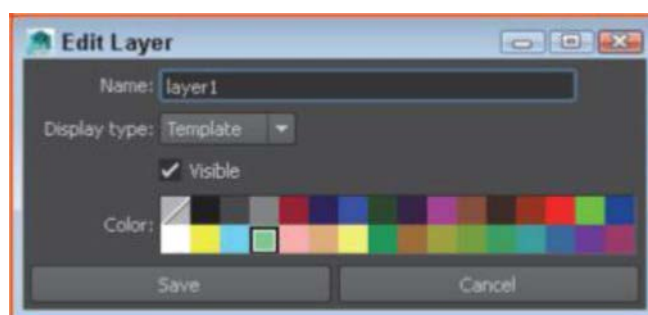
Fig.3.2.25: Figure 1-25

Tutorial 1: Changing Channel Box Attributes

1. **Step 1:** Movement is done using the X and Y axis. You can go to Select Files, Open Scene (which requires work) All attributes for the object can be seen in the Channel box.

2. **Step 2:** For simple movement horizontally enter a number in Translate X, for Vertical movement enter a number in Translate Y axis. Eg 5 will move 5 units distance

3. **Step 3:** Translate Y option attribute in Channel Box is clicked and dragged upward in workspace with middle mouse button. The object is moved along the Y-axis a distance equal to the amount that the mouse was dragged and the attribute value is changed, as shown in Figure 1-26.

4. **Step 4:** Select File, Save Scene As and save the file as Translated rocket.mb
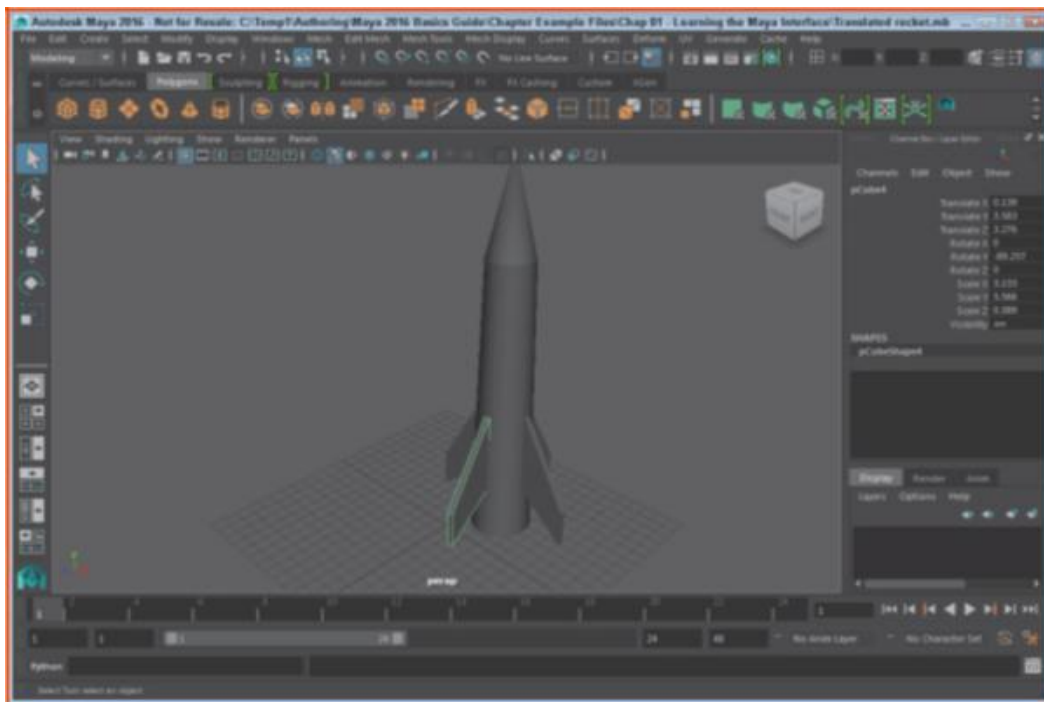
Fig.3.2.26: Figure 1-26

Tutorial 2: Layer create and rename

1. **Step 1:** Use the Layer editor for same by clicking on create new layer. T

2. **Step 2:** Then double click on layer in interface to pop up Edit Layer box.

3. **Step 3:** Write the new layers name and hit Save

Tutorial 3: Adding objects to Layers

1. **Step 1:** Select the required object from Create, Polygon primitives

2. **Step 2:** Then In Edit, select all menu for objects selection

3. **Step 3:** Using Layer Editor Add Selected objects command to the new layer by simple right click on it

4. **Step 4:** To hide them use toggle button to hide these

3.2.2.5 Animation Controls, the Command Line, and the Help Line

Several interface controls are used to toggle through different animation frames. There is Command Line lets you type word commands and below it is the Help Line that displays information related to interface

Selecting Animation Frame

The Time Slider displays all working on frames at the bottom by numbers. Enter frame number in the right of slider or use black time marker to move between them.

Fig.3.2.27: Figure 1-27

Setting Animation Range

Focus on selected set of frames by the Ranger slider. When it is moved the Time Slider changes.

Fig.3.1.28: Figure 1-28

Playing Animation

Many Buttons that let you play, pause, forward, rewind, end of frame etc are placed on animation frame. You can see your work by clicking the buttons as required

Fig.3.2.29: Figure 1-29

Preferences

Animation preferences can be changed by opening the Preferences dialog box below the Go to End button, this selects Timeline category to edit.

Fig.3.1.30: Figure 1-30
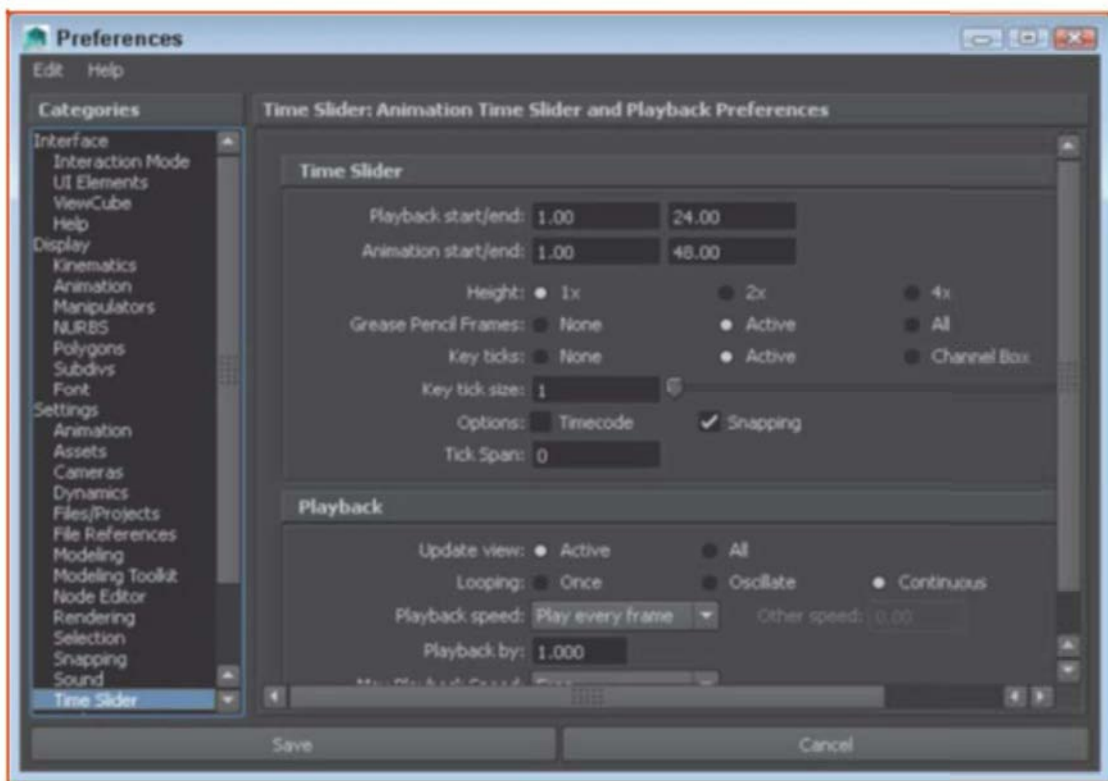
Fig.3.2.31: Figure 1-31

Tutorial 1: Play an Animation

1. **Step 1:** Go to File, Open and double click on file name that you need to open .
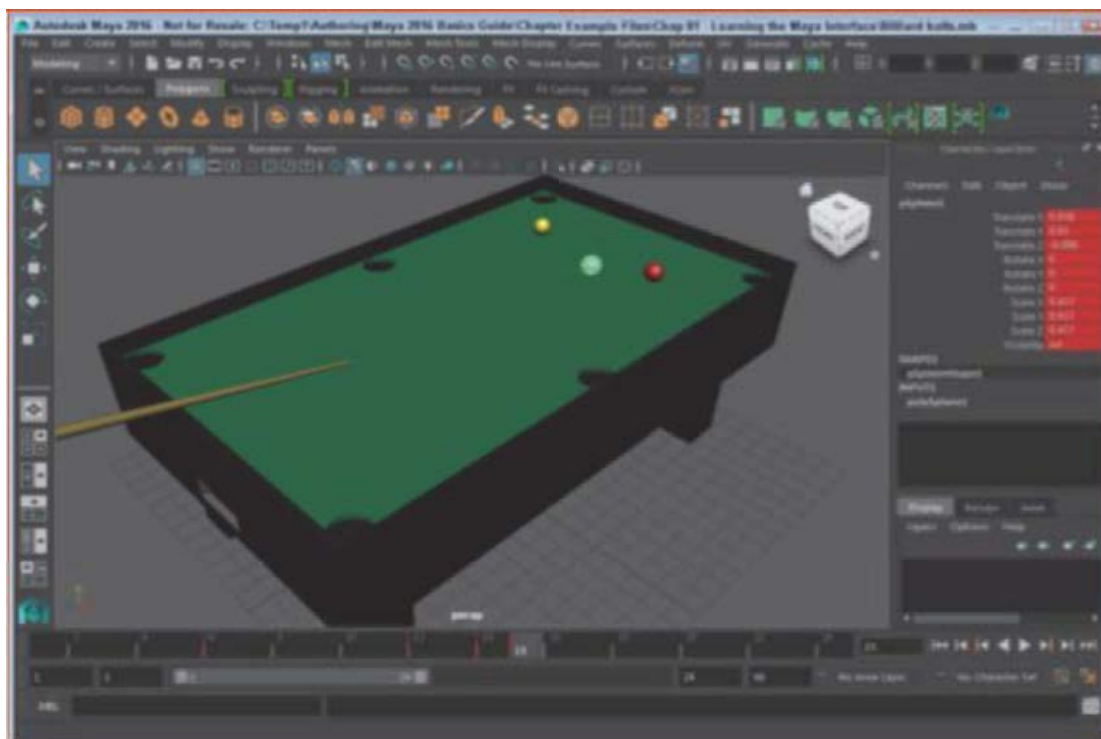
Fig.3.2.32: Figure 1-32

2. **Step 2:** Using the time marker in Time Slider to move to left to increase the frames and see objects move.

3. **Step 3:** Click Play Forward button to play the animation repeatedly

4. **Step 4:** Stop button is clicked for pausing the animation

3.2.2.6 Use the Toolbox and Quick Layout Buttons

The Toolbox has Quick Layout buttons that are on the left of interface. There are several buttons to use from.

Selecting Objects

Click on the Select tool to extend a rectangular border around the object to select and the Lasso tool to select objects in any free shape as desired around it. To see selected objects in set, use the Select Object tool with the Shift key. The objects will be coloured white whereas just the last which is the key object will be green.
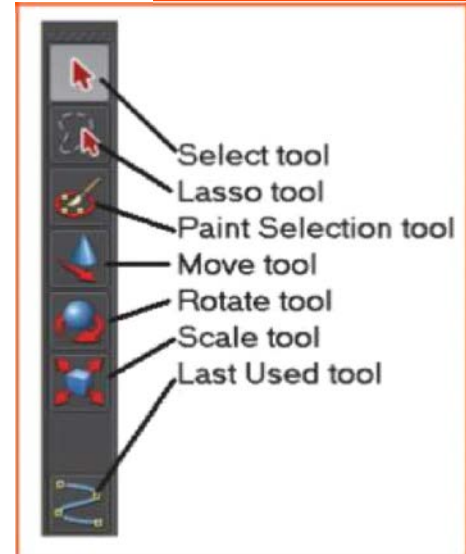
Fig.3.1.33: Figure 1-33

Use of Transform Tools

Transform objects that are selected using the Toolbox. When required tool is selected a Manipulator occurs in the centre of object to Rotate or Scale it within a single axis of the pivot point. On selecting tool handle it turns yellow to enable dragging it with mouse button. You can enter values manually by using transform values button.
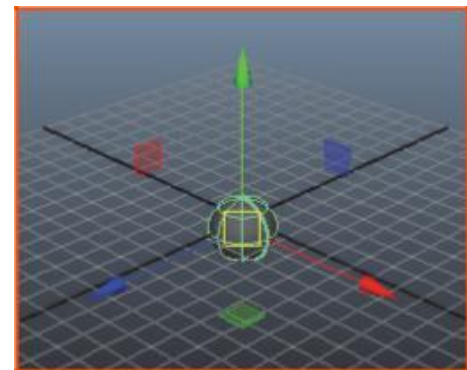
Fig.3.1.34: Figure 1-34

Using Manipulators

There are three axis colours to the yellow coloured manipulator that let you drag and transform objects, Y axis is green, Z axis is blue and X axis is red. Use Shadow Manipulator to change light requirements like direction, reflection, fall against etc. by dragging the Object Manipulator. The toolbox below Show Manipulator tool will always hold the last tool as current used till another is selected.
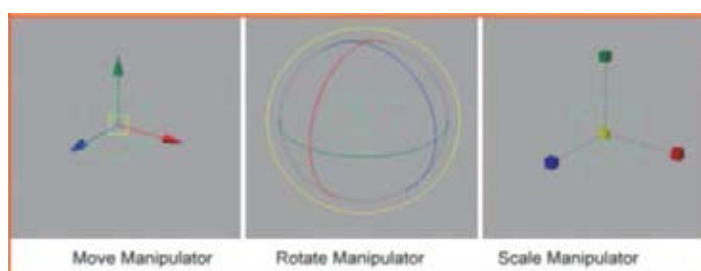
Fig.3.2.35: Figure 1-35

Switching Layouts

You can change layouts in the interface from default ones by clicking on arrow below to get additional menus apart from the defaults. Options visible are Single Perspective View, Four View, Outliner, Graph Editor, Hypershade, and Perspective/Hypergraph/Graph.
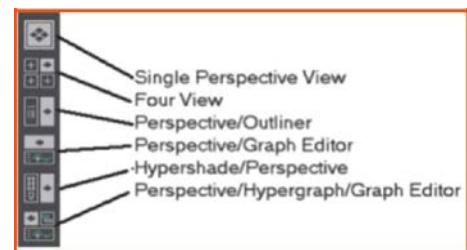

Single Perspective View
Four View
Perspective/Outliner
Perspective/Graph Editor
Hypershade/Perspective
Perspective/Hypergraph/Graph Editor

Fig.3.2.36: Figure 1-36

Customizing Layouts

Select layouts from pop up box that appears when you click the Model view button placed at bottom of Quick Layout. You can select multiple panes and Model View will show the division, and let you change display view of frames

Resizing and Editing View Panels

You can drag the dividers between panels to resize or use the Spacebar to alternate between active views to maximise working panel in interface. You can change Panel views by the Panels, Saved Layouts and Edit Layouts menu to create, edit and choose existing layouts
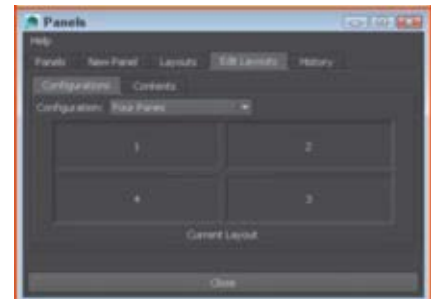
Fig.3.2.37: resizing panel

Tutorial 1: Select an Object

1. **Step 1:** Open Five spheres.mb file having five sphere objects.

2. **Step 2:** Select tool is clicked and then center sphere is clicked. Sphere in scene becomes light green

3. **Step 3**: while holding Shift key, other spheres is clicked. All spheres will be selected while last sphere would be light green as in Figure 1-38.
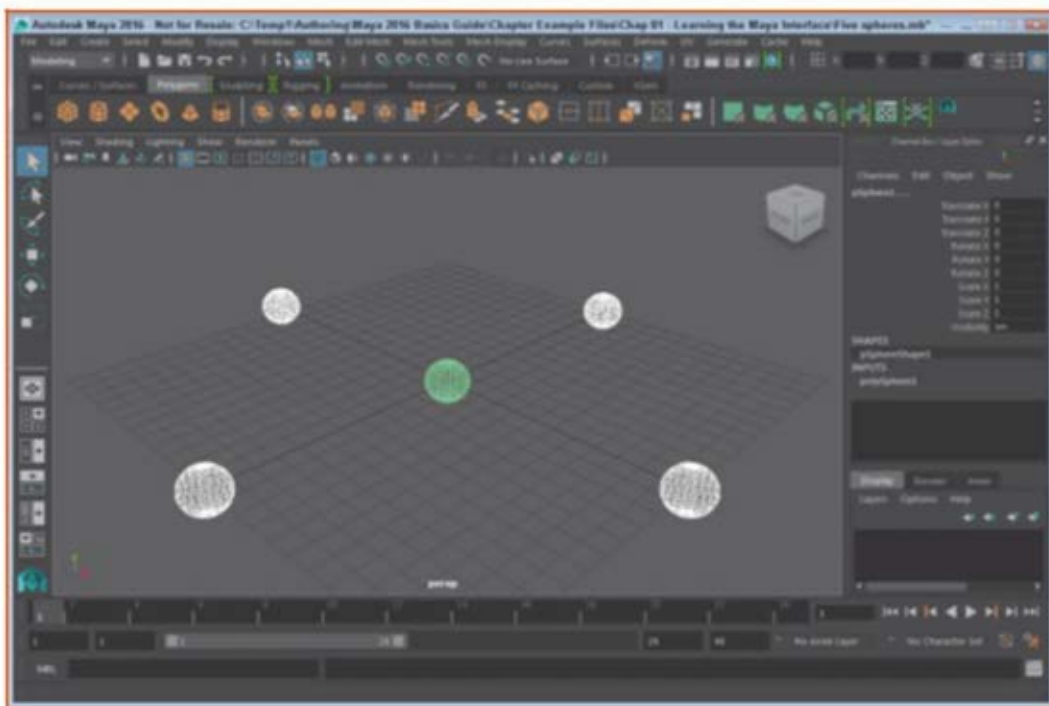
Fig.3.2.38: Figure 1-38

Tutorial 2: Transform an Object

1. **Step 1:** File Five spheres.mb is opened

2. **Step 2:** Select tool to select one object and use Shift key to select multiple objects. The last selected will be light green and rest will be white.

3. **Step 3:** Using Select tool select object then Click on Move tool in Toolbox to drag upward or downward. The Scale tool can be used to move left or right.
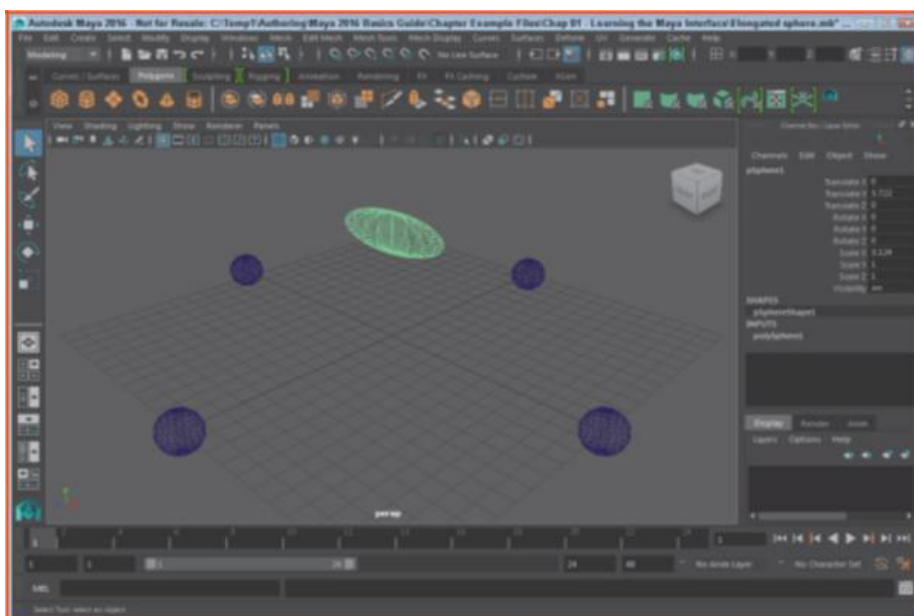

Fig.3.2.39: Figure 1-39

4. **Step 6:** As in figure, sphere is elongated along the X direction
5. **Step 7:** SAVE AS the file

Tutorial 3: Changing Interface Layout
1. **Step 1:** At end of Status line click on Show/Hide buttons and click on Four Views button in Quick Layout.

2. **Step 2:** Click required layout as wanted.
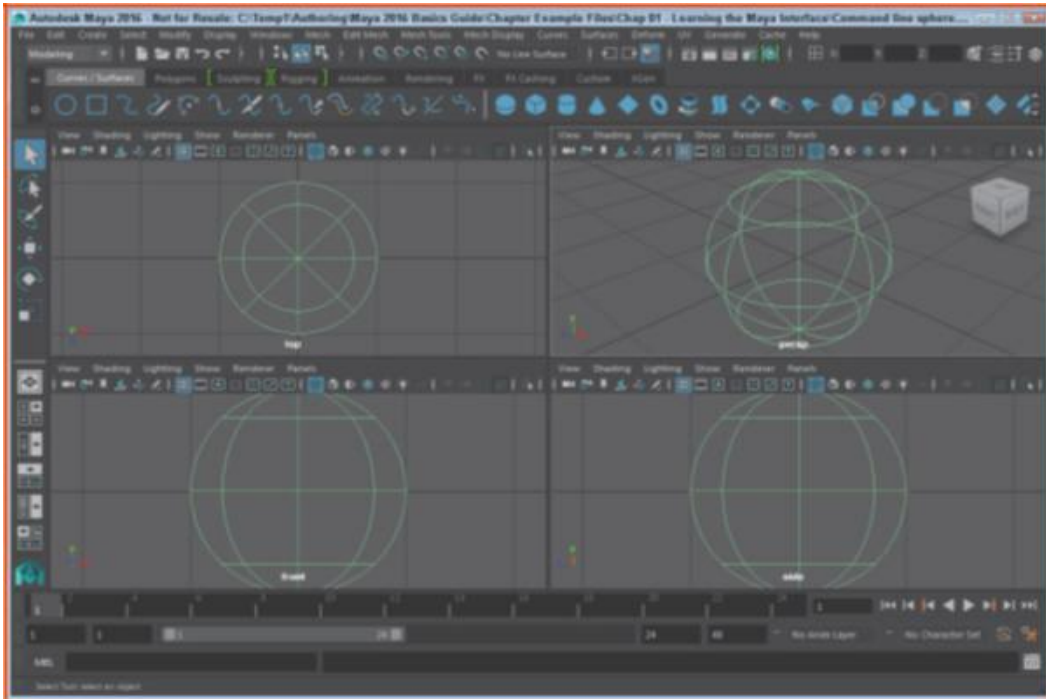
Fig.3.2.40: Figure 1-40

3.2.2.7 Discover the Secret Menus

Hidden menus that appear as pop up and not always open on Interface.

Accessing the Marking Menus

Access marking menu by right click on view panel and holding to see menu appearing, releasing the button will let you select required command. There are alphabets on keyboard denoted to marking menus, like hold down q for selection options, e for rotate tools, h for Menu sets etc
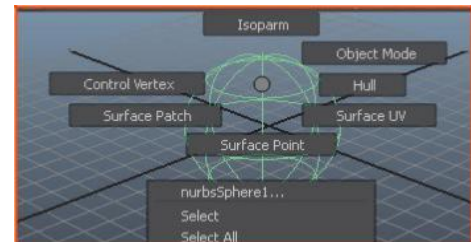
Fig.3.2.41: Figure 1-41

Customizing Marking Menus

Go to Windows, Settings, Marking Menu command to customize, alter, assign keys with these..
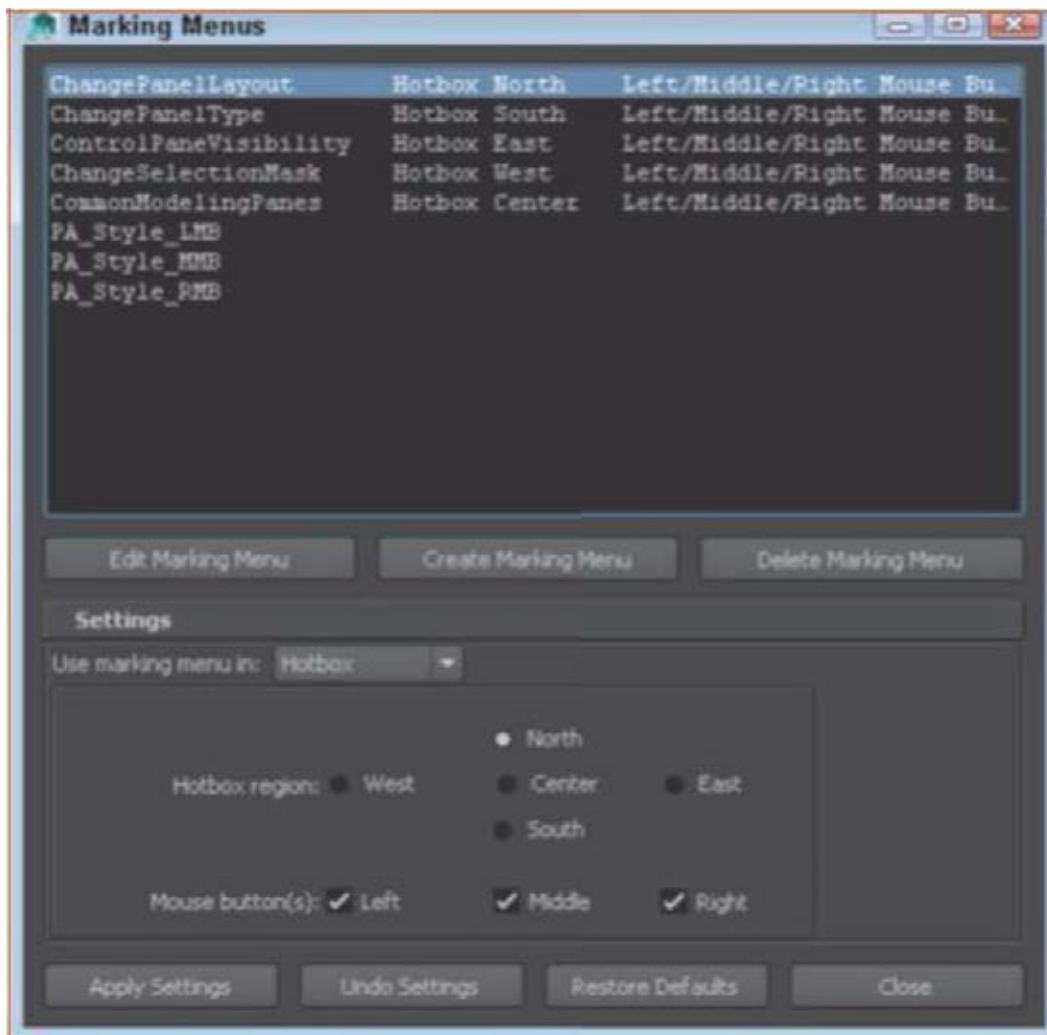
Fig.3.2.42: Figure 1-42

Using the Hotbox

It is menu created by you that can be accessed by holding down the Spacebar. Use Hotbox Controls button to customize the commands. You can access it by placing cursor on View menu and holding down Spacebar appear
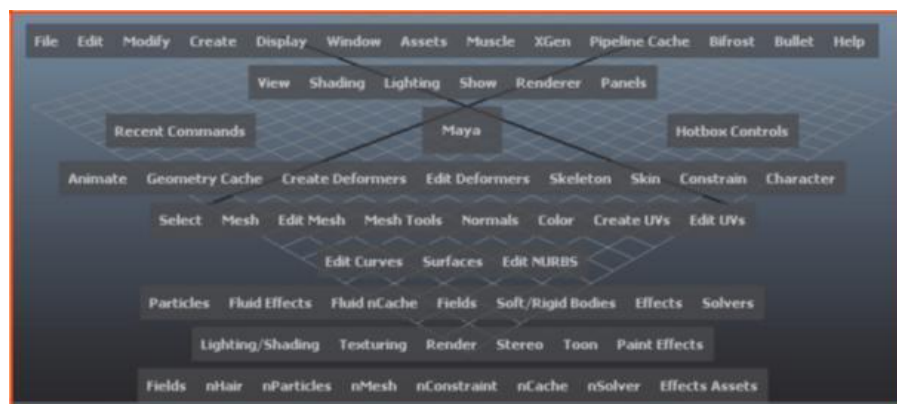
Fig.3.2.43: Figure 1-43

Customizing the Hotbox

If you select the Hotbox Controls option from the Hotbox, you can select which menu sets to include in the Hotbox. You can also select to Show or Hide all menus.

Tutorial 1: Access a Marking Menu

1. **Step 1:** Select Create, Polygon Primitives, Sphere to create a sphere object.

2. **Step 2:** Click on the view panel away from the sphere to deselect it.

3. **Step 3:** Right-click on the sphere and choose Select from the pop-up marking menu. The sphere object is selected.

Tutorial 2: Use the Hotbox

1. **Step 1:** Move the cursor to the center of the view panel and press and hold the Spacebar. The Hotbox appears centered around where the cursor is located, as shown in Figure 1-44.

2. **Step 2:** Drag the cursor to the Create button and select the Polygon Primitives, Sphere command. The sphere object appears in the view panel.

3. Release the Space bar.
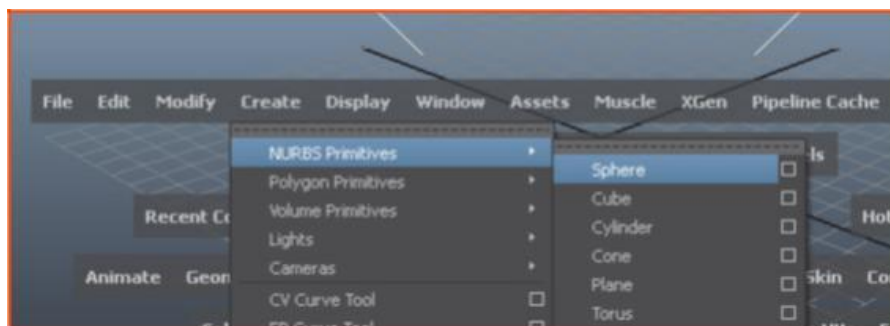
Fig.3.2.44: Figure 1-44

3.2.3 Working with NURBS Surfaces

NURBS is an acronym for Non-Uniform Rational B-Spline. These splines are mathematically defined lines that you can manipulate to form unique shapes. A NURBS surface is a solid object created from NURBS curves. NURBS surfaces are useful for modeling organic objects like flowers and trees where the surfaces flow into one another.

NURBS surfaces, like NURBS curves, can be edited by moving their control vertices (CVs). You can also display hulls for the NURBS surfaces to see how the various CVs are connected. Using the right-click marking menu, you can select to see all the components that make up a NURBS surface.

Another common component for NURBS surfaces are isoparametric curves (isoparms, for short). Isoparms are representative lines that show the object surface. The direction of an isoparm is defined using the U and V coordinate system with U-direction isoparms running horizontally and V-direction isoparms running vertically.

At the Rough resolution (enabled by pressing the 1 key) the number of isoparms is greatly reduced, but at the Fine resolution (enabled by pressing the 3 key), many additional isoparms are shown. New isoparms can be created easily by dragging from an existing isoparm to mark the location of the new isoparm. Marked isoparms can be made permanent using the Surfaces, Insert Isoparms menu command.

The area between the Isoparms is called a patch. Each patch face has two sides. The side that is rendered is determined by the direction of a hidden vector that is called the normal. It extends perpendicular to the patch face.

NURBS surfaces can be created using the Create, NURBS Primitives menu or by using one of the Surfaces menu commands on a NURBS curve. Once the NURBS surface is created you can use the operations found in the Surfaces menu to work with it.

Some of the operations found in the Surfaces menu let you attach and detach, align, open and close, extend, offset and fillet surfaces. These operations all require that one or more surfaces are selected before they can be used. The Help Line explains exactly what must be selected to use an operation.

The Surfaces menu also includes several tools and commands that may be used to edit NURBS surfaces including the Surface Editing tool, the Sculpt Geometry tool, and the Break and Smooth Tangent commands. The Surface Editing tool lets you click on a surface location and move it with a manipulator or change its tangent. The Sculpt Geometry tool lets you push, pull, and smooth a surface using an interactively changeable brush. Breaking tangents lets you create hard edges on NURBS surfaces.

Trimming is the process of adding holes to NURBS surfaces. This is accomplished by marking the area to trim with a NURBS curve. These curves must be attached to the surface by projecting it onto the surface, marking an intersection between another surface or by drawing on a live object.

Booleans offer a way to combine, subtract, and extract an intersecting volume between two overlapping NURBS surfaces.

Stitching NURBS surfaces together attaches the surfaces so that moving one causes the other to move with it. Maya lets you stitch objects by points, edges or using a Global Stitch command.

You can also convert between the various modeling types using the Modify, Convert menu. This menu allows you to convert between NURBS, polygons, and subdivision surfaces.

3.2.3.1 Learn the NURBS Primitives

The simplest NURBS surfaces are the primitive objects that can be created using the Create, NURBS Primitives menu. The NURBS primitives include the sphere, cube, cylinder, cone, plane, and torus (which is shaped like a doughnut), as shown in Figure 2-1. When selected, the primitive object appears at the grid's origin.
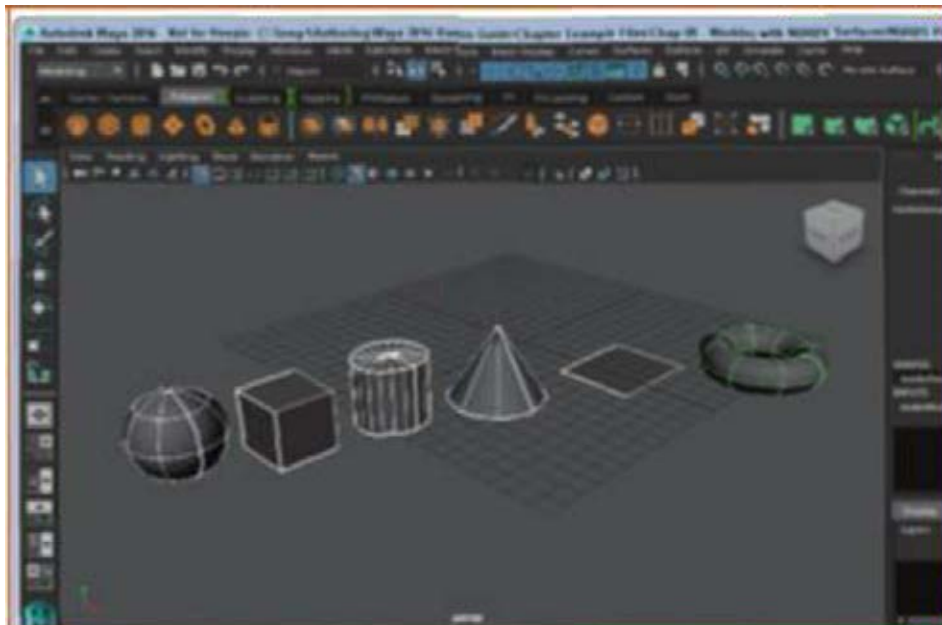

Fig.3.2.45: Figure 2-1

Creating Spheres and Cubes

For the NURBS sphere primitive, you can select the axis about which the sphere is oriented. You can also change the start and end sweep angle values to create a partial sphere, as shown in Figure 2-2, using the Sphere Options dialog box. The Radius value determines the size of the sphere and the number of sections and spans define the number of isoparms that are shown in the sphere. The cube NURBS primitive includes similar orientation axis. You can also specify the cube's width, length, and height values and the U and V Patches options set the number of isoparms.
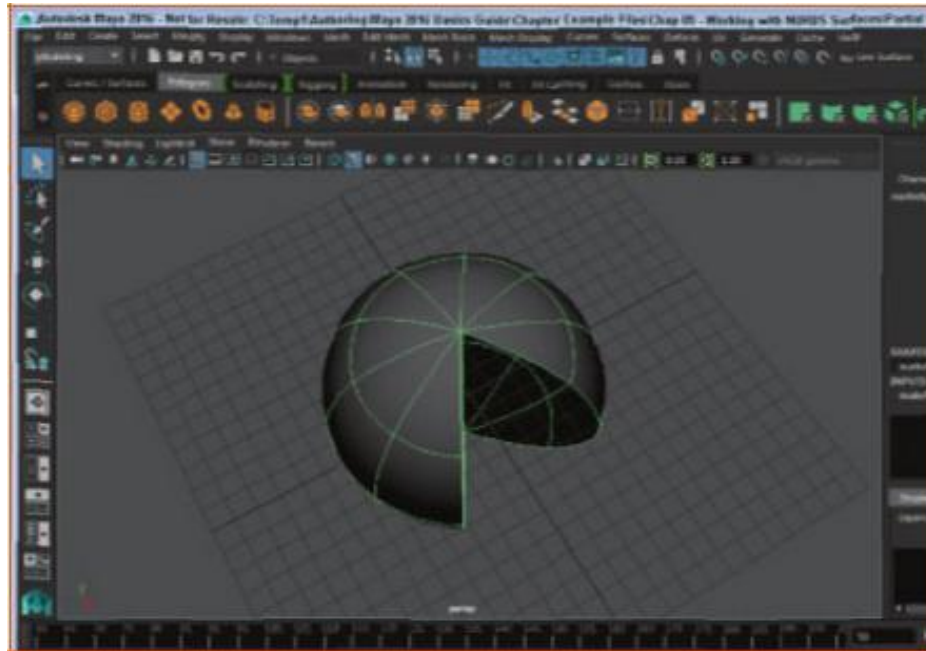
Fig.3.2.46: Figure 2-2

Creating Cylinders and Cones

The cylinder and cone NURBS primitives include Start and End Sweep Angles settings for creating partial objects. You can also enter radius and height values and whether the object includes a cap on the top, bottom, or both. The number of sections and spans determines the number of patches that make up the object.

Creating a Plane and a Torus

For plane NURBS primitives, you can set the width and length values. For the torus NURBS primitive, you can set start and end sweep angle values, as well as radius and minor radius values.

Inserting Isoparms

The number of isoparms is initially set by the number of segments and spans, but you can add more patches to a NURBS primitive using the Surfaces, Insert Isoparms menu command. If you select Isoparm display mode from the marking menu, you can drag from an existing isoparm to the location where you want the new isoparm to be located. This location is marked with a yellow dashed line, shown in Figure 2-3. If you apply the Insert Isoparms menu command with the At Selection option enabled, a new isoparm is created. The Between Selections option lets you create new isoparms for the U or V direction for the entire object.
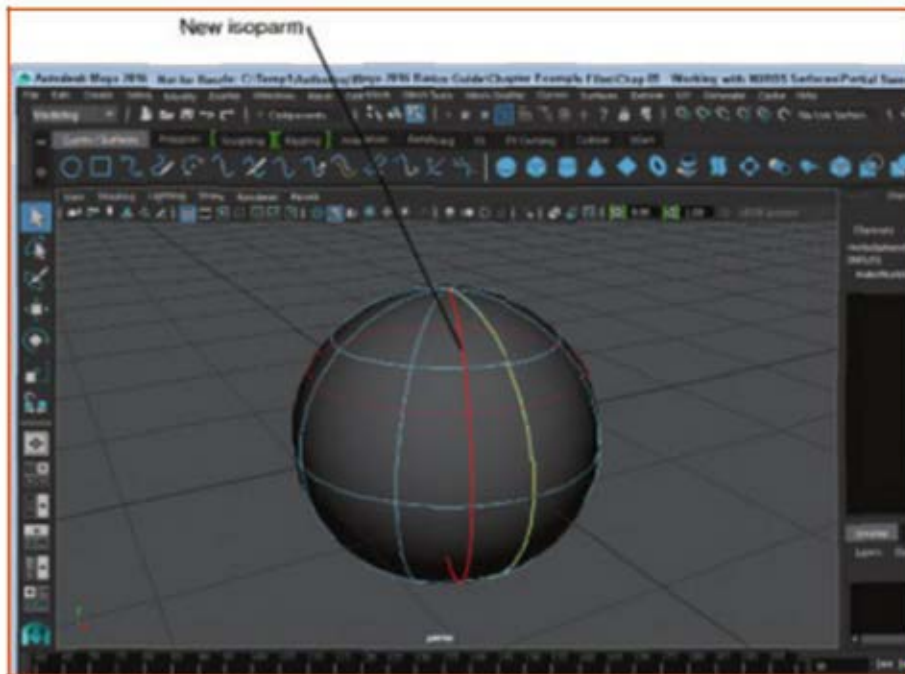
Fig.3.2.47: Figure 2-3

Tutorial 1: Create a Candle from Primitives

1. **Step 1:** Click on the Four Views button in the Quick Layout Buttons.

2. **Step 2:** Select Layout type in Quick Layout button

3. **Step 3:** Click on the Scale tool and drag the green Y-axis manipulator to increase the cylinder's height.

4. **Step 4:** Create another cylinder object using the Create, NURBS Primitives, Cylinder menu command.

5. **Step 5:** Drag the center handle in the Top view with the Scale tool to reduce the diameter of the cylinder, and then drag the green Y-axis manipulator upward to lengthen the cylinder. Select the Move tool and drag the green Y-axis manipulator to move the small cylinder to the top of the larger cylinder. The larger cylinder is for the candle and the smaller cylinder is the wick.

6. **Step 6:** Create another cylinder object using the Create, NURBS Primitives, Cylinder menu command.

7. **Step 7:** Drag the center handle in the Top view with the Scale tool to increase the diameter of the cylinder, and then drag the green Y-axis manipulator downward to reduce the cylinder's height. Select the Move tool and drag the green Y-axis manipulator to move the large flat cylinder to the base of the candle.

8. **Step 8:** Create a sphere object using the Create, NURBS Primitives, Sphere menu command.

9. **Step 9:** elect the Move tool and drag the sphere upward in the Front view to the top of the candle wick.

10. **Step 10:** Click on the Select by Component button in the Status Line.

11. **Step 11:** Drag over all the top CV points in the Front view and move them upward in the Front view using the green Y-axis manipulator.

12. **Step 12:** Select the very top CV point on the sphere and drag it up and to the left in the Front view. The edited sphere looks like a simple candle flame, as shown in Figure 2-4.

13. **Step 13:** Save the file in Save Scene As, Name the File .
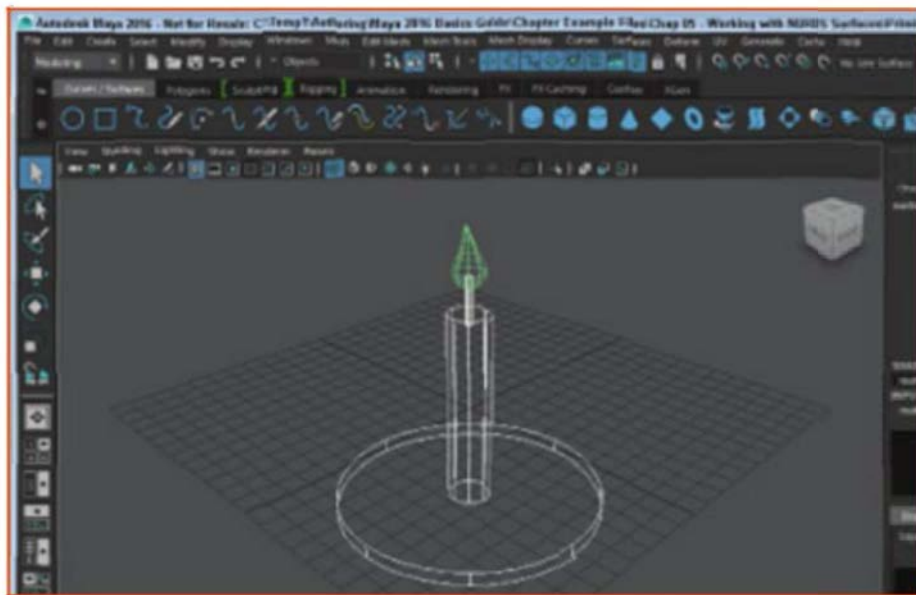
Fig.3.2.48: Figure 2-4

Tutorial 2: Add Isoparms

1. **Step 1:** Create a cone object using the Create, NURBS Primitives, Cone menu command.

2. **Step 2:** Right-click on the cone object and select Isoparms from the pop-up marking menu.

3. **Step 3:** Then, click and drag from the bottom circle upward about halfway up the cone. A yellow dotted line appears where the new isoparm is located.

4. **Step 4:** Select Surfaces, Insert Isoparms. A new isoparm is added to the object.

5. **Step 5:** Right-click on the cone object and select Isoparms from the pop-up marking menu again.

6. **Step 6:** Drag over the bottom circle and the new isoparm to select them both. The isoparms turn yellow when selected.
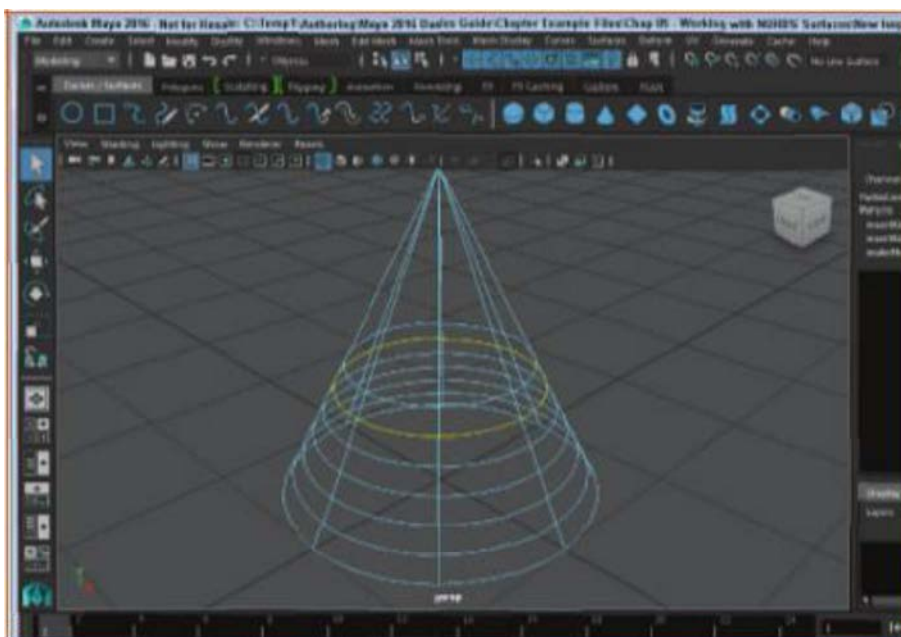
Fig.3.2.49: Figure 2-5

7. **Step 7:** Select Surfaces, Insert Isoparms, Options.

8. **Step 8:** Select the Between Selections option and set the # Isoparms to Insert value to 5. Then click the Insert button. Five new isoparms are created and equally spaced between the two selected isoparms, as shown in Figure 2-5.

9. **Step 9:** Select File, Save Scene As and save the file as New isoparms.mb.

3.2.3.2 Edit NURBS Surfaces

Once a NURBS surface is created, you can edit its surface directly by selecting and transforming its components. Transforming the object's CVs edits the basic shape of these primitives. Press F8 or use the Status line after selecting object by clicking on Component Type button. Use upwards downwards arrows to select CV ; select the primitive's CVs by right-clicking on the object and selecting Control Vertices from the marking menu. The selected CVs can then be transformed using the Move, Rotate, and Scale tools.

Selecting Components

NURBS surfaces can have as many times the number of CVs as a NURBS curve, as shown in Figure 2-6, which can make it tricky to select the exact CVs you want. To help resolve this problem, you can use the commands in the Selection menu. The Selection menu includes the Grow CV Selection, Shrink CV Selection, Select CV Selection Boundary, and Select Surface Border commands. These commands can really be helpful as you select NURBS surface components to edit.

Note: With a CV Selected, you can use the arrows keys to select the adjacent CV.
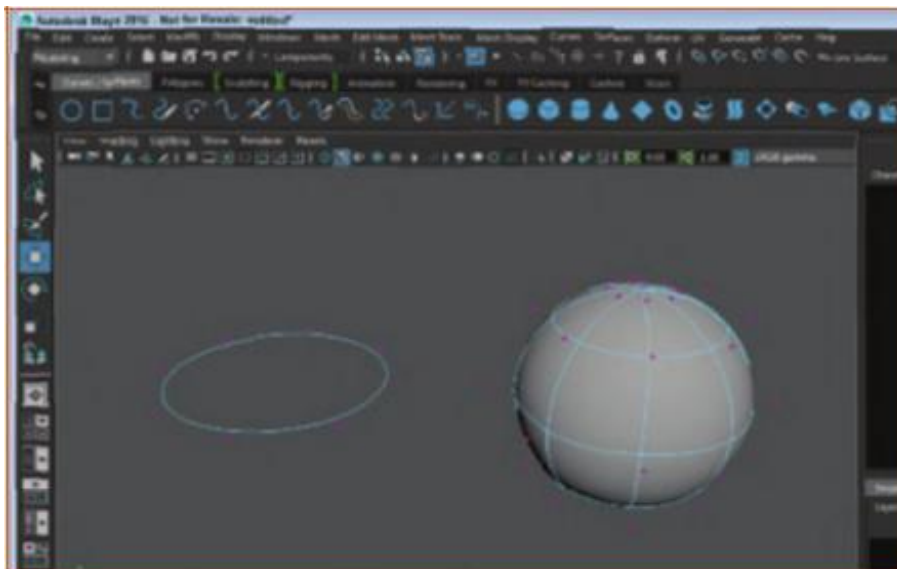
Fig.3.2.50: Figure 2-6

Using the Surface Editing Tool

With the Surfaces, Surface Editing, Surface Editing tool selected, you can click on any point of the surface and a set of manipulators appears (as shown in Figure 2-7) that let you move the selected point. Dragging the Point Position handle moves the point and dragging the Slide Along Curve manipulator with the middle mouse button slides the Point Position handle along the isoparm. Clicking the Tangent Direction toggle switches between a U align, V-align, and normal-aligned tangent. The Tangent Direction handle can also be manipulated to change the surface point's tangent. Clicking on one of the dotted axis lines aligns the tangent to that axis.
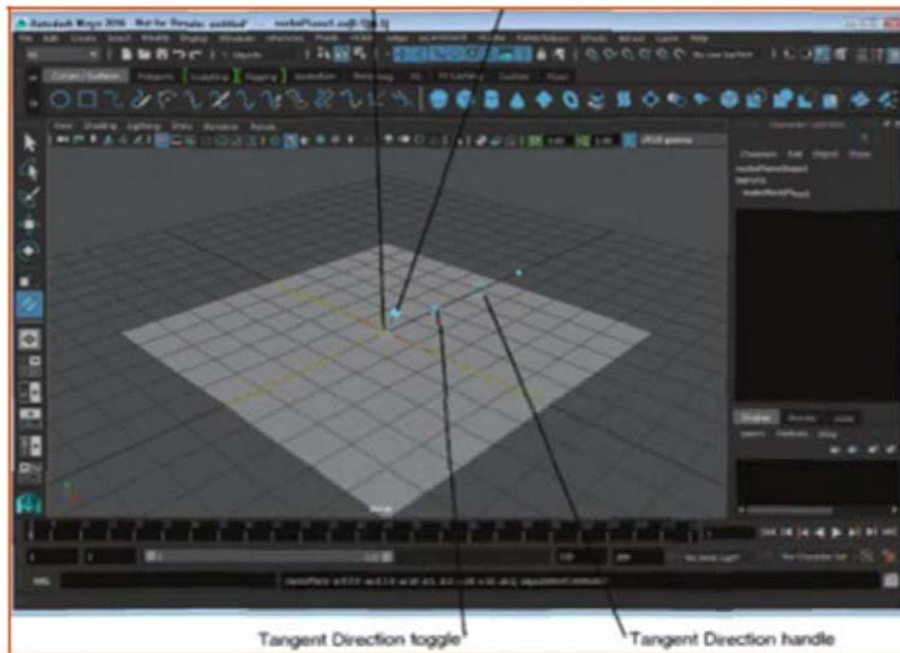
Fig.3.2.51: Figure 2-7

Using the Sculpt Geometry Tool

The Sculpt Geometry tool, available in the Surfaces menu, lets you push, pull, smooth, and erase surface CVs. Using the Tool Settings dialog box, shown in Figure 2-8, you can select the radius, opacity, and shape of the sculpt tool. When selected, a red manipulator shows you the size of the brush radius and an arrow pointing away from the radial circle shows how far the brush moves the surface. You can then paint on the surface of an object to deform the surface.

Note: You can interactively change the brush radius by dragging with the b key held down; you can change the brush distance by dragging with

Fig.3.2.52: Figure 2-8

Simplifying Surfaces

The Surfaces, Rebuild Surfaces menu command reduces the complexity of a surface. This option offers several different rebuild options and you can rebuild only the U or V direction.

Breaking and Smoothing Tangents

By default, NURBS surfaces are smooth across their surface because the tangent points between all the CVs are aligned, but if you want to create a hard edge, you can break the tangent for a selected isoparm using the Surfaces, Surface Editing, Break Tangents menu command. The Surfaces, Surface Editing, Smooth Tangents menu command may be used to smooth an isoparm that has been broken.

Tutorial 1: Edit NURBS Components

1. **Step 1:** Create a plane object using the Create, NURBS Primitives, Plane menu command.

2. **Step 2:** Click on the Select by Component Type button in the Status Line (or press the F8 key).

3. **Step 3:** Select the Move tool, hold down the Shift key and select the CVs at opposite corners of the plane object.

4. **Step 4:** Then drag the two CVs upward using the green Y-axis manipulator. The surface of the plane object bends to follow the CVs' movements.

5. **Step 5:** Hold down the Shift key and select the other two opposite corner CVs.

6. **Step 6:** Drag these two CVs downward using the green Y-axis manipulator.

7. **Step 7:** Press the 5 key to see this surface shaded, as shown in Figure 2-9.

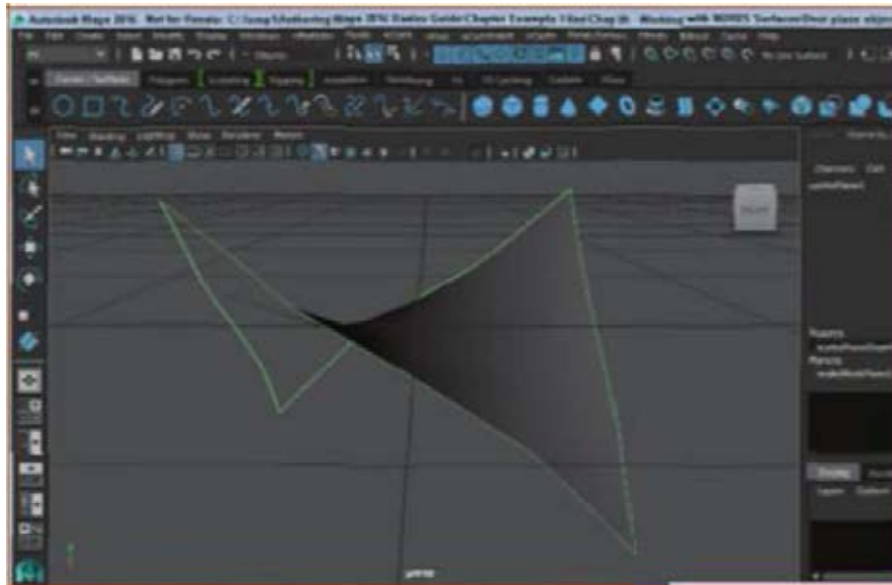8. **Step 8:** Select File, Save Scene As and save the file as Bent plane object.mb.

Fig.3.2.53: Figure 2-9

Tutorial 2: Use the Surface Editing Tool

1. **Step 1:** Create a sphere object using the Create, NURBS Primitives, Sphere menu command.

2. **Step 2:** Click on the Model View button from the Quick Layout buttons and select the Top View command from the pop-up menu.
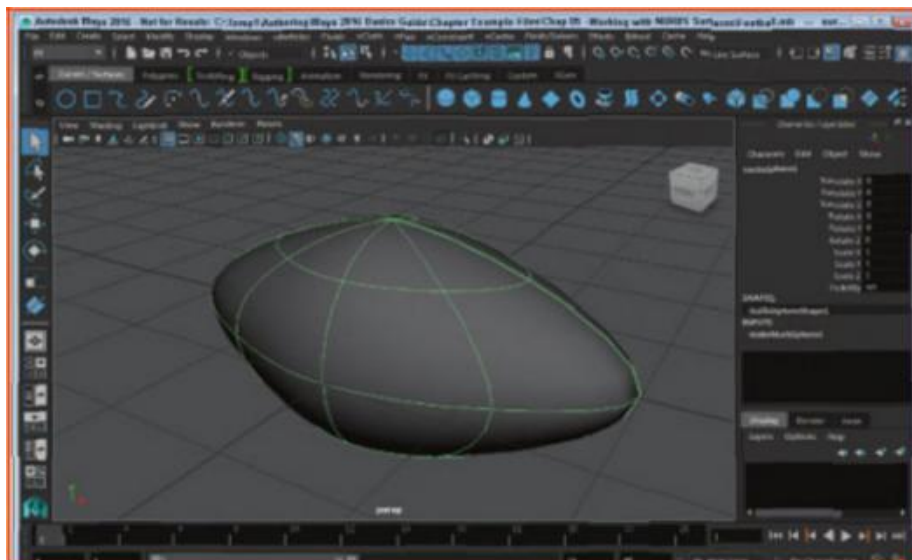
Fig.3.2.54: Figure 2-10

3. **Step 3:** Select the Surfaces, Surface Editing, Surface Editing Tool menu command.

4. **Step 4:** Click on the left edge of the sphere and drag the Point Position handle to the left to elongate the sphere.

5. **Step 5:** Then select and drag the Tangent Distance handle until it is on top of the Point Position handle.

6. **Step 6:** Repeat Steps 4 and 5 for the right side of the sphere.

7. **Step 7:** Click the Model View button again and select the Perspective view. Then press the 5 key to see the object shaded. The sphere object looks like a football, as shown in Figure 2-10.

8. **Step 8:** Select File, Save Scene As and save the file as Football.mb.

Tutorial 3: Use the Sculpt Geometry Tool

1. **Step 1:** Select the Create, NURBS Primitives, Cylinder, Options menu command to open the NURBS Cylinder Options dialog box. Set the Radius value to 5, the Height to 15, the Number of Sections to 20 and the Number of Spans to 10. Select the Both option for Caps and click the Create button.

2. **Step 2:** Press the key to zoom in on the selected plane object.

3. **Step 3:** Select the Surfaces, Sculpt Geometry Tool menu command. Double-click on the tool in the Toolbox and select the Pull option from the Tool Settings panel.

4. **Step 4:** Hold down the 'b' key and drag the tool radius to around 2.0. Then hold down the 'm' key and drag the Max Displacement value to around 2.0. Moving the cursor over the cylinder surface shows the size of the Radius and an arrow pointing out from the surface shows the Max Displacement.

5. **Step 5:** Move the sculpt cursor to the side of the cylinder and drag several times to pull a section away from the surface. This pulled section is the character's nose.

6. **Step 6:** Rotate the view until the pulled area is directly in front of the view. Select the Push option in the Tool Settings panel and drag below the pulled area to create a mouth.

7. **Step 7:** Hold down the 'b' key and drag to set the Radius to about 1.0, and then drag in two places above the nose area to create some eye sockets.
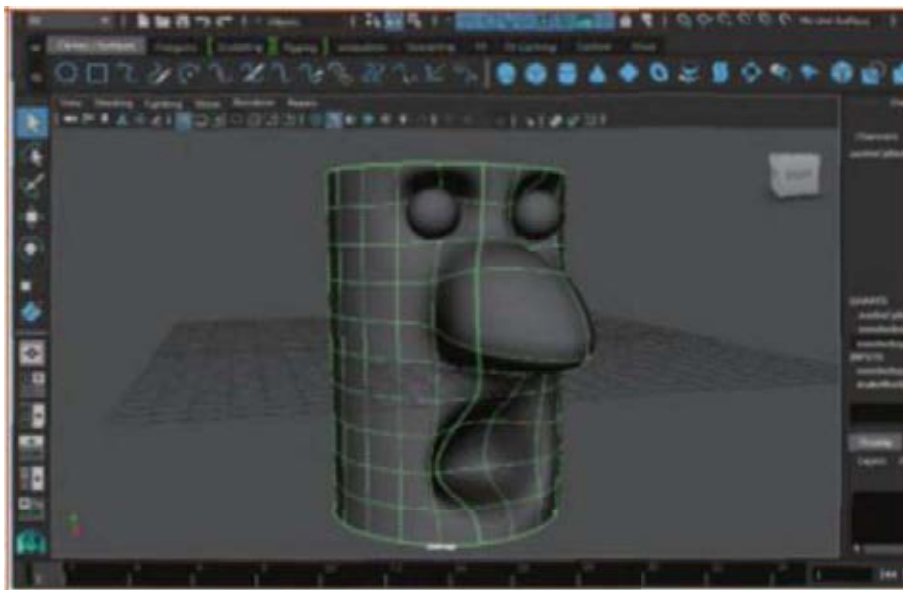
Fig.3.2.55: Figure 2-11

8. **Step 8:** Select the Create, NURBS Primitives, Sphere menu command and position the sphere in one of the eye sockets.

9. **Step 9:** With the sphere still selected, choose the Edit, Duplicate menu command and move the duplicate sphere to the other eye socket. The simple character face object is shown in Figure 2-11.

10. **Step 10:** Select File, Save Scene As and save the file as Sculpted face.mb. FIGURE 2-11 Sculpted

face **Tutorial 4:** Create a Hard Edge

1. **Step 1:** Create a sphere object using the Create, NURBS Primitives, Sphere menu command.

2. **Step 2:** Right-click on the sphere and select Isoparm from the pop-up marking menu.

3. **Step 3:** Drag over one of the vertical running isoparms to select it.

4. **Step 4:** With an isoparm selected, choose the Surfaces, Surface Editing, Break Tangent menu twice.

5. **Step 5:** Right-click on the sphere and select Control Vertex from the pop-up marking menu.

6. **Step 6:** Select the center CV that lies on the previously selected isoparm and drag it away from the center of the sphere.

7. **Step :** Press the 5 key to see the object shaded. With the tangent broken for the given isoparm, extra CVs have been added to the object that make the selected isoparm a hard edge.

8. **Step 8:** Select the Create, NURBS Primitives, Sphere menu command and position the sphere as one of the eyes.

9. **Step 9:** With the sphere still selected, choose the Edit, Duplicate menu command and move the duplicate sphere to the other eye position.

10. **Step 10:** Select File, Save Scene As and save the file as Bird head.mb.
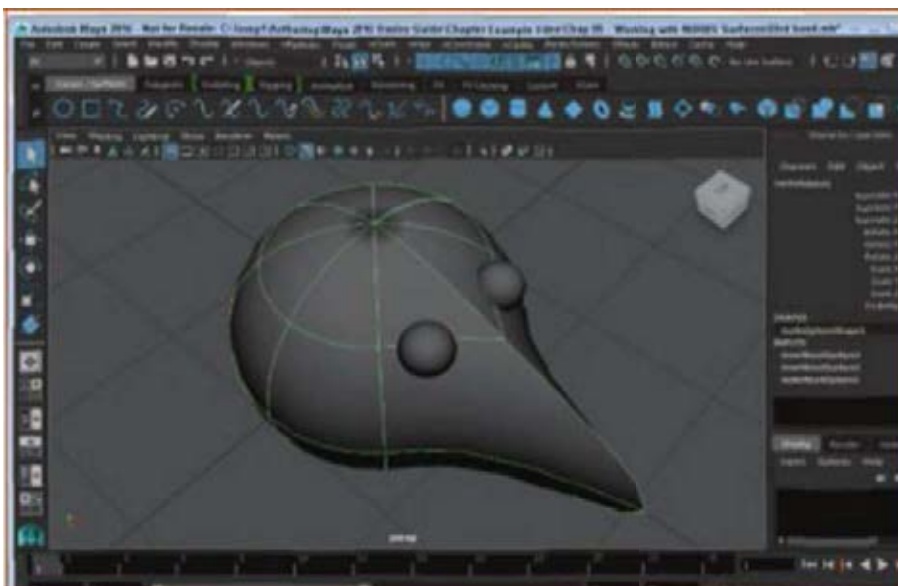
Fig.3.2.56: Figure 2-12

3.1.3.3 Use Boolean Tools

When NURBS surfaces overlap, you can use the Surfaces, Booleans menu to access one of three tools that can be used to add, subtract, or locate the intersection between the two objects. With any of these tools selected, you can click to select the first object or objects and then press the Enter key before clicking to select the second object or objects. The options dialog box (shown for the Union tool in Figure 2-13) for each of these tools lets you delete the inputs and exit the tool on completion.

Note: The Boolean tools can only work on two NURBS surfaces at once
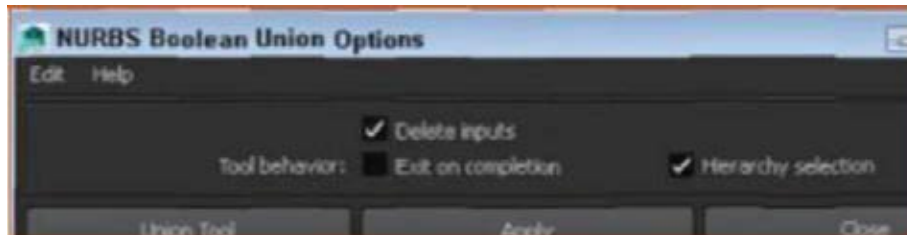
Fig.3.2.57: Figure 2-13

Combining Surfaces with the Union Tool : When the Union tool is used on two overlapping surfaces, the intersecting lines are removed and the resulting object acts as a single object.

Removing Surface Parts with the Subtract Tool : The Subtract tool removes an overlapping portion of the second selected object from the first selected object. The order in which the objects are selected is important. Reversing the selection order changes the result.

Creating a Surface Intersection with the Intersect Tool : The Intersect Tool removes all but the intersecting portion of the two overlapping surfaces.

Tutorial 1: Create Boolean Union Surfaces

1. **Step 1:** Select File, Open Scene and open the file named Boolean.mb.

2. **Step 2:** Select the Surfaces, Booleans, Union Tool menu command.

3. **Step 3:** Then select the sphere object and press the Enter key.
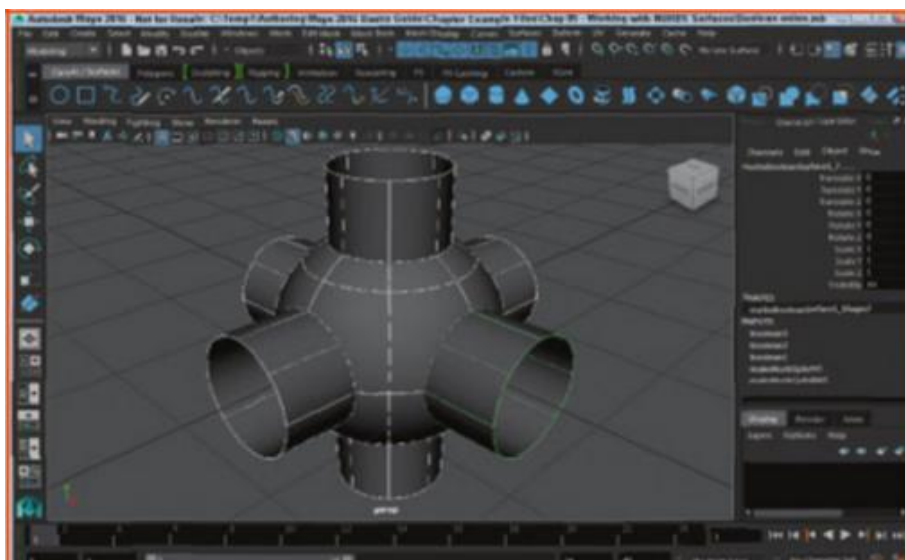
Fig.3.2.58: Figure 2-14

4. **Step 4:** Click on one of the cylinder objects and press the Enter key again to union the objects together.

5. **Step 5:** Repeat Steps 2-4 for the other two cylinders. The final object is shown in Figure 2-14

6. **Step 6:** Select File, Save Scene As and save the file as Boolean union.mb.

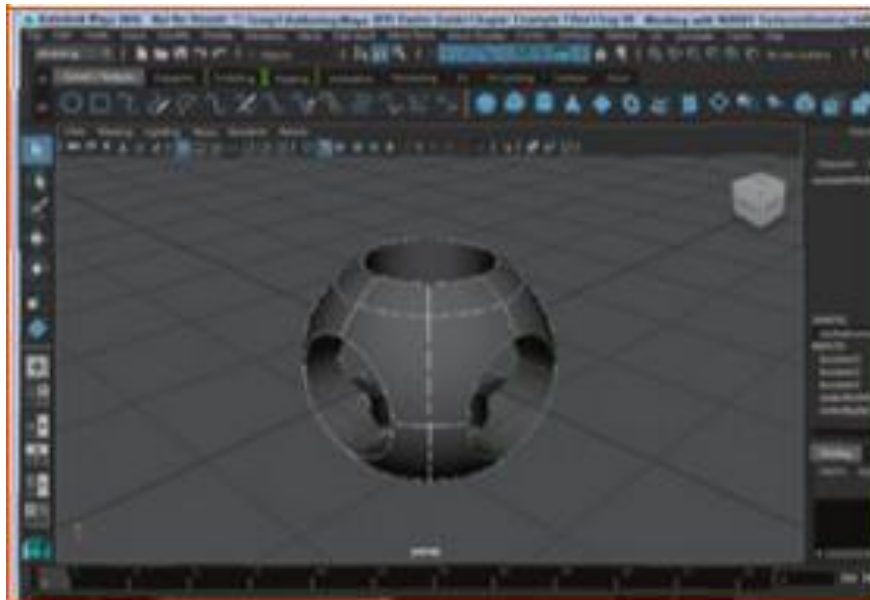1. **Step 1:** Select File, Open Scene and open the file named Boolean.mb.

2. **Step 2:** Select the Surfaces, Booleans, Subtract Tool menu command.

3. **Step 3:** Select the sphere object and press the Enter key.

4. **Step 4:** Click on one of the cylinder objects and press the Enter key again to subtract one object from the other.

5. **Step 5:** Repeat Steps 2-4 for the other two cylinders. The final object is shown in Figure 2-15.

6. **Step 6:** Select File, Save Scene As and save the file as Boolean subtract.mb.

Fig.3.2.59: Figure 2-15

Tutorial 3: Create Boolean Intersect Surfaces

1. **Step 1:** Select File, Open Scene and open the file named Boolean.mb

2. **Step 2:** Select the Surfaces, Booleans, Intersect Tool menu command.

3. **Step 3:** Then select the sphere object and press the Enter key.

4. **Step 4:** Click on one of the cylinder objects and press the Enter key again to intersect one object from the other.

5. **Step 5:** Repeat Steps 2-4 for the other two cylinders. The final object is shown in Figure 2-16.

6. **Step 6:** Select File, Save Scene As and save the file as Boolean intersect.mb.
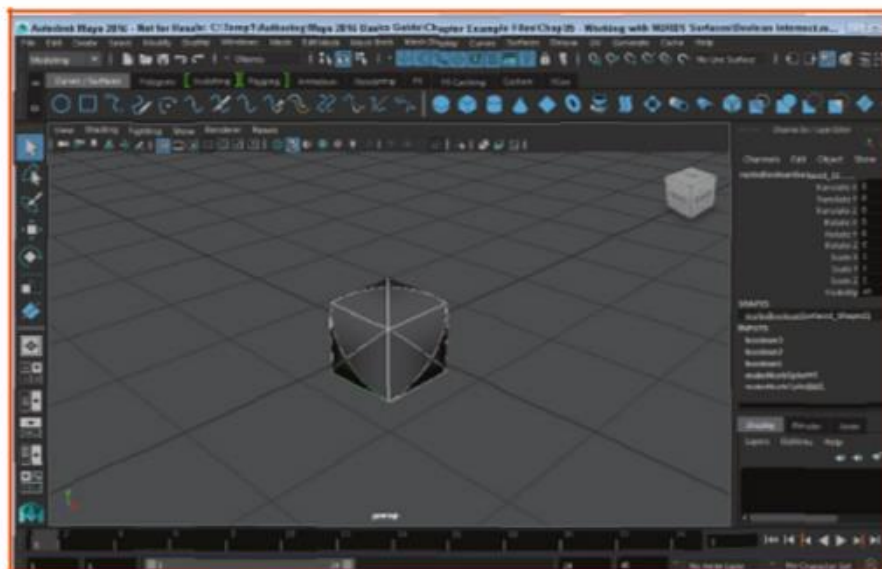
Fig.3.2.60: Figure 2-16

3.2.4 Animating with Keyframes

Simple 3D animation is surprisingly easy. Because Maya knows the exact location of objects in the 3D scene, it can quickly and easily interpolate the location of an object as it moves between two different points in space. These locations in space are called keyframes and they define intermediate positions of an object along its motion.

You can set keyframes for an object's position, rotation, scale, and any object attribute that is keyable. All keys, once created, are displayed along the Time Slider at the bottom of the interface. You can copy and paste these keys to other objects and then shift and scale them as needed.

Once an animation is created, you view it by scrolling through the time frames in the Time Slider. A preview of the animation is shown in the view panel. The Animation Controls are also useful in moving through an animation sequence. If the view panel is having trouble updating the scene fast enough, you can send snapshots of the current scene to a buffer using the Playblast feature.

There are several features that make it easier to visualize the animated objects. These features include motion trails, which show the trajectory of the object's motion, and ghosting, which shows copies of the animated object as it progresses in its motion.

Besides keyframing, another common way to animate objects is to attach an object to a motion path. The object then follows the path. This makes it easy to draw a curve that defines exactly where the object moves.

You can also edit animated scenes in the Graph Editor, where all object motions and attribute changes are shown as graphed curves and all keys are points. You can edit these curves and points by changing their smoothness and working with their tangents.

3.1.4.1 Set Key Frames

You can animate using keys by positioning an object at its starting state and setting a key, and then changing it to its ending state and setting another key. Maya then interpolates between the two states for all the times in between the two keys. Keys enable you to create fairly complex animation sequences with a limited number of

well-placed keys.

Note: All animation menu commands are found in the Animation Menu Set.

Setting Keys

When an object is in the exact position, you can set a key for the current time using the Animate, Set Key menu command. You can also set keys by right-clicking on an attribute in the Attribute Editor or in the Channel Box and selecting Key Selected or Key All from the pop-up menu. Attributes that have keys set are shaded light brown in the Attribute Editor and in the Channel Box, as shown in Figure 3-1. Tip The S key is the hotkey for setting keys.
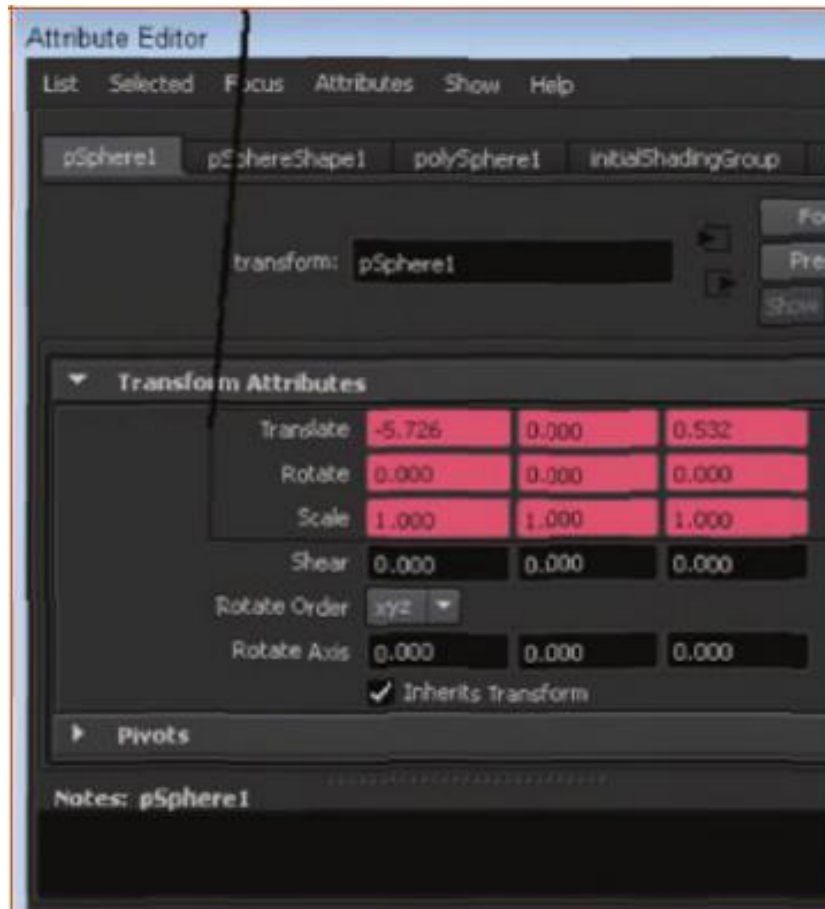
Fig.3.2.61: Figure 3-1

Using Auto Key

You can use Auto Key mode to automatically create keys for attributes that already have at least one key. To enable the Auto Key toggle, shown in Figure 3-2, click on the Auto Key button at the right end of the Range Slider. The button turns red when active. Once Auto Key is active, you can select a new time or update an attribute and the key is created automatically without needing to use the Set Keys menu command.
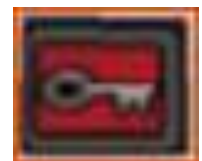
Fig.3.2.62: Figure 3-2

Note: You need to create a keyframe for the selected object before enabling Auto Key or it won't work. **Selecting Keys**

Keys for the selected object appear on the Time Slider as thin red lines. If you click on one of these red lines in the Time Slider, the current time is moved to that time and the key is selected. Selected keys are colored light blue, as shown in Figure 3.3. If you hold down the Shift key and drag over several keys, the selected time turns red and

all of the keys within that segment are selected, as shown in Figure 3-4. You can shift or scale the selected time by dragging on the arrows positioned within and at either end of the selected area.

Note: Using the Key Tick Size setting in the Timeline panel of the Preferences dialog box, you can increase the thickness of the keys displayed in the Time Slider. You can also change the key color in the Animation panel of the Colors dialog box, open with the Window, Settings/Preferences, Colors menu command.
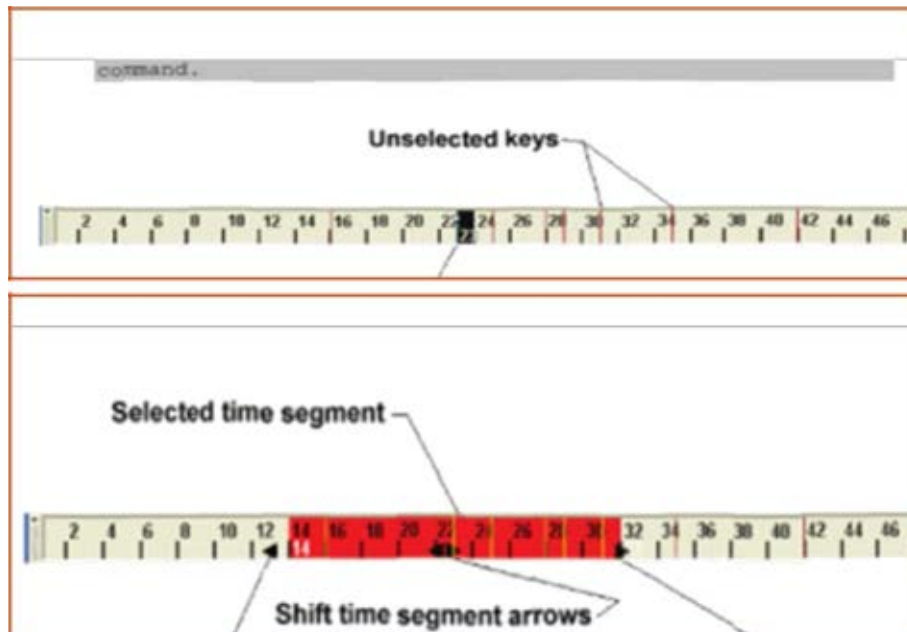
Fig.3.2.63: Figure 3-4

Copying Keys

You can copy and paste a set of keys for the selected object between files using the Keys Clipboard. To copy the keys to the Clipboard, select the Edit, Keys, Cut Keys or Edit, Keys, Copy Keys menu command. The keys stay on the Clipboard as you close the current scene and open a new one. You can paste keys to the selected object using the Edit, Keys, Paste Keys menu command.

Deleting Keys

The Edit, Keys, Delete Keys menu command deletes all keys for the selected object. Any keys set for unselected objects remain intact.

Snapping Keys

The Edit, Keys, Snap Keys menu command causes all selected keys to be snapped to their nearest Value or Time. This is especially useful after scaling several selected keys. The Snap Keys Options dialog box, shown in Figure 3-5, lets you select to snap only the selected keys or all keys. You can also select to snap only Times, Values or Both.
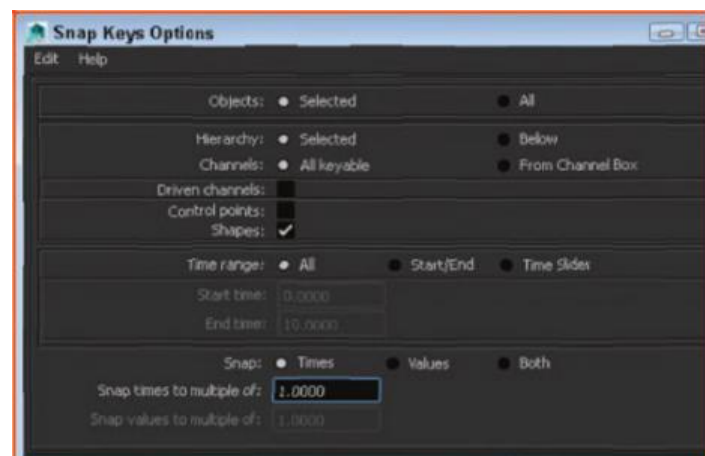
Fig.3.2.64: Figure 3-5

Tutorial 1: Set Keys

1. **Step 1:** Create a NURBS sphere object using the Create, NURBS Primitives, Sphere menu command.

2. **Step 2:** With the Time Slider at frame 1, select the Animate, Set Key menu command. All transform attributes in the Channel Box are highlighted in light brown to show that they have keys associated with them.

3. **Step 3:** Drag the time in the Time Slider to frame 25. Note If frame 25 isn't visible, drag the right end of the Range Slider until the frame is visible. If the Range doesn't extend to frame 50, enter 50 in the text field to the right of the Range Slider.

4. **Step 4:** Change the ScaleX, ScaleY, and ScaleZ attributes in the Channel Box to 5.0.

5. **Step 5:** Select the Animate, Set Key menu command again.

6. **Step 6:** Drag the time in the Time Slider to frame 50.

7. **Step 7:** Change the ScaleX, ScaleY, and ScaleZ attributes in the Channel Box back to 1.0.

8. **Step 8:** Select the Animate, Set Key menu command again.

9. **Step 9:** Drag the Time Slider marker back and forth. The sphere increases and decreases in size as you drag the Time Slider.

10. **Step 10:** Select File, Save Scene As and save the file as Growing sphere.mb.

Tutorial 2: Use Auto Key

1. **Step 1:** Create a NURBS sphere object using the Create, NURBS Primitives, Sphere menu command

2. **Step 2:** With the Time Slider at frame 1, click on the makeNurbsSphere1 input node in the Channel Box, click on the Start Sweep attribute, and then right-click and select Key Selected from the pop-up menu.

3. **Step 3:** Click the Auto Key button in the lower-right corner of the interface.

4. **Step 4:** Drag the time in the Time Slider to frame 25.

5. **Step 5:** Change the Start Sweep value to 180.

6. **Step 6:** Drag the time in the Time Slider to frame 50.

7. **Step 7:** Change the Start Sweep value to 359.

8. **Step 8:** Drag the Time Slider marker back and forth. The sphere slowly disappears as you drag the Time Slider, as shown in Figure 3-6.

9. **Step 9:** Select File, Save Scene As and save the file as Sweeping sphere.mb.

Fig.3.2.65: Figure 3-6

Tutorial 3: Move Keys

1. **Step 1:** Create a NURBS sphere object using the Create, NURBS Primitives, Sphere menu command, and then create a NURBS plane object and scale the plane object to be larger than the sphere.

2. **Step 2:** Select the sphere and click on the Select by Component Type button in the Status Line.

3. **Step 3:** Drag over all the CVs that make up the lower portion of the sphere in the Front view to select them.

4. **Step 4:** Select the Animate, Set Key menu command.

5. **Step 5:** Drag the time in the Time Slider to frame 3.

6. **Step 6:** Drag the CVs upward in the Side view and select the Animate, Set Key menu command again. This example shows that components as well as objects can be animated. By dragging the lower portion of CVs upward, the sphere is being squashed over three frames.

7. **Step 7:** Click on the Select by Object Type button in the Status Line.

8. **Step 8:** Select the sphere and move it upward in the Front view and select the Animate, Set Key menu command.

9. **Step 9:** Drag the Time Slider to frame 10, move the sphere back down to the plane object, and select the Animate, Set Key menu command again (or press the shotkey). The sphere is now falling onto the plane object.

10. **Step 10:** Click on the Select by Component Type button in the Status Line again.

11. **Step 11:** Select the same CVs that were selected earlier and drag over the set keys in the Time Slider with the Shift key held down.

12. **Step 12:** Drag the selected keys to the right until the first key rests at frame 7. Dragging over the set keys with the Shift key held down turns the selected keys red and displays some black arrows that you can use to move or scale the selected keys.

13. **Step 13:** Drag the Time Slider marker back and forth. The sphere falls to the base plane where it is squashed as it impacts with the plane object, as shown in Figure 3-7 Select File, Save Scene As and save the file as Falling sphere.mb.
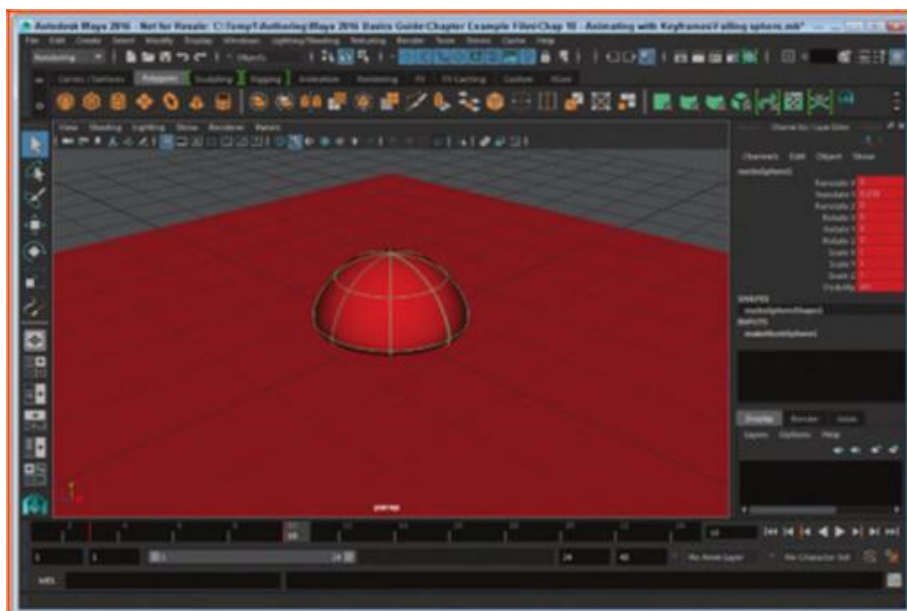
Fig.3.2.66: Figure 3-7

3.2.4.2 View an Animation

Spending a lot of time rendering a final animation only to find out that you've made a mistake can be time consuming and frustrating. Previewing animations can help eliminate mistakes early on.

Previewing Animation

Clicking the Play Forward button in the animation controls (shown in Figure 3-8) at the bottom of the interface cycles through the frames in the active view panel. You can also click on the Play Backwards button to see the animation in reverse. If you select and drag the Time Slider handle, the view panel is updated as you drag between the various frames.
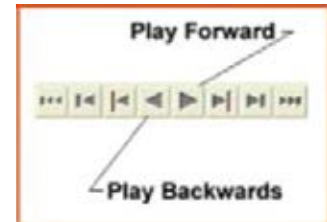
Fig.3.2.67: Figure 3-8

Looping an Animation

If you click on the Animation Preferences button, next to the Auto Key button, the Timeline panel of the Preferences dialog box appears, as shown in Figure 3-9. In this dialog box, you can set the number of frames that appear in the Time Slider. The Preferences dialog box also includes three Looping options—Once, Oscillate, and Continuous. The Once option plays the animation through once when the Play Forward button is clicked. Oscillate causes the animation to be played repeatedly forward and then backward, and the Continuous option plays the animation forward repeatedly.

Note: You can also access the Looping options from a pop-up menu by right-clicking on the Time Slider or the Animation Controls.
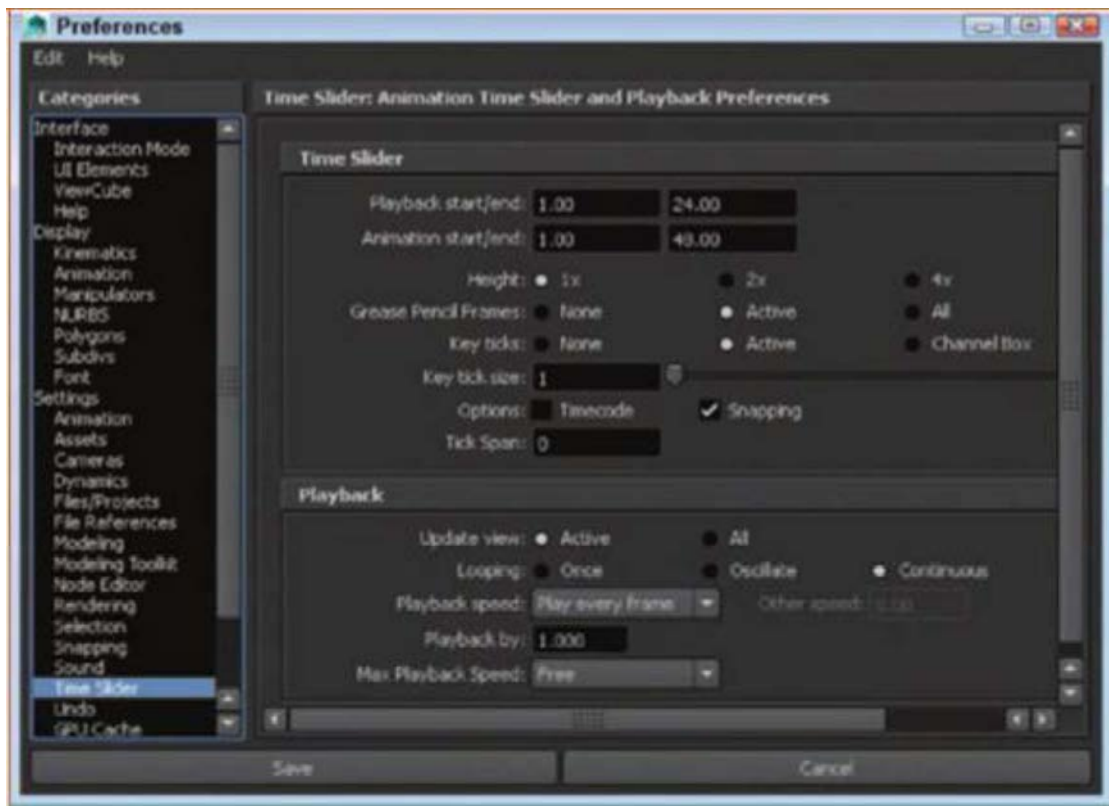
Fig.3.2.68: Figure 3-9

Enabling Ghosting

Ghosting is an animation technique in which you see an object's position in the previous and/or coming frames, as shown for the sphere in Figure 3-10. This is helpful when you work on the timing of an object's motion. To enable ghosting, select the Visualize, Ghost Selected menu command. In the Ghost Options dialog box, shown in Figure 3-11, you can select exactly which frames are ghosted or how many frames before and after the current frame are shown. To disable ghosting, use the Visualize, Unghost Selected or the Animate, Unghost All menu commands.

All menu commands.

Fig.3.2.69: Figure 3-10
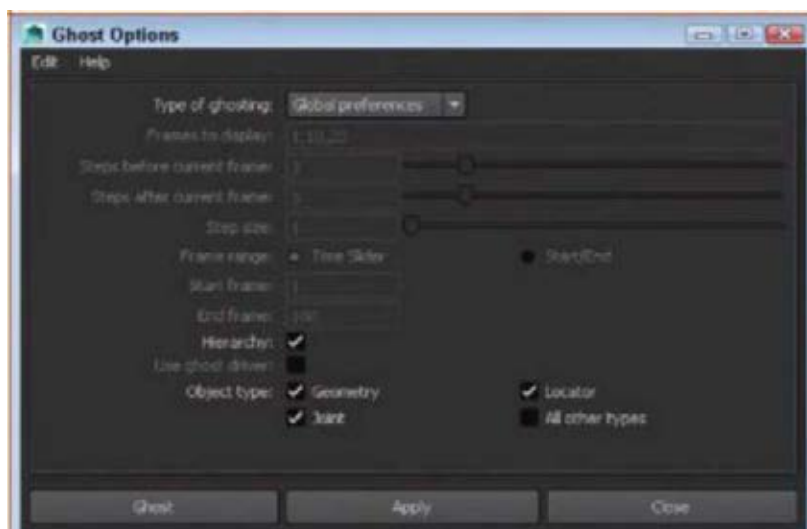
Fig.3.2.70: Figure 3-11

Creating Motion Trails

 A motion trail is the trajectory path that an animated object follows as it moves between frames, as shown in Figure 3-12. To create a motion trail, use the Visualize, Create Editable Motion Trail menu command. In the Motion Trail Options dialog box, you can set the start and end times for the motion trail and the Draw Style option to Line, Locator, or Points. You can also select or deselect Show Frame Numbers.
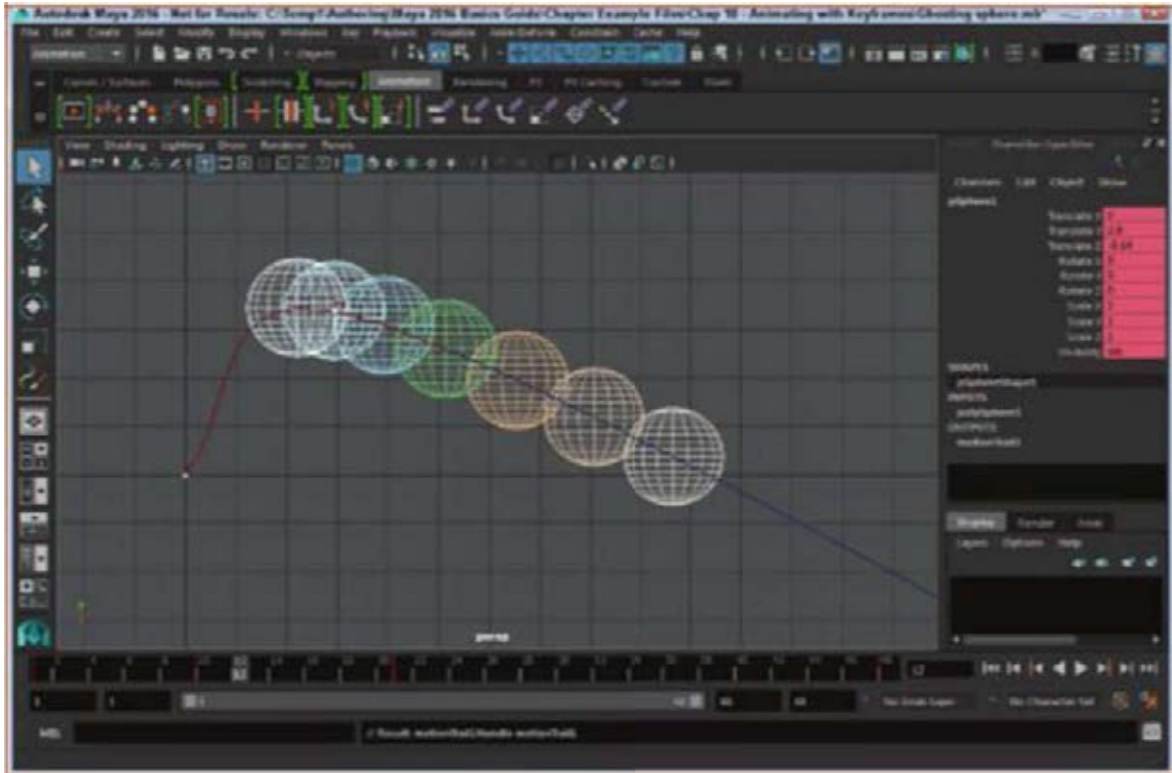
Fig.3.2.71: Figure 3-12

Using Playblast

The Window, Playblast menu command captures a screenshot of the active view panel for each frame. These frames are then stitched together to create a preview animation that is played in the default system movie player. Using Playblast is convenient, because complex scenes can take some time to update their view in the view panel. The Playblast Options dialog box, shown in Figure 3-13, lets you set the Time Range, Viewer, and Display Size options. You can also select to save the preview to a file.
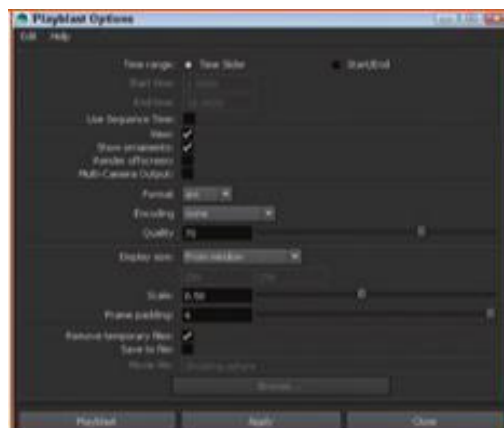
Fig.3.2.72: Figure 3-13

Tutorial 1: Preview an Animation

1. **Step 1:** Select the File, Open Scene menu command and locate and open the Simple airplane.mb file.

2. **Step 2:** Drag the Time Slider to frame 10.

3. **Step 3:** With the airplane selected, choose the Animate, Ghost Selected, Options menu command.

4. **Step 4:** In the Ghost Options dialog box, choose Custom Frame Steps from the Type of Ghosting list. Change the Step Size to 3 and click the Ghost button.

5. **Step 5:** In the Animation Controls, press the Play Forward button. The animation loops over and over with ghosting enabled, as shown in Figure 3-14.

6. **Step 6:** Select File, Save Scene As and save the file as Airplane with ghost.mb.
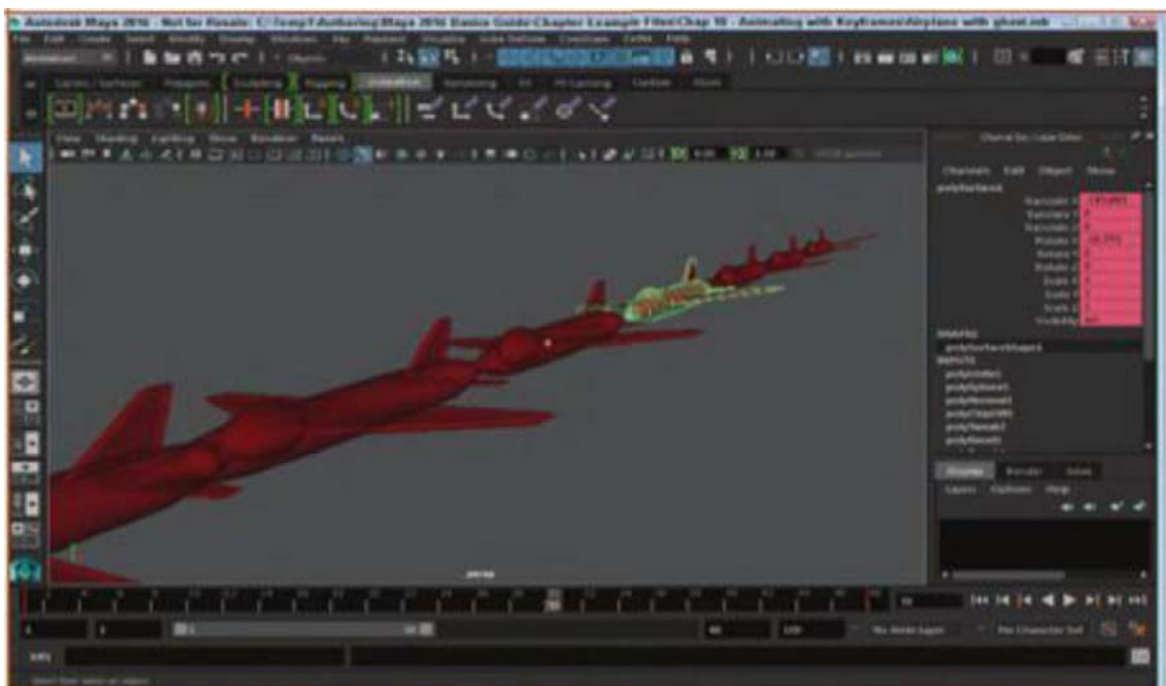
Fig.3.2.73: Figure 3-14

Tutorial 2: Use Playblast

1. **Step 1:** Select the File, Open Scene menu command, locate and open the Simple airplane.mb file.

2. **Step 2:** Select the Window, Playblast menu command. Every frame of the animation is captured in the Playblast buffer and the animated frames are shown in the default system video player, such as the Windows Media Player, as shown in Figure 3-15.
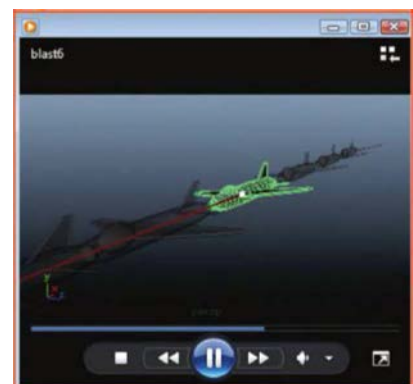
Fig.3.2.74: Figure 3-15

3.2.4.3 Animate Using Motion Paths

Key framing is easy to work with, but sometimes it can be easier to define a path and to have an object follow that path. Motion paths are curves that you can use to define how an object should move through the scene.

Creating Motion Path Keys

You can create a motion path by dragging objects about the scene and using the Animate, Motion Paths, Set Motion Path Key menu command. This command places a motion path key for the selected object for the current time frame. Moving the object to another location and using this command again creates another key, and a curve joining the keys is drawn. Each motion path key acts as a point on the curve. Figure 3-16 shows a sphere following a motion path with several motion path keys.
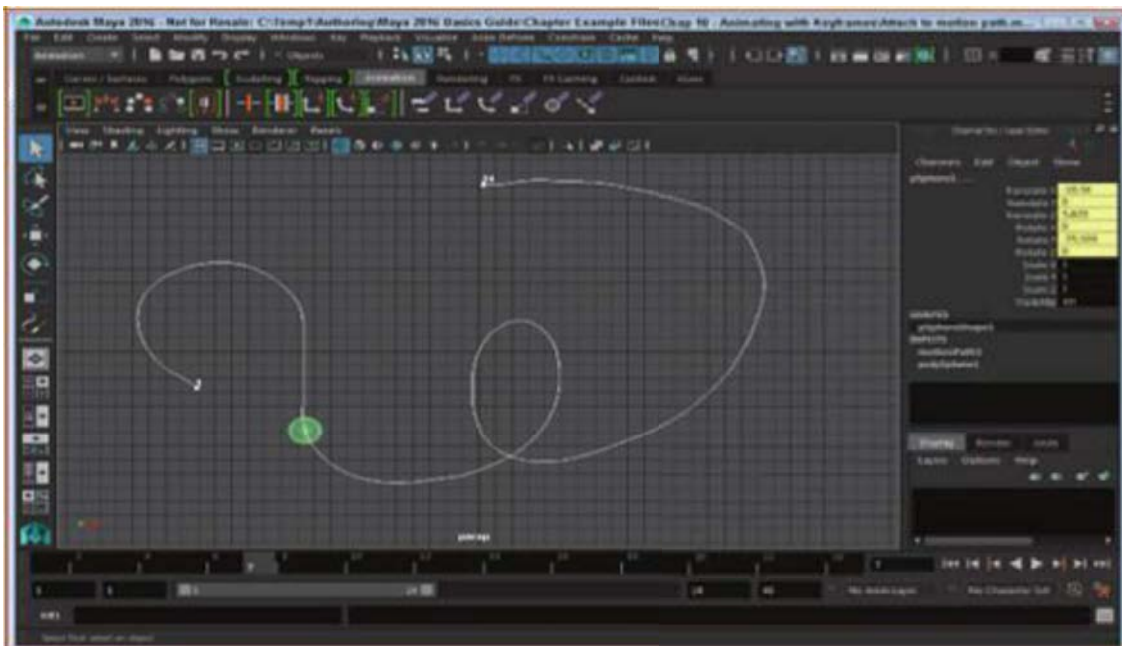
Fig.3.2.75: Figure 3-16

Drawing a Motion

Path You can use any NURBS curve as a motion path. By default, the first point on the NURBS curve marks the starting point for the attached object. You can create motion paths using any of the curve creation tools found in the Create menu, including the CV Curve tool, the EP Curve tool, and the Pencil Curve tool.

Attaching an Object to a Motion Path

To attach an object to a motion path, you need to select the object or objects to attach and then select the NURBS path that you want to use for the motion path. The motion path curve should always be selected last. Select the Animate, Motion Paths, Attach to Motion Path menu command. Figure 3-17 shows a NURBS sphere that has been attached to the motion path. Clicking the Play Forward button shows the sphere following the entire path.
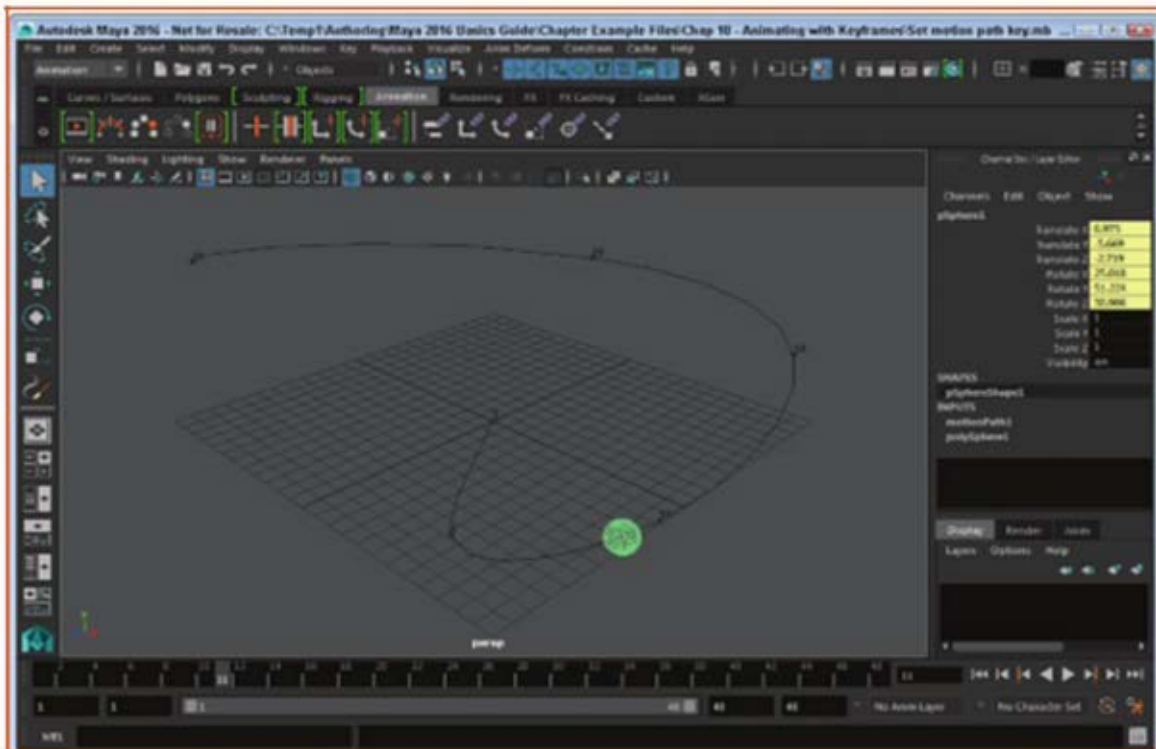
Fig.3.2.76: Figure 3-17

Adjusting an Attached Motion Path

When an object is attached to a motion path, you can move the object along the motion path by dragging the Time Slider. To adjust the attached motion path, you can move the attached object with the Move tool and create a new motion path key with the Animate, Motion Paths, Set Motion Path Key menu command. Figure 3-18 shows an adjustment made to the existing attached path.
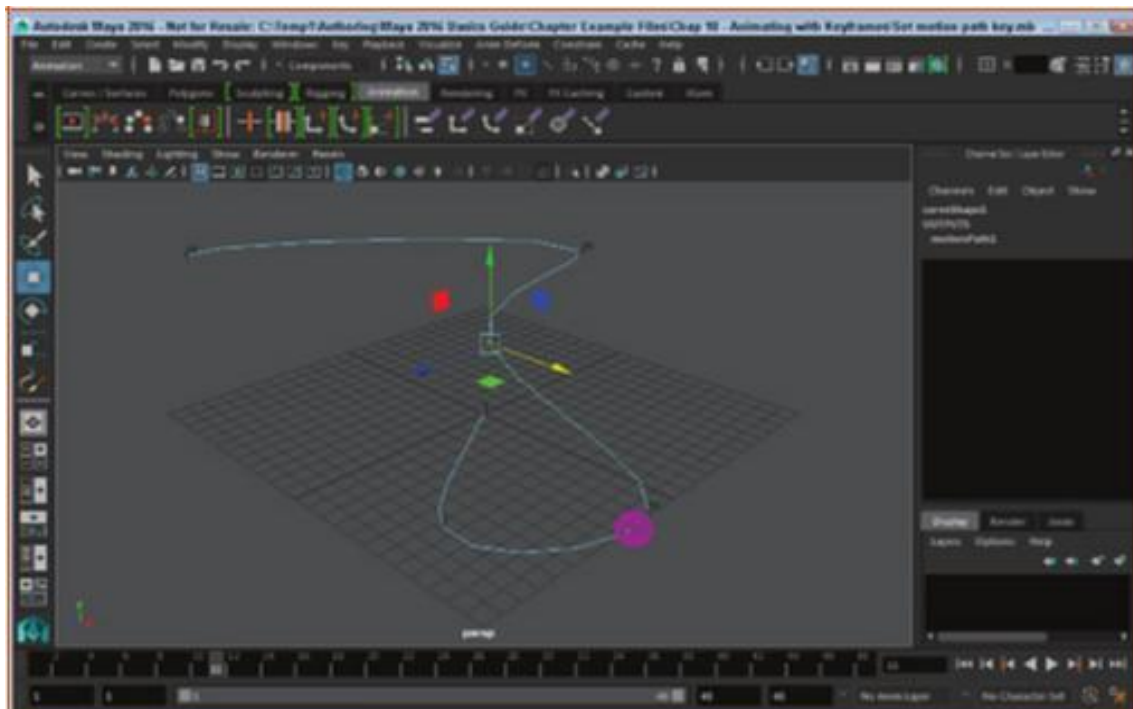
Fig.3.2.77: Figure 3-18

Deforming an Object as it Follows a Motion Path

If an object follows a motion path, you can select the object and choose the Constrain, Motion Paths, Flow Path Object menu command. This command causes a lattice to appear around the selected object. This lattice deforms as it moves along the motion path. By altering this lattice, you can control how the object deforms as it follows the motion path. Figure 3-19 shows a torus object that follows a motion path with a lattice surrounding it.
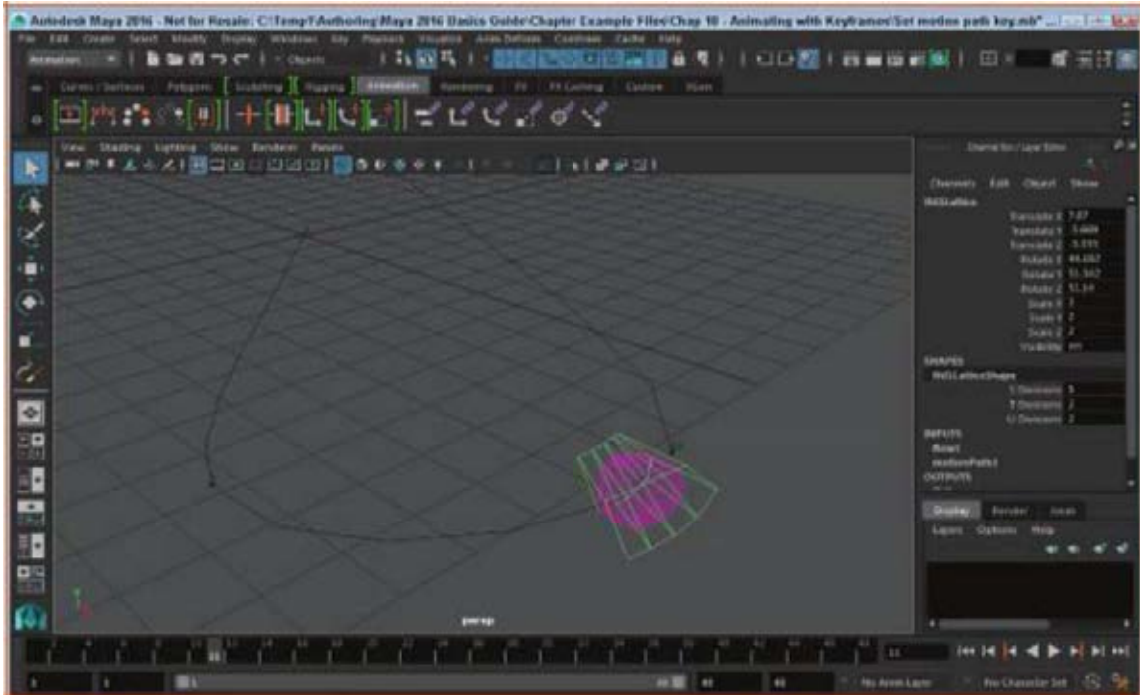
Fig.3.2.78: Figure 3-19

Tutorial 1: Create a Motion Path

1. **Step 1:** Create a NURBS cone object using the Create, NURBS Primitives, Cone menu command.

2. **Step 2:** Select the Animate, Motion Paths, Set Motion Path Key menu command.
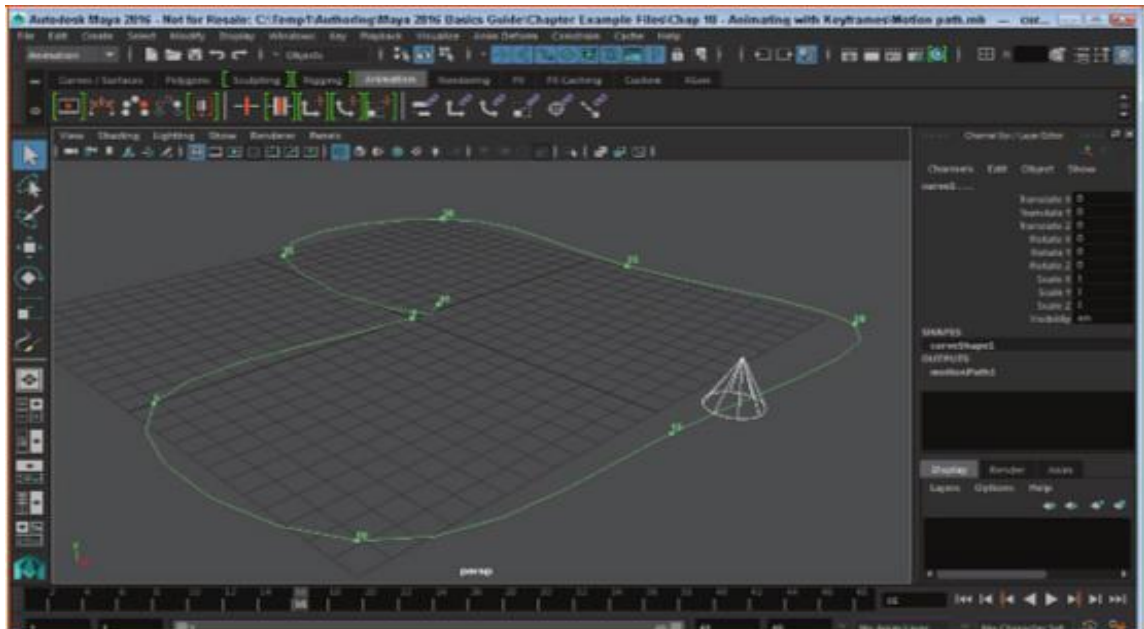
Fig.3.2.79: Figure 3-20

3. **Step 3:** Drag the Time Slider to frame 5 and drag the cone away from its current position.

4. **Step 4:** Select the Constrain, Motion Paths, Set Motion Path Key menu command again.

5. **Step 5:** Repeat steps 3 and 4 several more times. Each key acts as a curve point for the motion path.

6. **Step 6:** Press the Play Forward button. The cone object follows the motion path curve, as shown in Figure 3.20.

7. **Step 7:** Choose Save as option for saving file as Motion path.mb.

Parts of **perspective view panel by default are:**

- Persp at bottom of screen shows it is perspective view
- Menu at top left provides access to functions and tool
- Two lines intersecting at centres is called origin
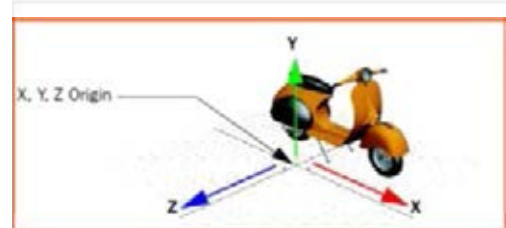
Fig.3.2.80: Perspective

The origin is the center of Maya's 3D world, and with all object's directional values measured from this position.

The Perspective panel vies had its menu at top left and has access tools related to it. It will be shown as perps to understand view of camera. The Scene will be dividing the centre called the Origin which decides all values from this point onwards. The plane imagery has three axis with distinct colours the on 0 position, X, Y, Z. Being red, green and blue respectively
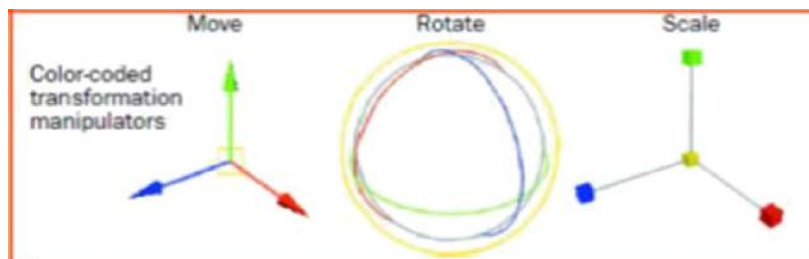
Fig.3.2.81: 3D view

Main Menu bar

Main menu has buttons of Animation, Polygons, Rendering and Dynamics as menu sets with their distinct tools. When one is selected it shows tools in those set. The common used File, Edit, modify, Display and Window are on the left and stay constant. The right side changes on selection

.
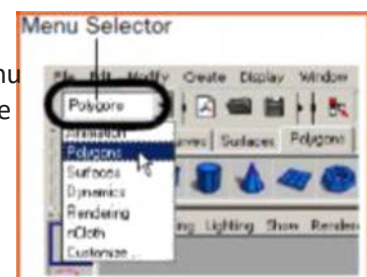
Fig.3.2.82: Main Selector
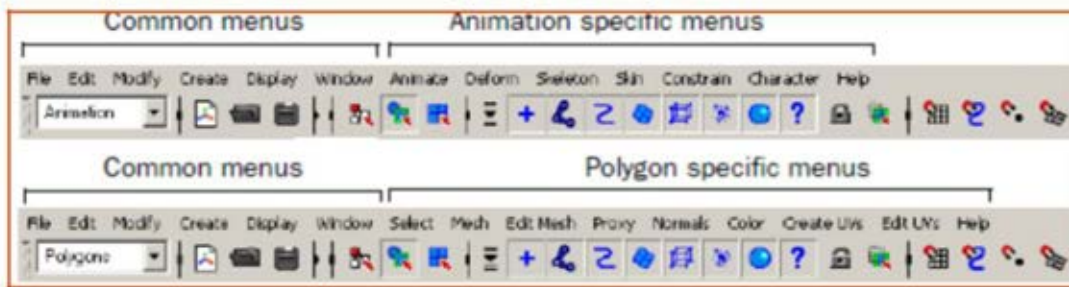
Fig.3.2.83: Menus

To select a specific menu set

- Select a specific menu set to open their tools as required from the drop down. You can change from Dynamics to Polygon and so on and relevant tools will appear. Like Animations will shoe Deform, Skin etc.

- Pick polygon from menu. The main menu changes to display the menu set for Polygons. Menu titles such as Select, Mesh, Edit Mesh, and so on, appear.

To create a primitive 3D object from the Polygons menu set

- You can use Create, Polygon Primitives, sphere to create 3D sphere object but first ensure that the interactive Creation in Polygon primitives is unchecked .

- Select cube under polygon primitive in create. 3D cube is placed in centre.

Status Line

Fig.3.2.84: Primitive 3D object

The Status Line heads the interface and has many tools and items that are used while animating, these are graphical to be easy to locate and use space well.

Fig.3.2.85: Status line

- The first is the Menu Selection tab, followed by Scene related items, the next is Object selection tools and Snap mode, last is show/hide buttons for Attribute and Layer Editor, Channel Box.

Fig.3.2.86: Line
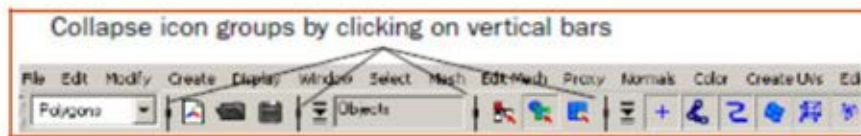
Fig.3.2.87: Bar

Shelf

The Shelf falls below the Status line and has tools that are used more often, it has options to customize as per need to make time saving and efficient
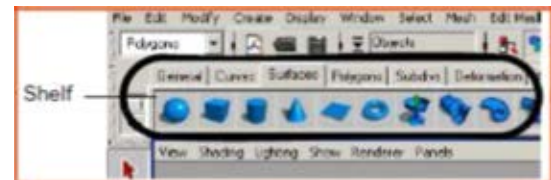
Fig.3.2.88: Shelf use.

Making object using shelf option

- Choose surface under shelf option for viewing associated tools.

Fig.3.2.89: Selecting Surface tab

- Choose Interactive Creation, from NURBS primitive under create option (for ensuring check mark is not displayed by this item)

- From the Shelf, select the NURBS sphere icon located at the left end by clicking on it.

- Maya creates a sphere primitive object and places it at the center of the Maya workspace in the same position as the cube.

Fig.3.2.90: Tool pop-up

Object is called active if it is shown as below
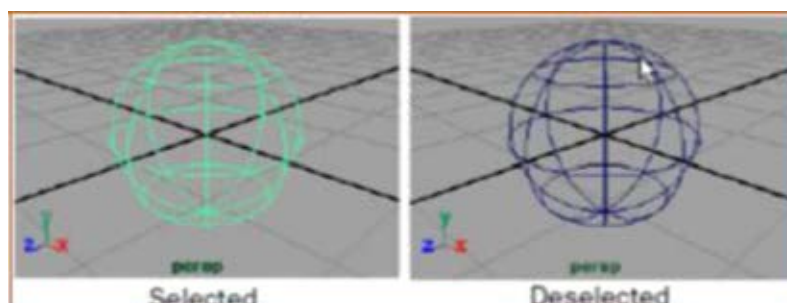
Fig.3.2.91: Object

To hide or show the Channel Box

- The show/hide button at end of Status line can let you show or hide Editors. The Channel box can be hidden to increase your work space.
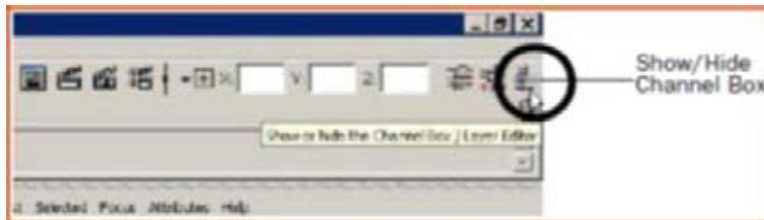
Fig.3.2.92: Channel box

- Show/Hide Channel Box icon may clicked for showing or hiding channel box.

Saving your work

- Ensure saving work frequently as scenes to avoid loss of work by File, Save Scene, Name the work for search in directory, automatic extension is. Mb as Maya binary

To save your Maya scene

- Save scene by using save scene option in file menu.

- Location prompt box open up, choose location here.

- Type: Lesson1 in the file name text box.

- Click Save.

Exiting Maya

- To exit interface go to Main menu then to File, Exit, the interface shuts only when all scenes are saved prior exiting, it gives you pop up to question changes or save if you try to exit without saving.

3.2.5 Pipeline and Modeling

A pipeline is a working schedule with concerned team members for deliverables, includes timelines and is a path to follow while creating animations. You can call it a flow chart.

At any given time, you should be able to locate art assets. Thus it is very important to become familiar with how production pipelines work.
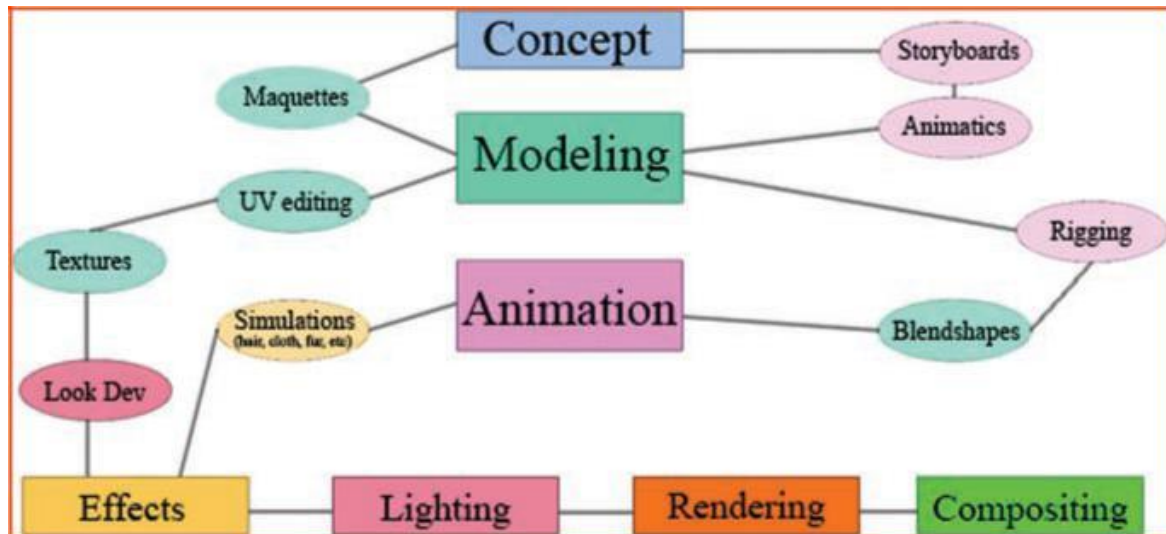
Fig.3.2.93: The modeling process

Concept art is the 2D designs created during pre-production. These will consist of orthographic views, reference views, and character sheets. A character sheet typically portrays the character in a variety of poses.

From concept, the pipeline usually branches out for storyboards on the animation side and maquettes on the modeling side.

Storyboards are somewhat related to animation. They are the story sequences as realized visually. The artist will compose the camera and place the characters on paper or 4 6 cards. If something doesn't look right at this stage, say a camera is too tight on a character or a character's pose is awkward, simply have the storyboard artist draw the frame again. It's much cheaper to work out the scene staging during the storyboarding phase than it would be during production.

After the storyboards are approved, they are given to the layout department to be made into animatics. Think of an animatic as a moving storyboard. During layout, the timing and spacing of the characters will be animated as well as the camera animation. The characters are generally low polygon placeholders. Simple quick renderings or playblasts are fi ne. The goal is to fi ne tune the timing and spacing for the characters and to get the camera animation in place. Working with simple placeholder objects allows for quick reviews and redos at this stage. This amounts to a huge cost-savings benefi t.

The other branch from concept art is the maquette phase. A maquette is usually a clay model built for reference purposes. The more complex the character the more likely there will be a maquette made. By allowing 3D modelers to handle a tiny statue that can be viewed from any angle, maquettes generally help for the creation of more lifelike characters. Some game companies, and almost every movie house, will have a maquette artist create a model. The 3D modeler may create the maquettes or at some larger companies there might be fulltime maquette artists on staff .

Modeling is the creation of the object or environment mesh in 3D. As with all of the other stages, the type of work may be split into smaller subgroups. For example, one person may model props, another may model Hero (a.k.a. main) characters, and still another might work on just the environments. Whatever needs to be modeled, though, it is done during this stage.

Fig.3.2.94: Maquette.

The focus of this book, of course, is character modeling, but it is important to see how modeling fits into the pipeline. Typically multiple people will work on the same model in different capacities and that work is often done concurrently.

After modeling, an object can be textured and rigged concurrently. During the texturing phase, a model needs to have the UV texture coordinate laid out. UVs are used to conform and hold the textures to an object. Maya creates UVs automatically, but these will almost always need to be changed. At many game companies the modeler lays out the UVs, while at a larger fi lm company, there might be a dedicated person working on the UVs. Proper UVs are vital for a model to look correct once textured, but be forewarned, UV editing can be a very timeconsuming process.

Once the UVs are complete, the textures can be created. The UVs can then be brought into an image editing program like Adobe Photoshop to be used as a template when creating the textures. Rigging is the process of preparing a model for animation. There are many steps within the rigging phase. First a skeleton comprised of joints and bones needs to be created. A skeleton in 3D functions the same as a skeleton in the real world; it acts as the framework for the body. In 3D the body being the mesh is created by the modeler. The mesh needs to be bound and weighted to the joints so that the mesh will move with the skeleton. After the rigging is complete, any blendshapes needed are created. Blendshapes (also known as morph targets) can be used for facial animation or for correcting problematic mesh deformations. To help keep the art consistent, blendshapes are usually created by the same person that modeled the character.
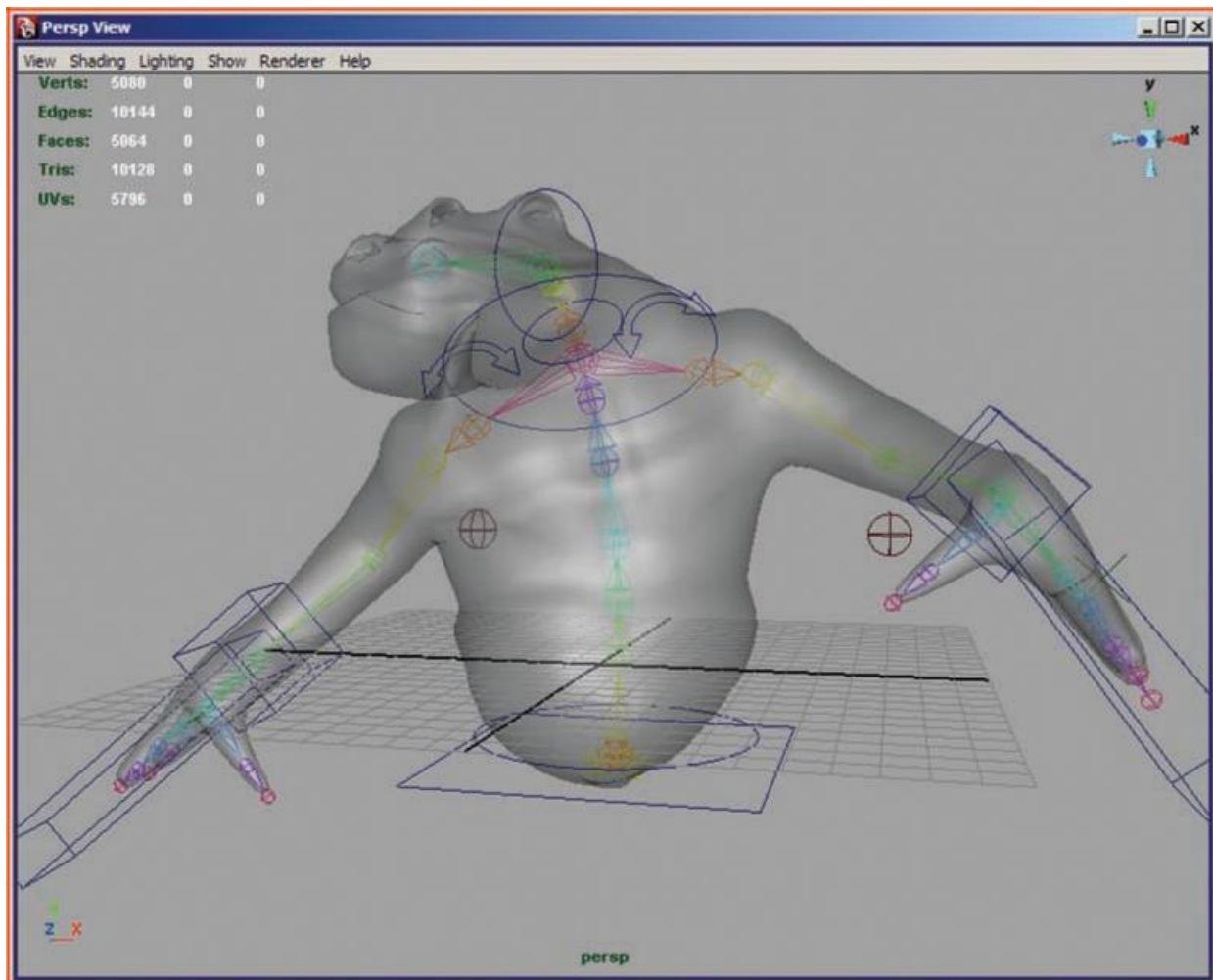
Fig.3.2.95: A rigged character

Look development can begin at this time. Creating shading networks and designing lighting for the characters are all part of developing the look of a character.

The next step is to animate the character. Once animation is complete, fur, hair, and cloth simulations can be performed. From there, the assets move to the eff ects artists.

Once the animation is complete, fi nal lighting is applied. Finally, the character is exported into the game engine or sent to the render farm for fi nal rendering. For fi lm and video game cutscenes, there is an added step after rendering. All of the elements need to be composited together.

Following shows simple pipeline. On large productions, each of these jobs could be further broken down into separate tasks. However, even on large productions, the goal is to make the process of getting assets into the game or movie as pain-free as possible. Often times, a model will need to go through the pipeline multiple times (if something needs to be changed, for instance) and having a smooth process to facilitate this is vital. Now that we can see how important it is to work within a pipeline, how can that be transferred over to Maya? Maya has very simple, yet complete project tools to help set up and manage your own pipeline. In Maya these are called projects.

To set up a new project go to:

1. FileProjectNew.

2. In the Project Setting window, type a name for the project and set a path.

3. Next click Use Defaults. It's advised to always select. Use Defaults as this will allow Maya to organize all of the assets for the project.

4. Click Accept. You now have a new project and are ready to work.
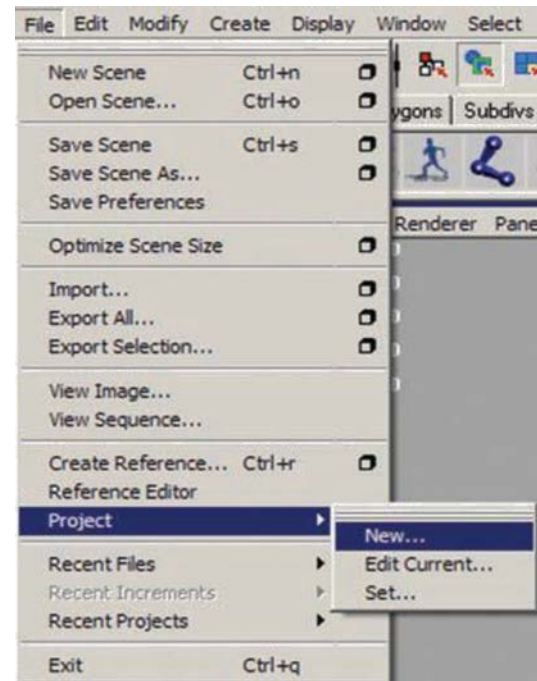
Fig.3.2.96(a): Open a new project

For a long while, polygons were relegated mainly to video game work. For that use they excelled.

The higher number of polygons needed to achieve photorealism proved to be prohibitive for film work. Thus NURBS were used extensively at many film houses.
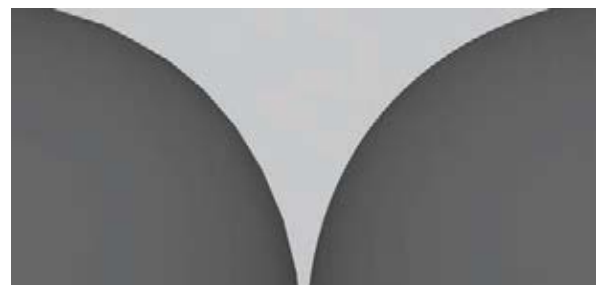
Fig.3.2.97: Start using NURBS

Fig.3.2.96(b): Open a new project

Notice that the polygonal sphere has blocky edges. In years past, the amount of extra polygons needed to render polygon objects with smooth edges similar to those of a NURBS object would have taken too many polygons to be feasible and useable on high-resolution fi lm projects. The render times would have been too high. The nature of NURBS surfaces allowed for very organic characters that would fi t within the rendering budgets. With NURBS, though, came the extra difficulty needed in working with the surfaces. Surface patches could lose their stitching during rigging and animation. Surfaces also had to be properly parametized for texturing, and surface trims had to be dealt with if holes were needed in the model. Polygons, on the other hand, had none of these drawbacks. Their one disadvantage was the incredibly high number of polygons needed for organic characters. Polygons could be made of a single mesh. UVs could be edited independently of the model. And polygons could contain holes in the mesh as desired. Not only that, but polygons were usually much easier for new artists to learn how to use for modeling. That has all changed now. Within the last few years, more powerful computers allow for the incredibly high amount of polygons needed for photorealistic fi lm projects. This was a huge turning point for polygonal modelers. Now they could apply their work on fi lm projects as well as video games.

That being said, keep in mind that there are still plenty of times where other modeling approaches will be useful. While NURBS have fallen out of favor for character modeling at most companies, they are still very useful for hard surface modeling. Vehicles are a perfect example of the type of hard surface model that many artists create using NURBS. The panel type construction of most vehicles lends itself very well to object creation using NURBS curves and surfaces. Also, because the models are hard surfaces and won't deform, there is no danger of gaps appearing where the diff erent surfaces meet. If you need a vase, simply create a curve outline and revolve it. Eyeballs are another good use of NURBS; the surfaces are ready to accept textures, no UV editing required.
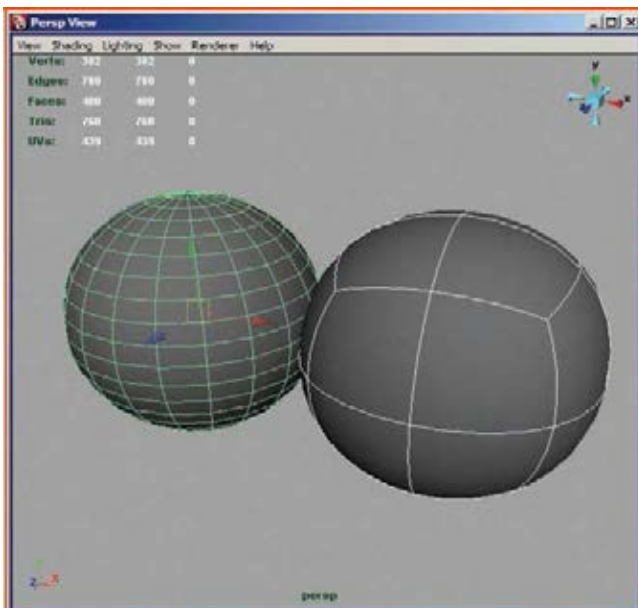

Fig.3.2.99: NURBS

Fig.3.2.99: Subdivision surface

Maya also comes with Subdivision Surfaces. If a production pipeline includes displacement maps, then most likely subD surfaces will be included in the mix. SubD surfaces generally produce better results than polygons when using displacement maps. When working with displacement maps, most artists will generally create the model with polygons because of the ease of working with them and then convert the model to subD surfaces prior to rendering. Not to worry, we'll cover subD surfaces in depth later in the book.

UNIT 3.3: Creating, Manipulating and Viewing Objects

Unit Objectives

The completion of chapter will enable:

*   Making three dimensional models
*   Selecting and working on Models
*   Application of motion with mouse Create 3D primitive objects.

3.3.1 Creating a new scene

Make a new scene in order to create a new project, for doing this:

*   Start Maya
    It will already create a new scene, if already running delete previous scenes by selecting no when pop up prompts saving it while you attempt to create new one

*   Choose New scene options from the file menu

*   This message is shown:

Fig.3.3.1: Project
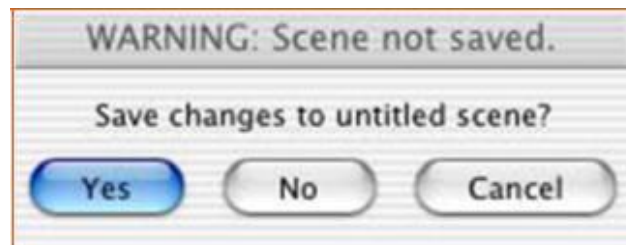
Fig.3.3.2: Saving Scene

*   Choose No option and new scene is created

3.3.2 Primitive objects

Primitive objects in Maya are shapes like polygon, cube, cylinders and cones.

Fig.3.3.3: Primitive Objects

To create a polygonal cylinder for the base

- Polygons menu set is selected.

- Choose cylinder, from polygon primitives under create option. A new window prompt comes up

- Choose edit and then reset setting option under Polygon Cylinder and put these numbers

  a. Radius= 10
  b. Height= 1
  c. Height divisions= 1
  d. Axis divisions= 8
  e. Cap divisions= 1
  f. Axis= Y

- Now choose create option under the Polygon Cylinder.

- Now octagonal shaped primitive object of cylindrical shape is created. It has 8 sides, width is 20units and height one unit
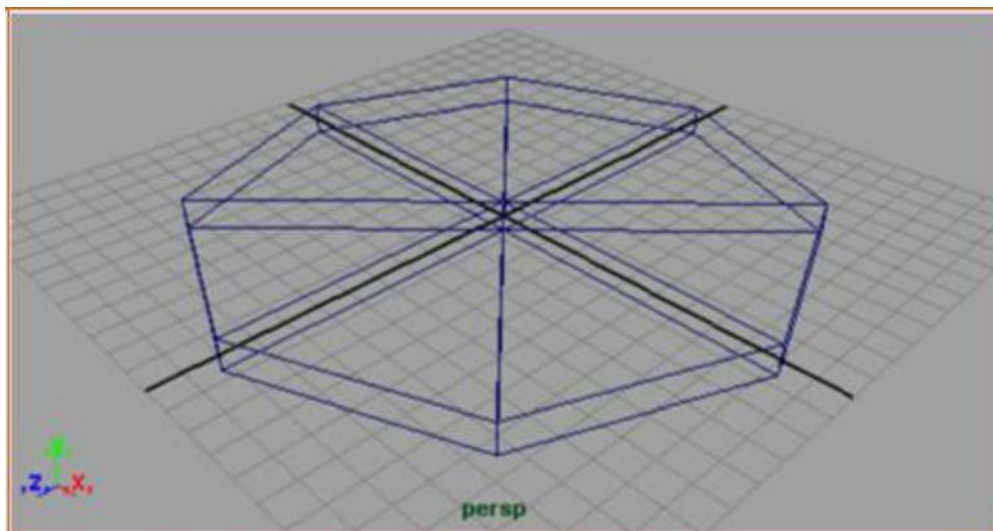
Fig.3.3.4: Cylinder

3.3.3 The Toolbox

The Toolbox: Layout shortcuts

The toolbox contains tools to select, transform, rotate your objects within interface and it situated at left hand. It also has Quick Layout buttons to select, view and edit panel layouts. In Four View layout you can see object from different angles, the second one shows camera perspective. To increase image size, use space bar after placing cursor on side view. To move objects in directions you can use Move transformation tool from the Toolbox.

Fig.3.3.5: Toolbox

- workspace modifies to different view which is 4 view. Different views option like perspective, front, top, side are displayed.
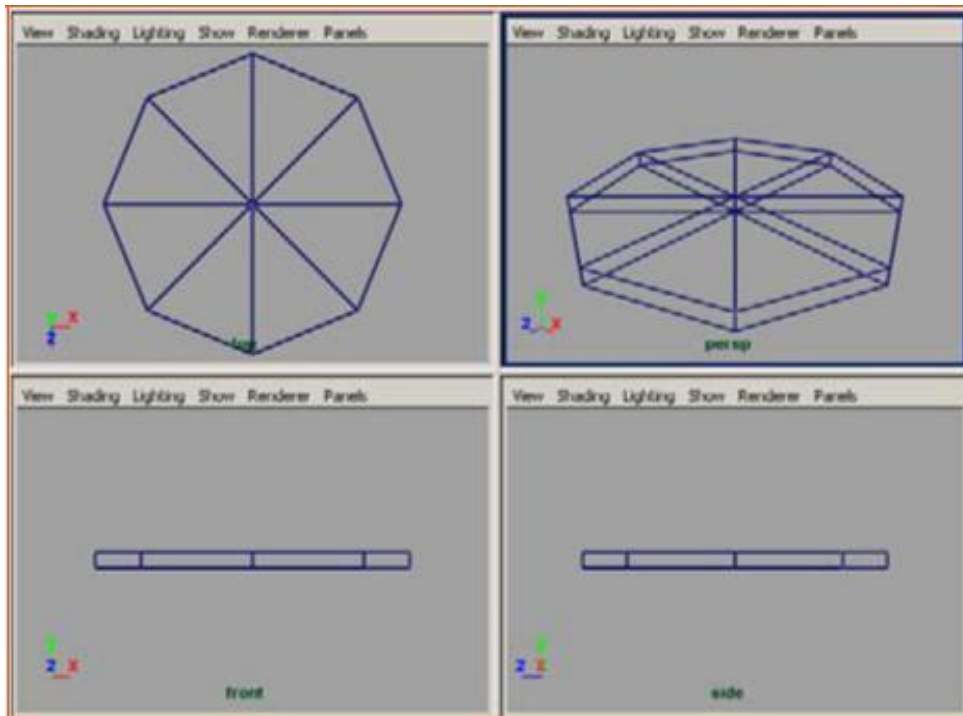
Fig.3.3.6: Four View

- Press space after taking cursor over side view for increasing size of that view

The Toolbox: Transformation tools

- For moving base in X direction, it is positioned on the Y-Z plane. For this purpose use move transformation tool.

- Bottom window displays name of the tool.
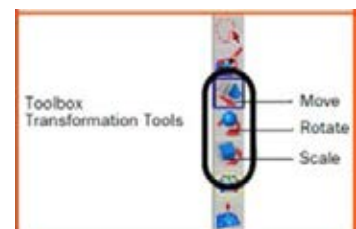
Fig.3.3.7: Transformation tools

Fig.3.3.7: Shortcut Key

Selection and de-selection of objects

- Select the object. To deselect, click somewhere which is not object.
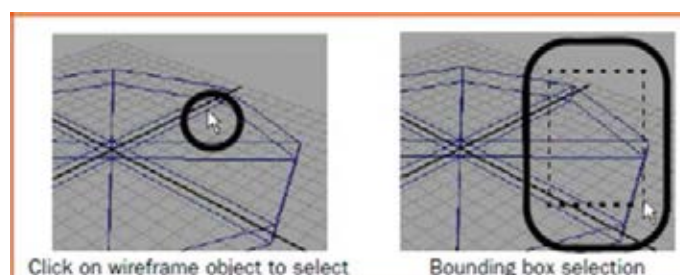
Fig.3.3.7: Transform object

To choose the base primitive object (scene view)

- Click wireframe outline of the object

- Drag a bounding box about object's one edge.

Objects selected go green but otherwise remain blue

Using move tool for adjusting base position

- Use the Move tool from toolbox to get manipulator handle and drag the Y axis to position upwards. Slightly rotate the base once aligned with X axis. Consider half of 45 degrees.
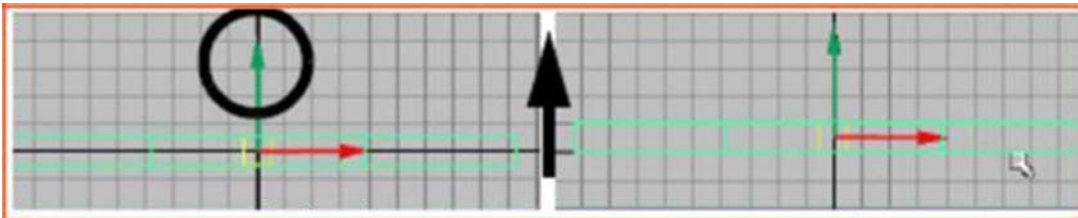
Fig.3.3.8: Use Moov Tool

Using Rotate Tool for adjusting base position

- Keep Four Views Panel constant, and enlarge first view and select the base of cylinder and using the rotate tool from primitive menu drag the Y axis so that it aligns with grid image

- Move cursor to top view and press space key. Top view is shown

- With base chosen, select rotate tool. Rotate manipulator icon is shown

- For rotating the cylinder, move Y manipulator ring (which is shown in green).
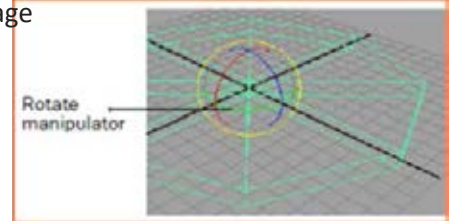
Fig.3.3.9: Rotate Manipulator
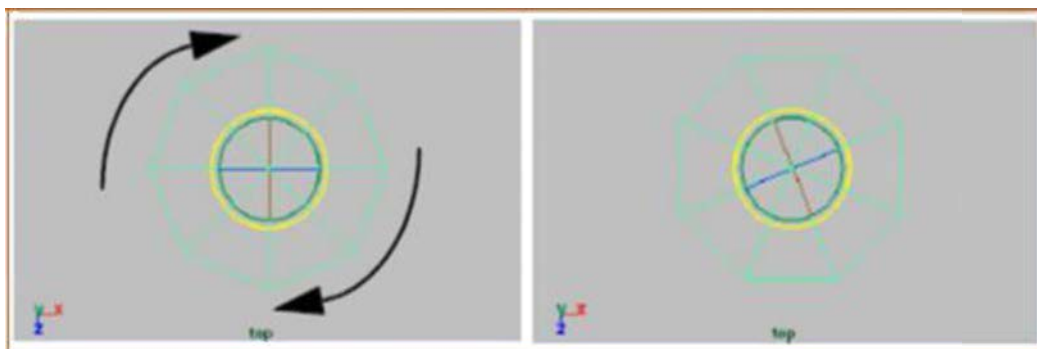
Fig.3.3.10: Top view

3.3.4 The Channel Box

Chanel Box may be used for changing details (x, y values) of object by changing values. This may be used for translation   or   rotation Rename the cylinder here.

To move and rotate the base using the Channel Box

• transformation attributes may be seen in channel box

• change these values so that they Make above image similar to above image and enter number values
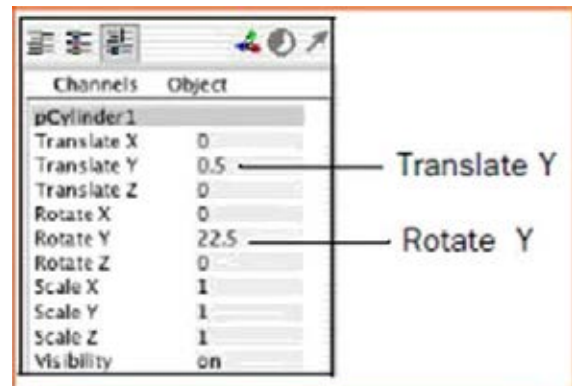
• Software automatically names a file, it may be renamed

Fig.3.3.11: Move and Rotate

For renaming

• Choose name filed (pCylinder1)

• Rename this with more meaningful name.
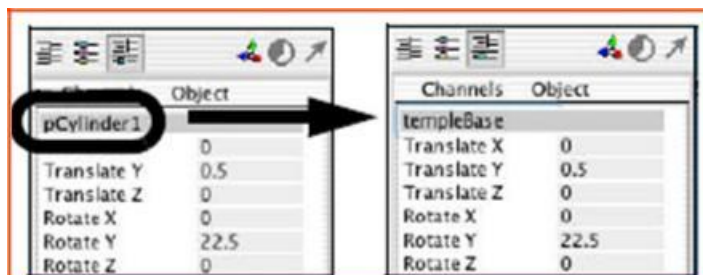
Fig.3.3.12: Rename Primitive object

3.3.5 Duplicating objects

Duplicate tool helps you save time and gives accuracy to objects we wish to use again. The attributes remain the same   as   original   and   all   transformation   will   automatically   apply. Select the object you wish to duplicate and go to Edit, Duplicate Special when the window opens select Edit, Reset settings).

For duplicating temple base

• Display base in perspective view

• Select duplicate special from edit option in main menu, options are shown in Duplicate special window.

• Here, Choose reset setting in edit option. Enter the details:

    a.   Translate- 0 1.0 0

    b.   Rotate- 0 0 0

c. Scale- 0.9 1.0 0.9

d. Geometry Type- Copy

e. Group under: Parent

Fig.3.3.13: Scaling

Software makes duplicate of templeBase which is scaled 0.9 of Original (in X, Z direction) & is 1 unit above templeBase.

Notes

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UNIT 3.4: Viewing the Maya 3D Scene

Unit Objectives ⊘

On completion of module, you can:

1. Application of 3D animation techniques on Maya Software-Viewing the Maya 3D Scene.

2. Identify and use of camera tools.

3. Familiarise with the overview of workflow.

3.4.1 Camera tools

There are two views discussed and seen in above chapters, one seen was the orthographic view that is 2D images and second is Perspective view which is 3D. The orthographic view considers only 2 axis whereas perspective considers 3. The interface shows you how scenes look from camera. Use the Camera tool to see these .
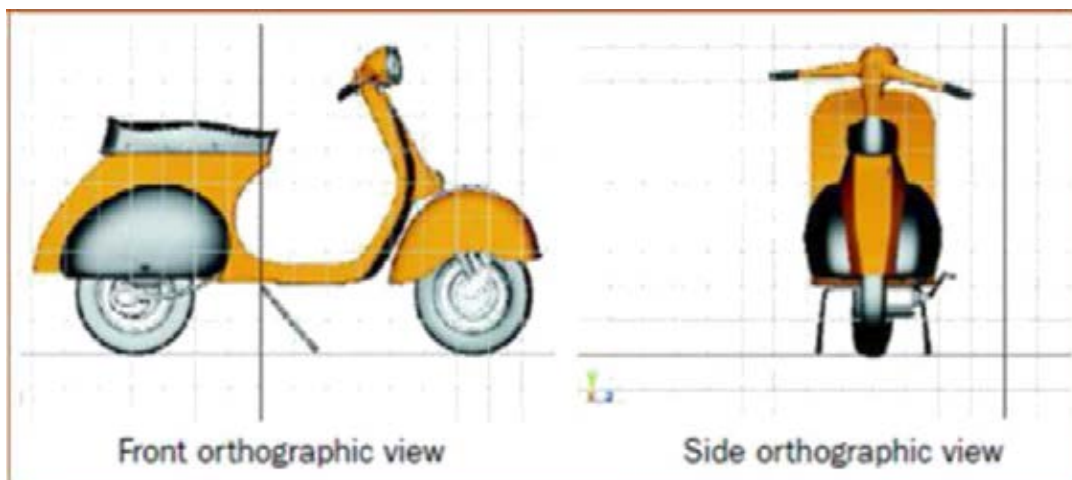
Fig.3.4.1: 2 Axes View

Perspective View

Scene is viewed through set of virtual cameras which are perspective or orthographic. View settings may be changed in camera tool

Fig.3.4.2: Perspective view

3.4.2 Workflow Overview

A group of primitive shapes design the pillars of temple,like the base was duplicated we will apply the same process to all pillars.

Fig.3.4.3: 1st Column Named

To create a polygonal cube for the pedestal

- Select Create, Polygon primitives and Cube

- Open Options for object and enter values as:
    a. Width= 1.75
    b. Height= 0.6
    c. Depth= 1.75

  Other values are left same
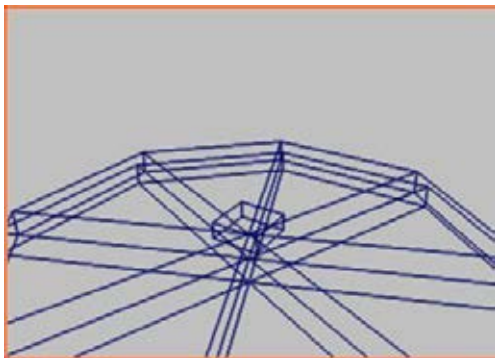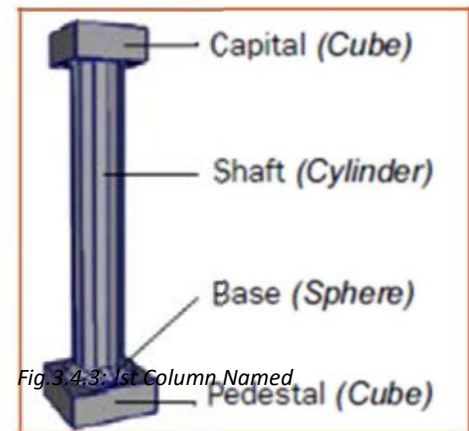
Fig.3.4.4: Polygonal cube for the pedestal

Creating cube primitive at origin

This will be placed at the origin, using side view Move the cube so it sits on the base. Save the object by Renaming.

To create a polygonal cylinder for the shaft

- Create, Polygon primitives and Cylinder.

- Reset Settings with below values:
    a. Radius= 0.5
    b. Height= 6
    c. Axis divisions= 1
    d. Other values are left same
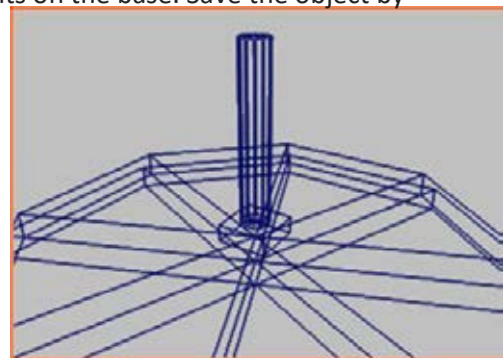
Fig.3.4.5: Polygonal cylinder for the shaft

- I Use side view to place on top of Cube. Save the object.
- In the Channel Box, rename the cylinder columnShaft.

See objects in shade type (mode)

There are two view modes- wireframe & shaded. In wireframe model, transparent object shape with edges only are shown. In shaded model, solid object is shown.
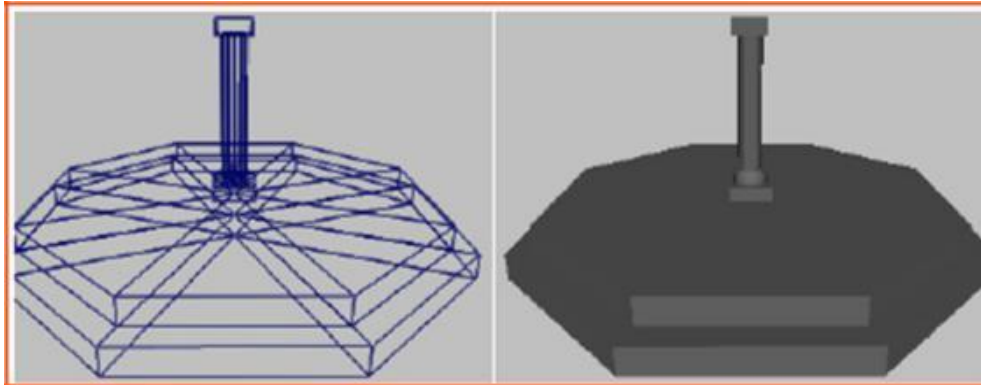

Fig.3.4.6: Objects in shaded mode

Change the display of your scene from wire frame option to shaded object mode to understand dimension from the Panel menu, Shading, Smooth shade all.

3.4.3 Grouping Objects

Primitive objects in Maya have a hierarchy that is grouping together to form a unit that share similar attributes or features. Most of Mayas objects are grouped like the Cube is squares and planes. This makes scaling, rotating and   moving   a   group   easier   than   individual.

To group select objects, with left mouse button holding shift select all objects, then drag a box around them except the base as we are duplicating the pillars.
Go to Edit, Group, then Reset Settings, Group under select Parent.
Select Group in the Group options window

3.4.4 The Hypergraph

This shows hierarchies of objects and nodes organization in your scene. To view Hypergraph go to Panels, Layouts Two Planes stacked. Each split view has its own menu to work in. In the upper menu select Panels, Hypergraph Panel, Hypergraph hierarchy and in the bottom select Hypergraph Scene hierarchy. In the Hypergraph panel select Frame All. This gives a detail hierarchy for all objects in group and various nodes can be seen graphically.
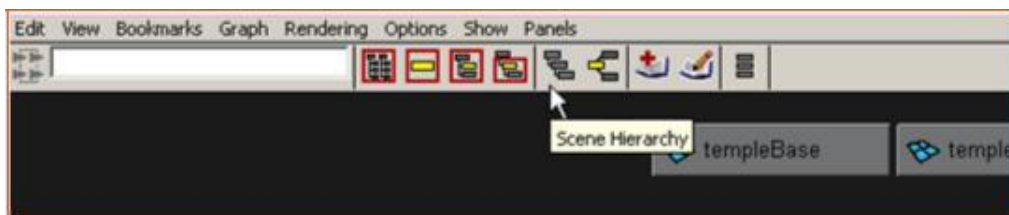

Fig.3.4.7: view the Hypergraph

Fig.3.4.8: Nodes

To rename Hypergraph

- To activate group on select the node in the Hypergraph does all objects gets selected as per hierarchy

- You can rename the Hypergraph directly from the pop up the menu by right clicking on the belief the node.

- Once you rename the column place it at a corner for easy access.

Positioning the column on the base

- Get the display back to wire frame by using shortcut of number four key rather than going in the menu.

- In the scene view, select the column in Hypergraph.

- And using the move tool get the column in the front in one of the corner of the base.
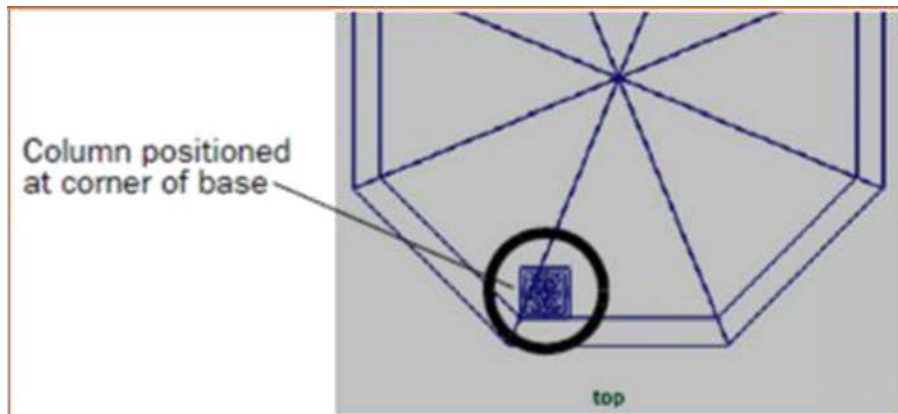
Fig.3.4.9: Column Positioned

With the first column in position, one can generate a copy of the column and move it on the another corner of base.

To create a duplicate copy of the column

Once created, duplicated and place on the opposite corner use command edit, Duplicate special when the window opens go to reset settings and enter the number of copies. When you click on duplicate special an additional column is shown with the name of original column in Hypergraph view. But in seen view no duplication is seen. When duplicated as is the objects appear on one another.

To move the duplicate column into position on the base

- In Hypergraph in scene view, with Column1 selected, click on top node.
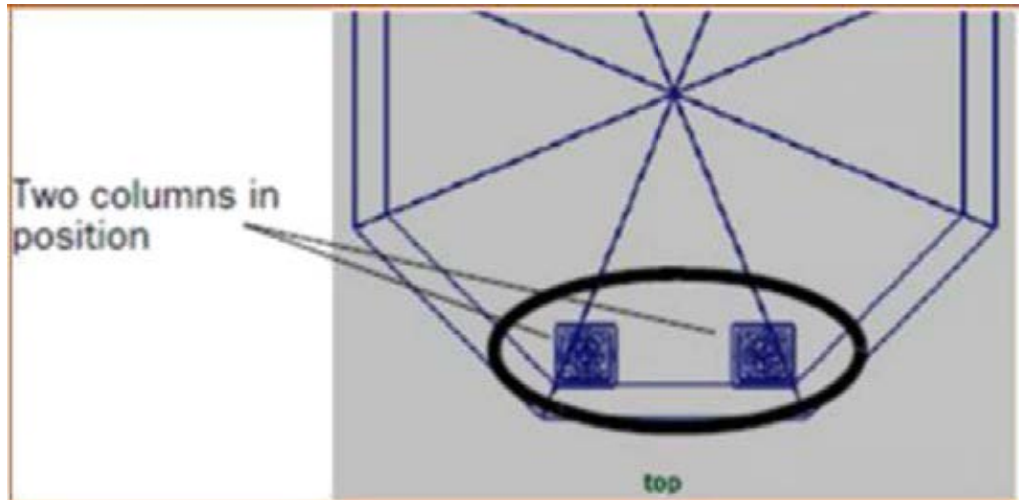- Now, make use of move tool for placing column 1 on other corner.

Fig.3.4.10: Two Columns in Position

- Choose 4 view layout, hypergraph is not displayed.

Selection mask and mode

Maya offers different selection modes for types of new items and their specific needs the default selection is at object and remaining two are named Hierarchy and Components. These are used for limiting selection of objects which ensures only items wanted are selected.

Fig.3.4.11: Selection modes and masks

To use the Hierarchy and Combinations selection mask

To use Hierarchy on the status line there are selection mask icons that displays these choices to select at parent node select the hierarchy option. Using shift, click on both the columns.

3.4.5 Pivot Points

It is used as reference point along with other objects (curves, surfaces, and groups) are transformed.

To group the two columns

* Once the column are selected by the specific positions go to Edit, Reset the settings. Select parent for group

* In the Group Options window, click Group.

Software automatically has the pivot points at the origin for an objects that have been grouped.

To duplicate and rotate the group

* Go to Edit, duplicate special and Reset settings to Rotate (90) and copies at (3)
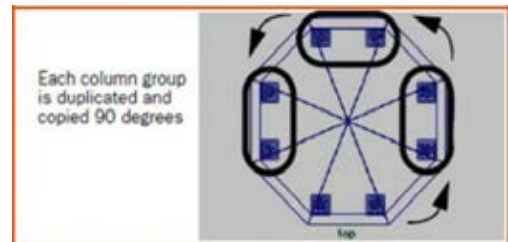
Fig.3.4.12: Rotate the Group

* Duplicate Special, in Duplicate Special prompt. Duplicated copy is created and rotated by 90 deg.

Components and attributes

Maya offers various display modes to make work easier in interface.

Templating column & base

* Select all objects in side view (with hierarchy mode ON)

* Choose template from, object display under display option in main menu Objects is templated.
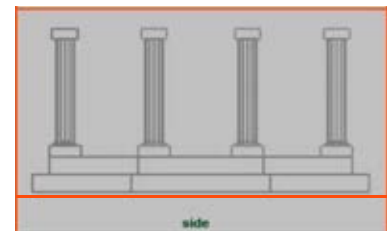
Fig.3.4.13: Template the base and columns

Making and positioning a torus primitive for entablature

* Select all objects in the side view and go to Display, Object Display, Template. Then go to NURBS, TORUS.

* In Reset setting enter the Radius, Section, Minor Radius:

  - Radius: 8.5

  - Minor Radius: 0.5

  - Number of Sections: 24

* Click Create in TORUS option.

* Renamed the Transformation and move it in scene view so it sits on the columns.
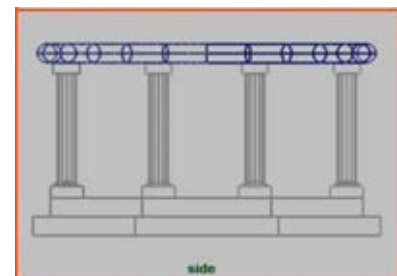
3.4.6 Components

- All objects are provided with shape & transform node.

- For modifying shape, you need to change information of component

Selecting components of entablature

- Dolly in in order to get close view of Entablature, in side view.

- You need to Transform in Component View. Once Selection mode is at Component right click the Created roof and go to Control vertex.

- A new menu pops up, this is for selecting operations for object by right clicking

- Pool a Selection box across the top row and pool the vertices.

- With help of Move Tool, Change shape of Entablature by vertically moving up vertices.

- Click on the wireframe to get back to object mode.
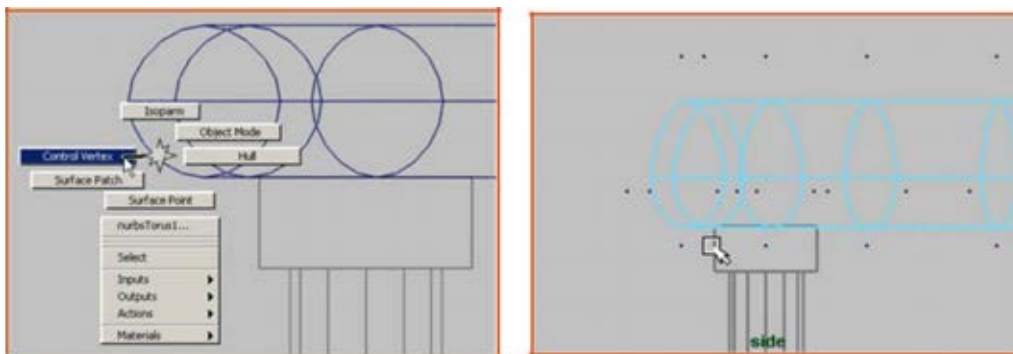
Fig.3.4.15: Components of the entablature

Roof for temple is made by half sphere primitive & is resting on top of entablature.

Making a roof for temple

- go to Create, NURBS , Primitives, Sphere and in Reset settings set radius(8.75), Section (8), Spans(4)and End Sweep Angel (180)

- Then Rotate the roof at 90 degree angle. Place it on Top and Use the Z axis to manipulate its appearance

Positioning & rotating roof on entablature

- Rotate roof with dome pointing up, in side view

- Position roof along top side of Entablature.

- Scale roof in Z direction using blue manipulator handle. Sphere appears little squashed.
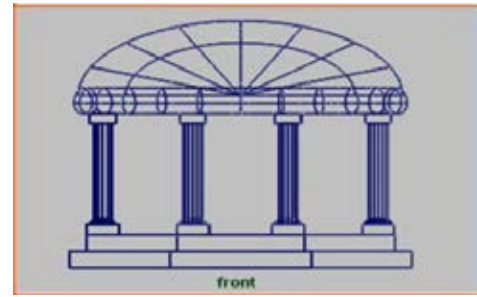
Untemplating objects

Fig.3.4.16: Roof on the entablature

- Using Hierarchy and Combinations, pick select in status line.

- On the Status Line, choose the Select by hierarchy: template button.

Fig.3.4.17: Untemplate objects

- Only those objects which are templated, are affected

- While being in scene view, select all objects in scene together by moving in selection box.

- Choose untemplate from object display option in display option in main menu.

- Pick Select by hierarchy option : root button (on status line)

Attribute Editor

It gives information on attributes & nodes for object in the scene.

Viewing objects attributes (use of Attribute Editor)

- templeRoof is selected in scene view

- On status line, pick show/hide option, Attribute Editor appears

Fig.3.4.18: Atributes

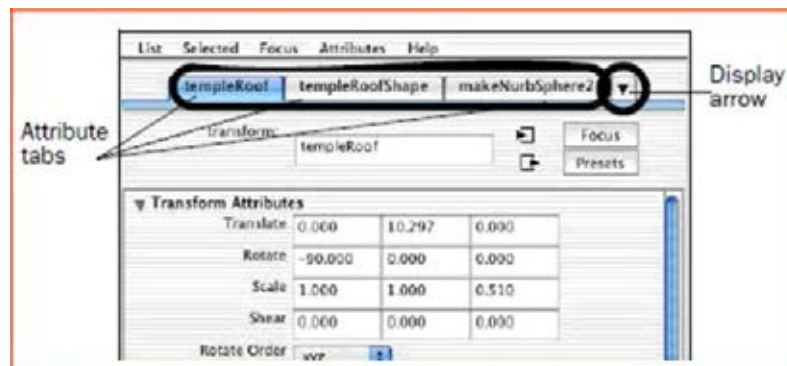- It shows attributes for the this selected object under different tabs, each of which shows a node

Fig.3.4.19: Attribute Editor

- **For seeing its attributes, pick templeRoof tab:** This controls its transformation so it is called transform node. Change the camera and lights in Transform mode.

- **For seeing its attributes, pick templeRoofShape:** This tab has information on attributes which form object's shape and physical properties, so it is also called shape node.

- **For seeing the attributes, pick makeNurbSphere tab:** It has construction History, shading and physical properties, of different nodes.

- **Lambert11 & initial Shading Group:** Pick display arrow for seeing them. These two are two default nodes for shading in maya software.

3.4.7 Surface materials

The next attribute is the Surface to create reflection, shade all related to light .

To assign a new material to the temple objects

- Go to object mode and select all the objects.
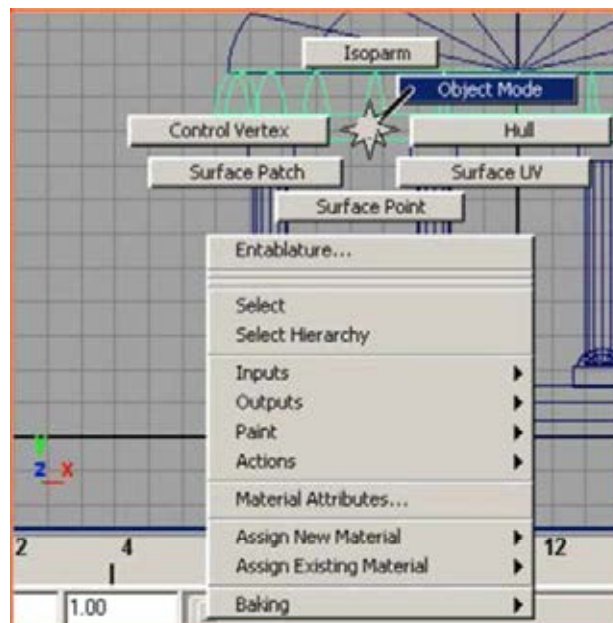
Fig.3.4.20: Wireframe of Entablature

- Select all objects in scene using selection box.

- Choose rendering menu in menu selector from status line.

- Menu for Rendering is displayed.

- In the main menu go to lighting and assign new material, Blinn

- Rename shading material (to templeShader) in Attribute Editor.

Editing attributes of shading material

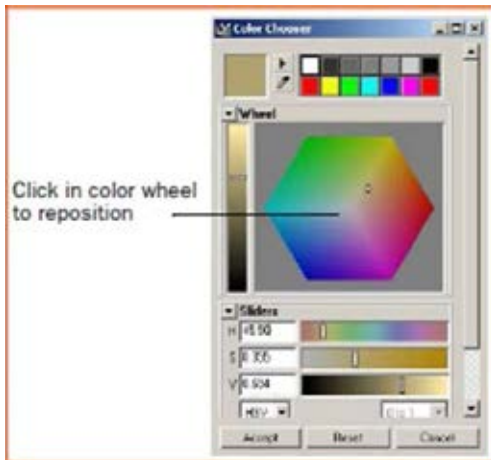- Click in grey menu box in Attribute Editor

Fig.3.4.21: Edit the shading material's attributes

Fig.3.4.22: Color Chooser appears.

- The Color Chooser appears.

- Now using the Editor use the Color wheel to get color like golden or shiny side.
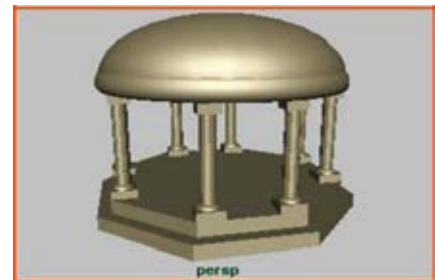
- Click Accept to freeze the color.

Fig.3.4.23

- Pick Selected menu item, and then choose templeBase in list. It shows attributes for templeBase.

- Choose node tab of templeshader for seeing its attributes

- Exit Attribute Editor

Notes

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UNIT 3.5: Polygonal Modelling

Unit Objectives ⊚

Upon culmination of this, reader would be able to comprehend:

1. Application of 3D animation techniques on Maya Software-Polygonal Modelling.

3.5.1 Modeling

The accuracy and Artistry required for designing the making the shape and structure detail and proportionate is called Modelling.

3 kind of modeling surface are there in Maya software:
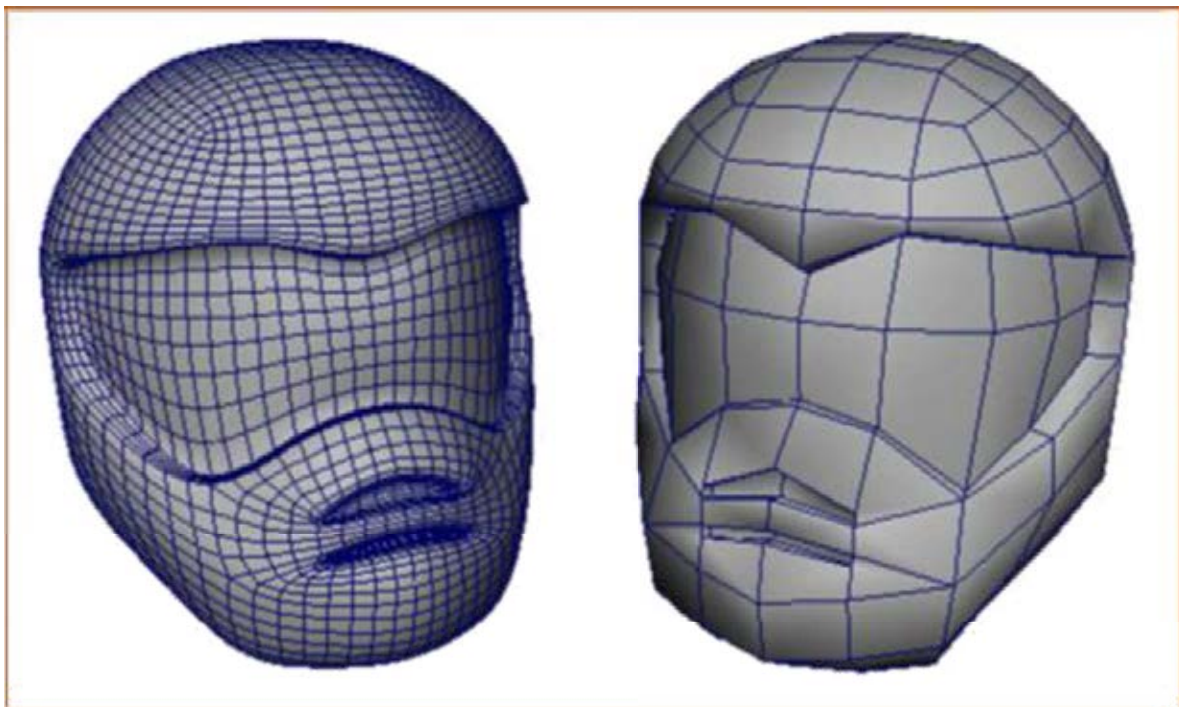
1. Polygons
2. NURBS
3. Subdivision surfaces.

Fig.3.5.1: Modeling surface

Modelling uses flat surface faces called the Polygon mesh.

3.5.3 Choosing Modeling Preferences

Modify default setting to better understanding of this unit.

- Go to Window, Preferences and select Polygon.

  In the Settings enter the width as 4 and set the border edges on to help distinguished the border from others in the model.

- Pick selection in Category option in Preferences

In polygon Selection settings, make the Next in the Polygon Selection Setting go to whole face (option that select dictates what you can click in the scene)

  »» Save and close settings window.

»» Need to turn off interactive option. For this, deselect interactive creation in polygon primitive option under create menu
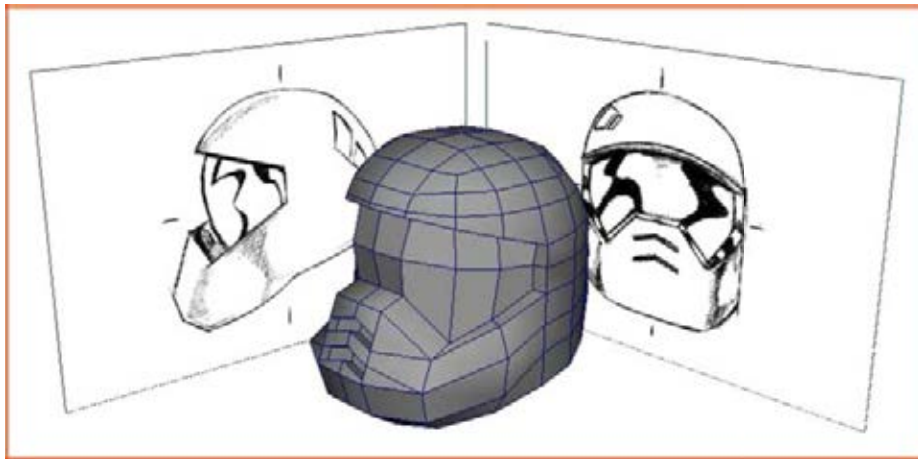

Fig.3.5.3: Interactive Creation option for primitives

Loading reference images into side & front orthographic views

- Pick 4 View shortcut in Layout bar. Perspective view is shown on top right & other views are also shown

- Select four view option and from View, Image plane import the image in front panel and renamed.

- Choose image file: HelmetFront.jpg. It would be located in Getting Started directory of Maya software

  Getting Started Lesson Data/Polygon Modeling/source images

There is a saved file in your directory named as headguard

Open this file. In the side view panel import this image

Select the image file named as headguard.jpg. T It would be located in Getting Started directory of Maya software GettingStartedLessonData/PolygonModeling/sourceimages

- In the browser, click the Open button.

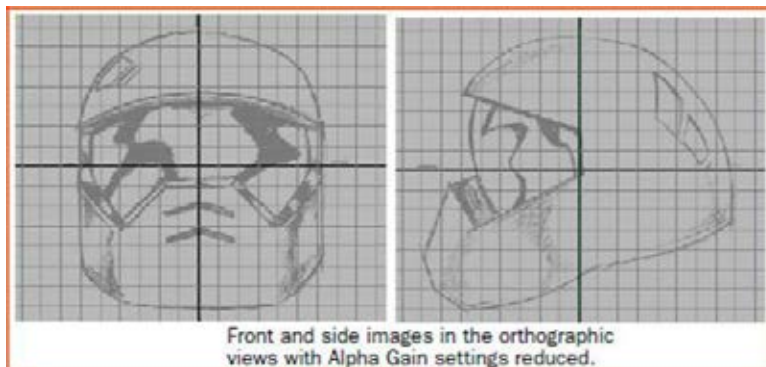   headguard.jpg appears in the side view.

Fig.3.5.4: HelmetSide.jpg

To modify the transparency of the reference images

- Next go to view, select Camera and make sure Channel Box is displayed for the key attributes.
- For showing attributes of image plane, select ImagePlane1 name.
- Put alpha gain attribute as point 30 to make it slightly translucent and apply the same setting in the side view panel as well.

3.5.4 Creating a Polygon Primitive

Now the helmet mode needs to be created in the perspective view. Use of primitive object is one way for beginning 3D meshes as these may be changed to different forms

Making cube primitive for a helmet mesh

- In perspective view, Now create the Cube from Polygon primitive then in Edit
- Reset settings change the width, height, depth (14) and their respective

    divisions at (1).

- Click Create .

Cube primitive is made at centre (origin) having size as specified &
1 subdivision in centre. The cube Primitive with the one centre
subdivision and four faces(quads). Quad polygons are commonly used
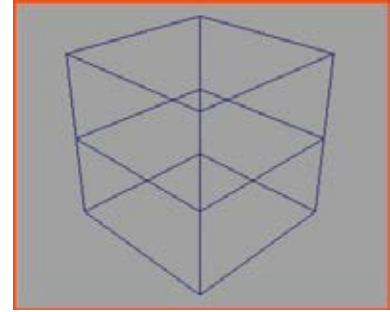alongside 3D character models because these may be smoothen easily
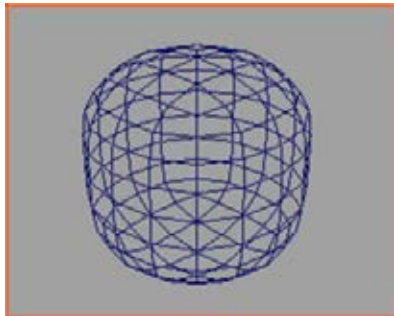

Fig.3.5.5: Cube primitive

Fig.3.5.6: Cube primitive Smoothen

To smooth and subdivide the cube primitive

- Go to mesh, smooth and enter the following options:
    - Add divisions- Exponentially
    - Division levels- 2

- Click the Smooth

This will make the cubes the surface smooth and corners rounded
you will see smaller faces subdivisons
.
Even after the smooth operation of changing shape & location, faces
remain 4 sided.

3.5.5 Modeling in Shaded Mode

3D volume is better understood by modeling the polygon mesh in shaded mode.
you can select the different display options like the orthographic mode for wireframe and perspective for
shaded

Showing helmet mesh in Wireframe (in Shaded mode)

- Follow the instructions of Right Click on the mesh and select the view from the object mode.

- Select the helmet mesh.

- then in perspective view select shading, smooth shade and with the same pathway Select Wireframe

Displaying the helmet mesh in shaded X-Ray mode

- Helmet being selected, choose below from side view's menu:

- Choose 'smooth shade all' in shading

- Choose 'Wireframe on Shaded' in shading

- Choose 'X-Ray'.

helmet mesh is updated to semitransparent shaded display having wireframe. 2D image can be seen behind mesh.
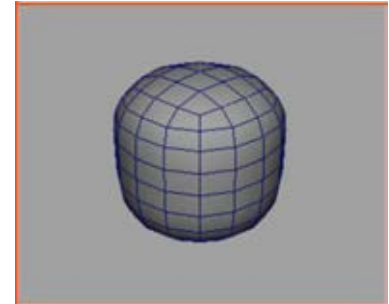
Repeat this for other view as well

Fig.3.5.7: Shaded X-Ray mode

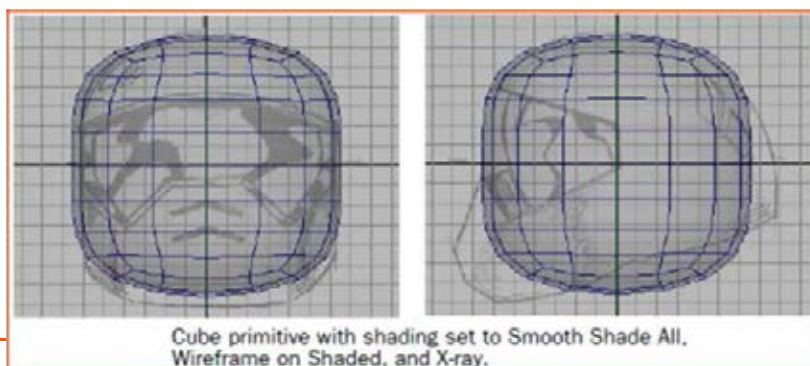Cube primitive with shading set to Smooth Shade All, Wireframe on Shaded, and X-ray.

Fig.3.5.8: Wireframe

3.5.6 Model Symmetry

- Symmetry means taking advantage of object dimensions.

- In order to delete faces on left part of mesh

- In top view, mesh is right-clicked & Face is selected from marking menu

- Bounding box is dragged around the faces in left side of helmet mesh in order to select it

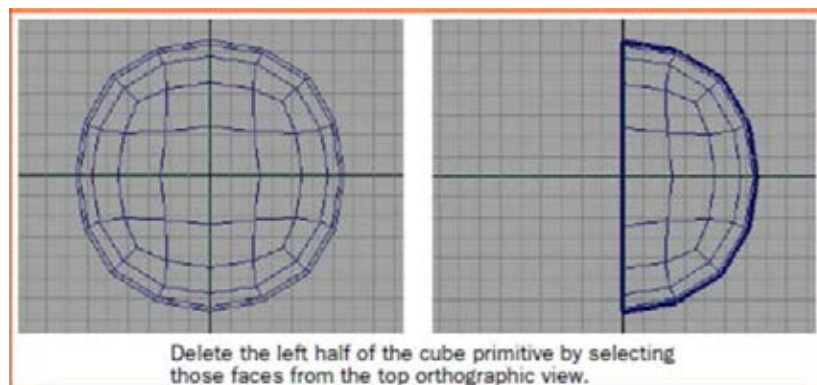- Delete is pressed and faces which have been selected are deleted

Delete the left half of the cube primitive by selecting those faces from the top orthographic view.

Fig.3.5.9: Model Symmetry

3.5.7 Selecting Components by Painting

Deleting faces

Choose paint selection tool

Click the Paint Selection Tool icon and paint select faces using Face selection mode.
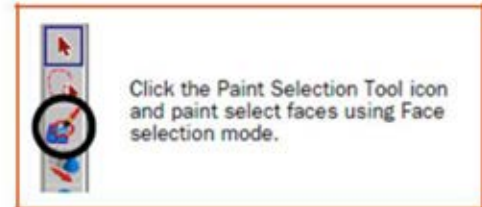
Fig.3.5.10: Paint Selection Tool icon

- Select face by right clicking helmet mesh.
- From the Paint Selection item, In the side view use marking menu to create a side helmet face.

Paint select the faces along the front and lower half of the mesh.
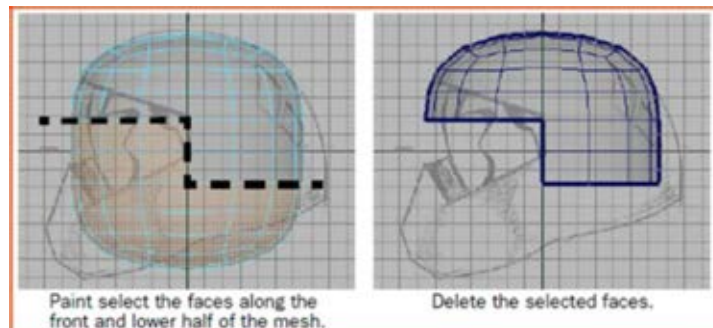
Delete the selected faces.

Fig.3.5.11

- Press Delete Key

- Review work done by flipping perspective view
- Border edges are edges along outer periphery of mesh. This will be shown in 2D flat image and the outline of the current object will be thicker than the internal edges

3.5.8 Selecting Edge Loops

Edges need to be aligned in the X and Z Axis by the using the Move Tool to snap them. Edge Group Selection are sequential path of Polygon Edges by its vertices.

To align edges on the helmet mesh

- In the top view, select the first horizontal edge loop that appears directly below the X axis by choosing Select > Select Edge Loop Tool from the main menu and then double-clicking the edge loop as indicated in the image above. The edge loop is selected.
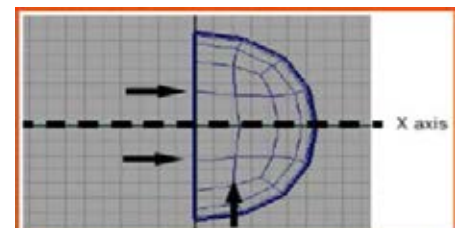

Fig.3.5.12: Select Edge Loop

- Turn on the Snap to Grid Feature

Fig.3.5.13: Clicking the icon

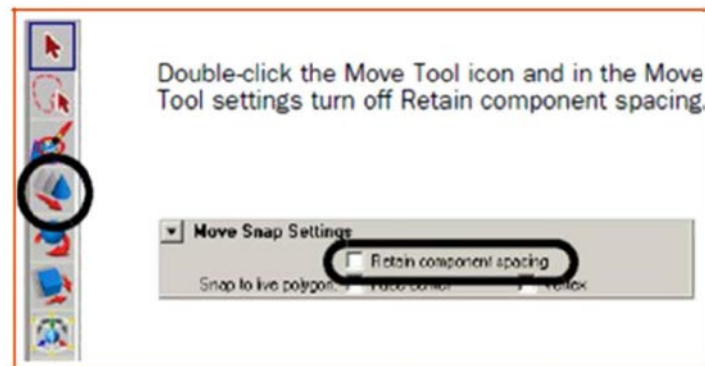- To align the simultaneous object click on Grid Intersection Point

Fig.3.5.14: Clicking the Moov Tool icon

- For showing tool settings, double click Move Tool.
- From Move tool options Turn off the retain component spacing in the Move Snap Settings.
- When you drag the Move Tool downwards the Edge loop will Snap to a lower grid line.
- Turn off the snap grid feature and drag the Move tool upwards to position the loop.
- Follow the same steps to align the other edge groups till X and Z axis are align.
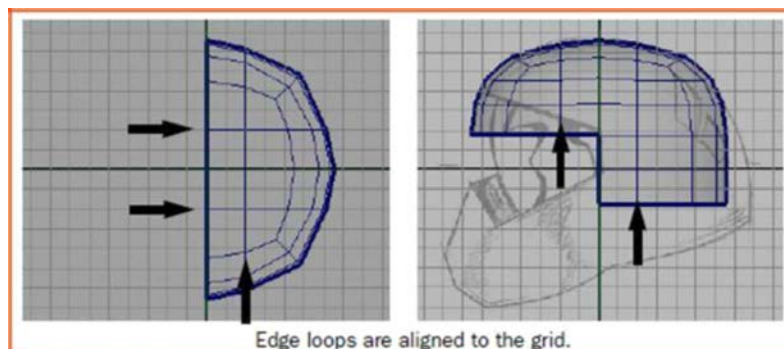- When finished, edge loops nearest to X axis & Z axis are aligned.

Fig.3.5.15: Edge Loops aligned

Editing components in the orthographic views

Orthographic views are an essential method to constantly recheck, refined and match various images in different scenes. The fundamental components of the Polygon (Edges, Vertices, Faces) are frequently examine in the component selection.

Repositioning vertices on helmet rear

- Manually set the vertices by selecting Vertex by right clicking and dragging a box around the vertices pair
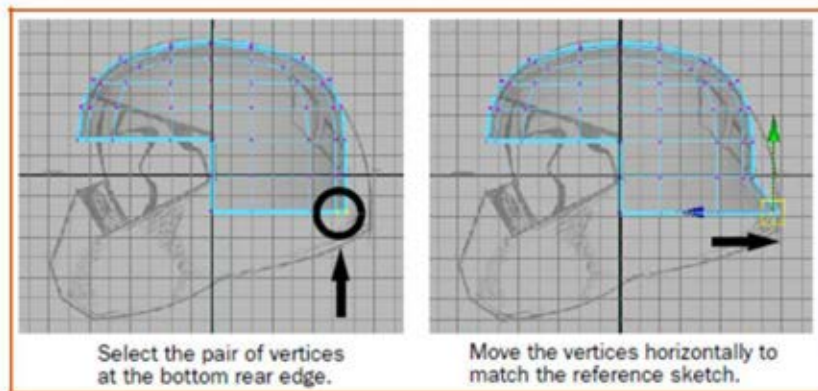
Fig.3.5.16: Select Vertex

- Choose vertices pair at the rear edge (as shown in image) by moving bounding box around it, in side view

- Press Move Tool, in toolbar

- Drag the move tool manipulator towards the required direction to reposition the vertices.

- Ensure the symmetry of the shape is maintained by following the same steps for the other vertices, pair as well.

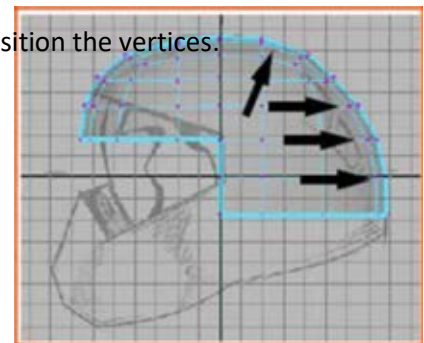- Do same steps (from 2 to 4) for other vertices. Make sure edge loops are smooth.
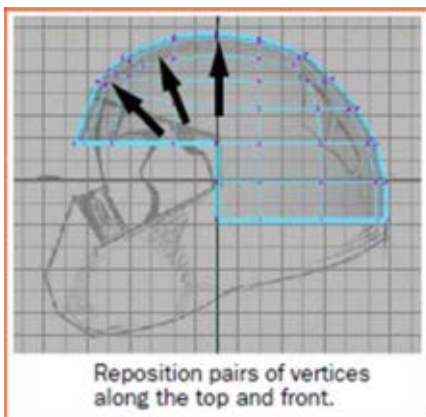
Fig.3.5.17: Appear smooth

- Choose vertices pair at the top & front edge by moving bounding box around it, in side view. Don't position vertices on top of face now

Fig.3.5.18: Select other pairs of vertices

To reposition the lower border edges on the helmet

- Position the border edges by selecting the lowest edge loop. Using Select, Select Border Edge Tool, Command

- Click it on the first and last edge and drag it downwards to match the base edge using the Move tool.
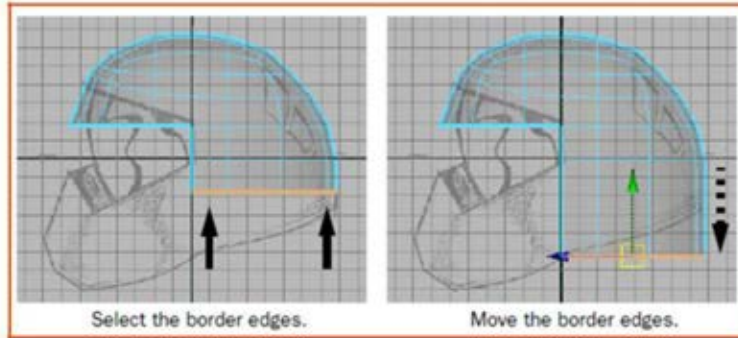
Fig.3.5.19: Reposition the lower border edges

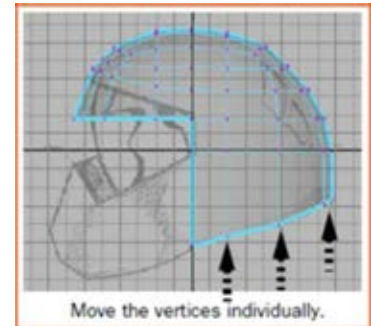- Manually select and change positions to match the sketch in the mesh.

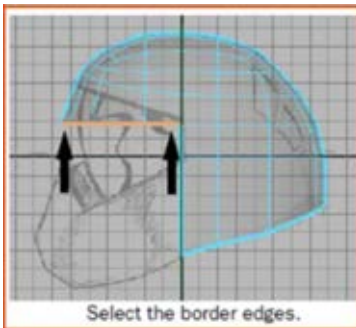*Fig.3.5.20: Select and reposition the Remaining vertices*

Editing border edges on upper edge of face shield

- Choose Border Edge Tool in selection menu.
- First select first border edge and then select last border edge, in side view. All other edges in between these are selected automatically.
- Choose rotate tool.
- Select rotate manipulator and drag it in such a way in clockwise direction so that border sides are rotated by same amount as the edges in reference sketch.

Fig.3.5.21: Select Border Edges

- While selecting border edges, pick move tool and drag green manipulator. It should be moved in such a way to match corresponding edge in reference sketch.
- Vertices are relocated on upper part helmet again matching those in reference sketch.
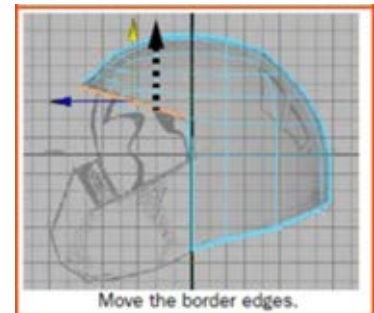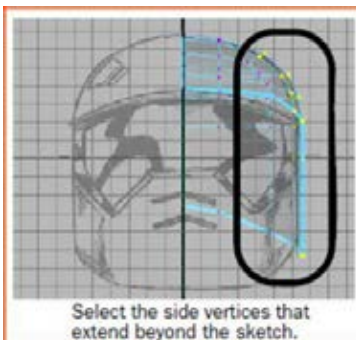

Fig.3.5.22: Move Border Edges

Relocating vertices on helmet's side

- Choose front view.
- Select vertices that are outside the image outline and move them to match it manually.

Fig.3.5.23: Selecting
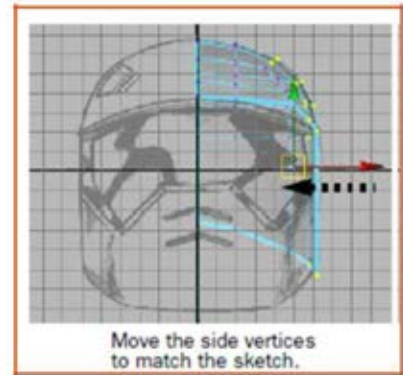
Fig.3.5.24: Moving Left

3.5.9 Editing Components in the Perspective View

Perspective view is complicated as you tumble track and dolly 3D view.

Moving vertex on mesh

- Find vertices that push out unexpectedly while tumbling in perspective view

Fig.3.5.25: Moving Left

- Show Move Settings editor by clicking move tool.

- In the Move Tool Options go to setting editor and turn on the normal.
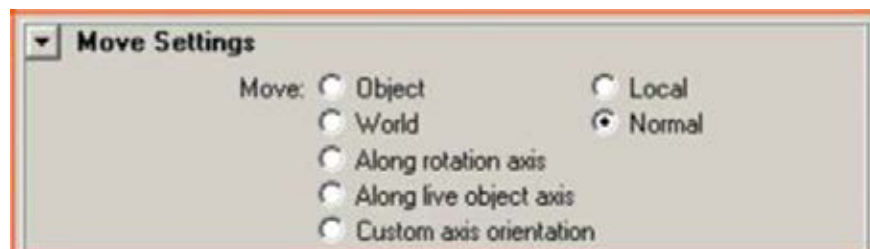
Fig.3.5.26: Moving Left

- Select the vertex to move.

- You will see three possible directions named as the U and V handles and N Handle that move in the direction of your mouse.
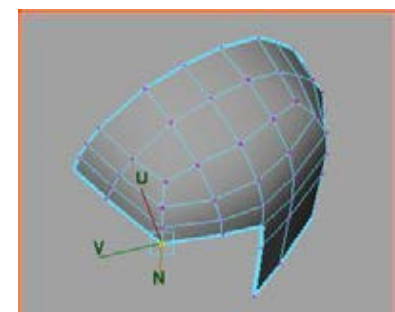
Fig.3.5.27: U & v handle

- While examining the Mesh, Drag the handles inward or Outward as required.
- Do the same steps again for other vertices
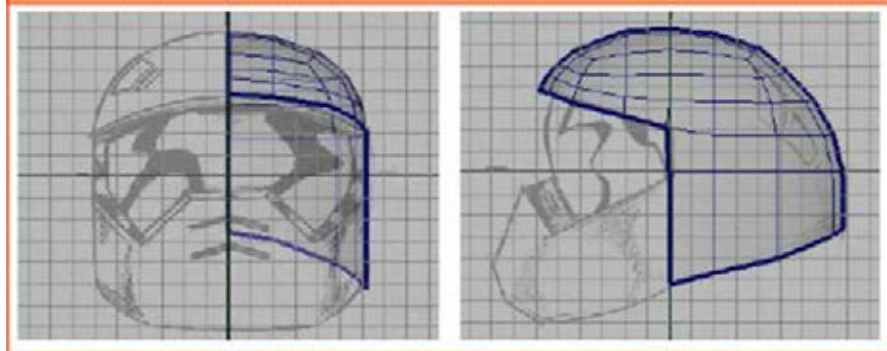
Fig.3.5.28: Smoothing mesh

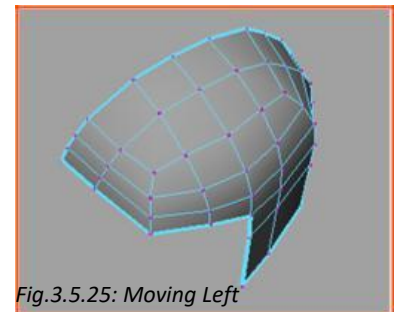# 3.5.10 Drawing a Polygon

Now we proceed to the front vision of Helmet that is the Protruding section of the front jaw.

Placing vertices for polygon

- In the side view go to Mesh, Create Polygon tool, in the Editor Enter the limit points to (6) after turning them on.

Place this 6 points in the section of the front jaw that pushes out. Vertices to be places in anticlockwise direction.

- Close create polygon tool by pressing Q
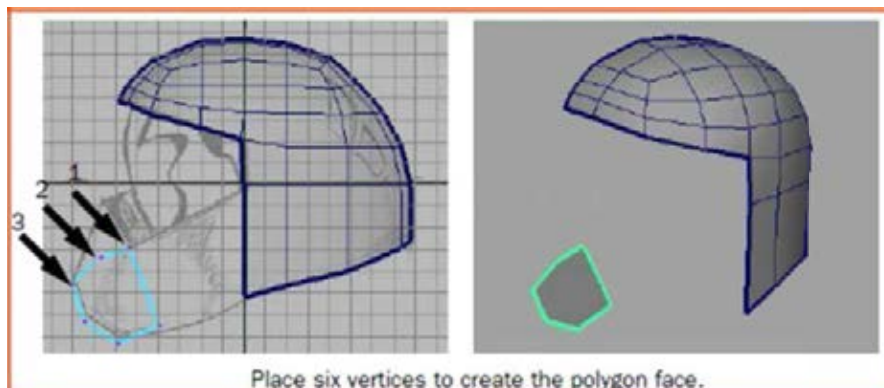
Place six vertices to create the polygon face.

Fig.3.5.29: Creating Polygon face

Extruding polygon face

- Now enlarge the scene and choose perspective view

- Go to edit mesh, extrude.

- Drag the manipulator towards X a little bit.

Drag the blue arrow to extrude the selected face.
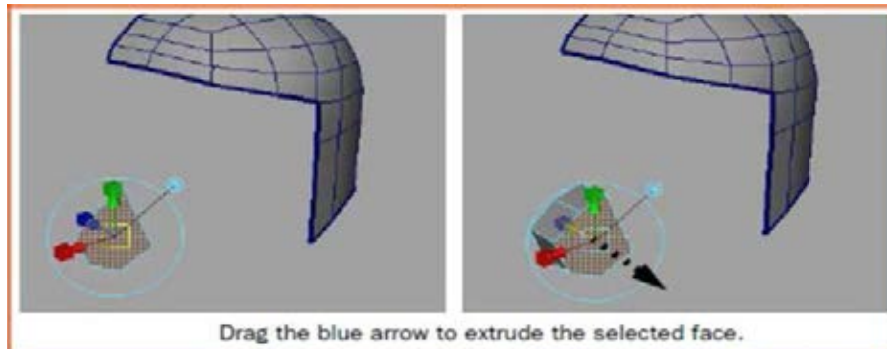
Fig.3.5.30: Extruding

- Press G on keybord to extrude.

- You can see a large circle that displays rotate options. Use them to rotate and match the Helmet.

Extrude three segments, changing the extrude angle as you proceed.
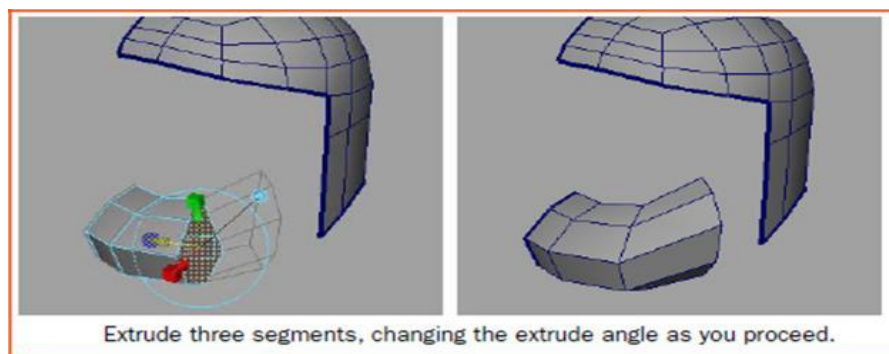
Fig.3.5.31: Rotate Angle of Extrusion

- Press G key to extrude and position on Mesh.
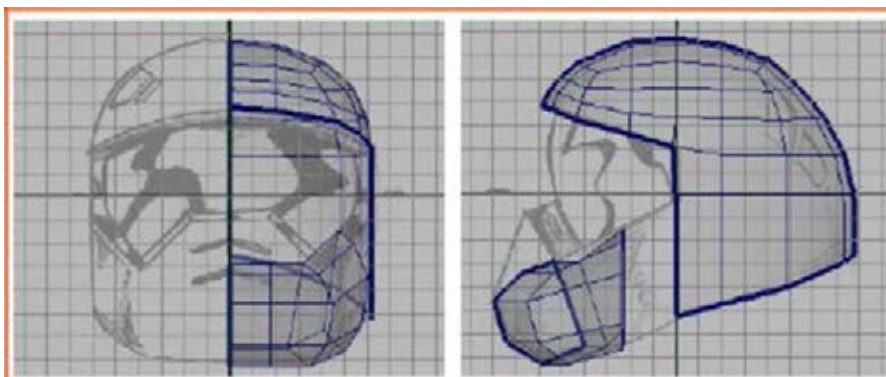
Deleting unwanted faces

- In perspective view delete unwanted faces by tumbling the image and noticing the faces on extrusion ends.
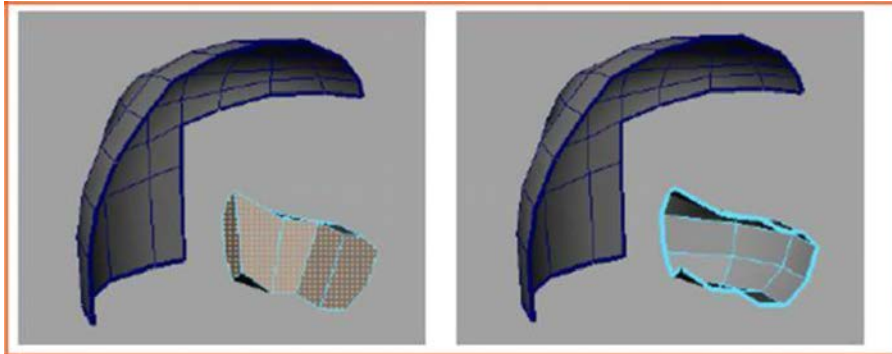
Fig.3.5.33: Select & Delete the interior Faces

- Select the faces to deleted
- Press Delete
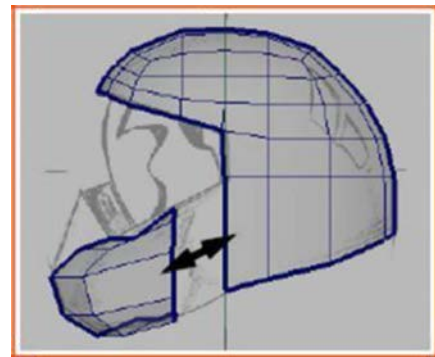
Fig.3.5.34: A gap exist Between two meshes

Extruding bottom edges (of helmet mesh)

- Select lower edges as before
- Use extrude command (in edit mesh) and then move blue manipulator. It should be done in a way towards inside of helmet for creating rows of edges which are at 90 deg to bottom. Now extrude with 1 unit depth
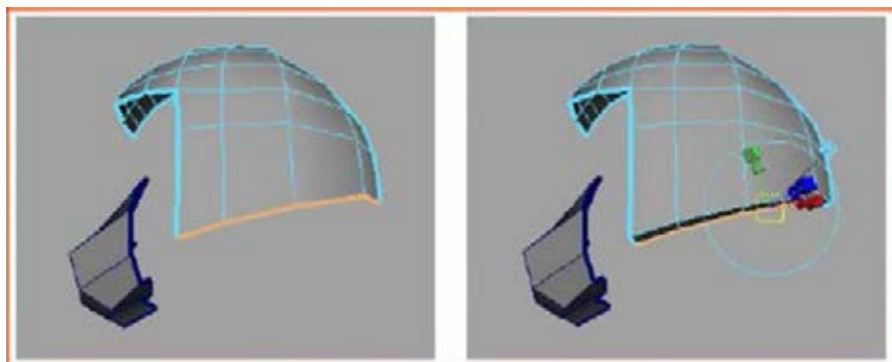
Fig.3.5.35: Extrude the top and side edges inwards

Extruding top & side edges

- Select side (upper & side edges)
- Use extrude command (in edit mesh) and then move blue manipulator.

It should be done in a way towards inside of helmet for creating rows of edges which are at 90 deg to top & side edge. Now extrude with 1 unit depth
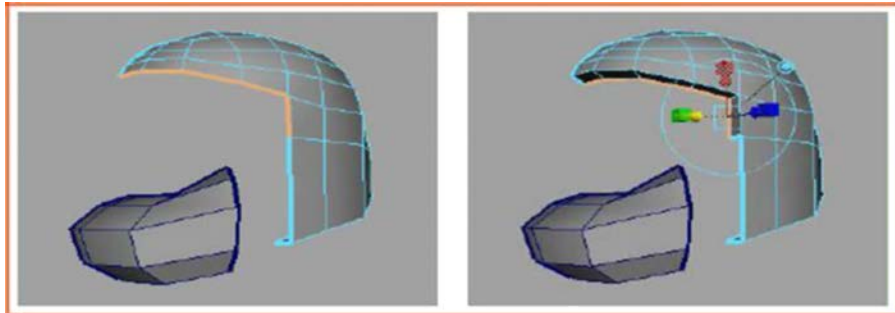
Fig.3.5.36: Extrude the top and side edges inwards

Moving vertices (in lower front region)

- Select vertex mode and change type to vertices.

- Select 4 vertices on said region closer to axis (see image below). Move these upward by moving green arrow in move tool.
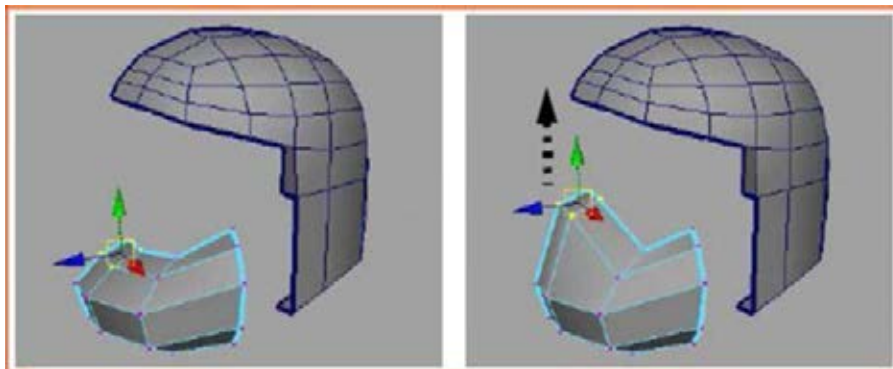
Fig.3.5.37: Select four vertices

- If any vertex on lower part need relocation, do it accordingly.
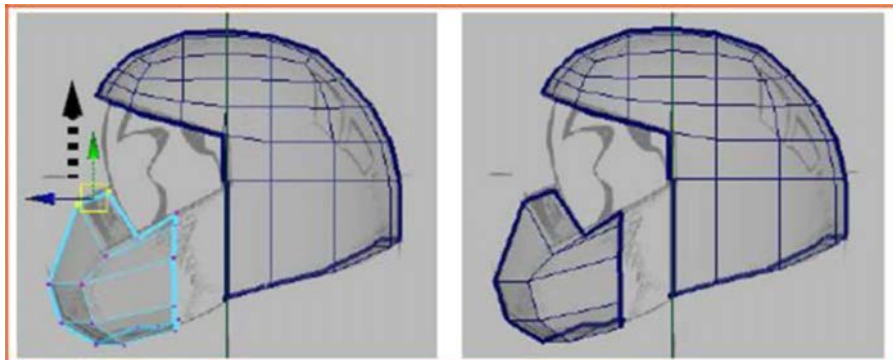
Fig.3.5.38: Move the vertices upward

3.5.11 Bridging Between Edges

When using the bridge feature you must ensure that:

- Use command Edit Mesh, bridge to create meshes that will connect the borders. It has the combine feature to bridge the age gaps.

- Select same number of edges on both sides in region which is to be bridged.

To insert edge loops on the side region of the helmet

- Begin with inserting edge loop tool and in settings Editor select Maintain Position(relative distance).

In the perspective view, Now Drag the side edge close to the bottom and without leaving the click drag mouse upwards towards the edge to insert the edge loop
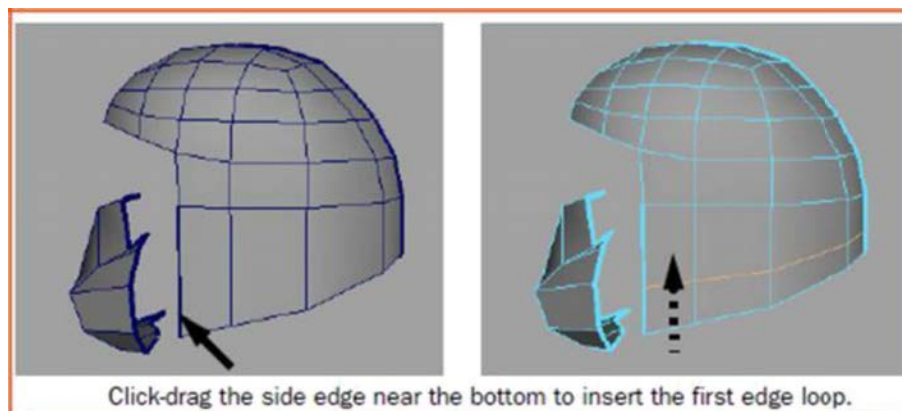
Fig.3.5.39: Drag the side edge

- Insert the second edge loop near the top of the previous edge loop.
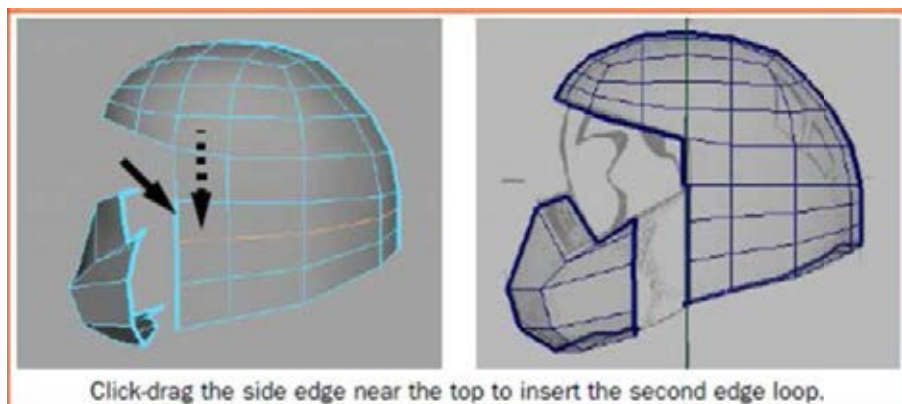
Fig.3.5.40: Drag the side edge

Bridging lower front & side region

- Now construct the bridging mesh o the front and side section of the helmet by the select border edge tool

Use the Select Border Edge Tool
to select the edges for the bridge.

Fig.3.5.41: Selecting Edges

- In the bridge option window (edit mesh) keep Divisions to 0 and create the bridge
- Return to select mode by pressing Q, and click outside for unselecting
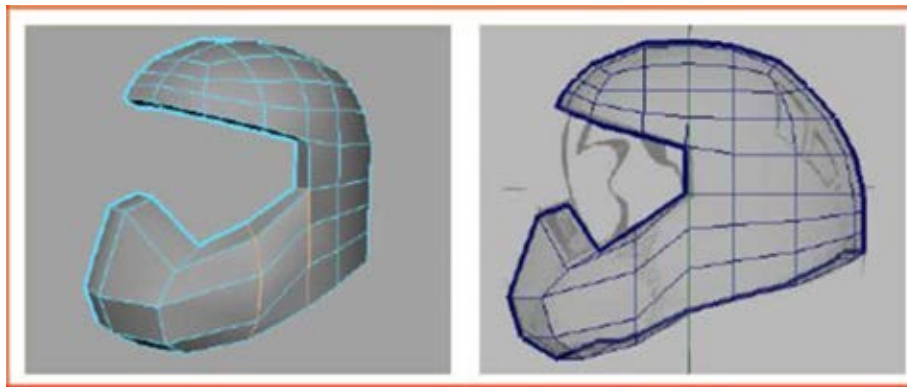
Fig.3.5.42: Unselect the edges

3.5.12 Adding Polygons to a Mesh

We will now create a large polygon for the face shield on the helmet and split into quads (quads)

Creating face shield

- Be in perspective view.

- Go to Edit Mesh, Append.

- Make sure keep new faces option in polygon tool settings is off. Else quads will not be created.

- Keeping Perspective view Click on the Top border Edge and begin Append.

- Now click on the bottom edge of the face. A polygon will be appeared across the selected edges.
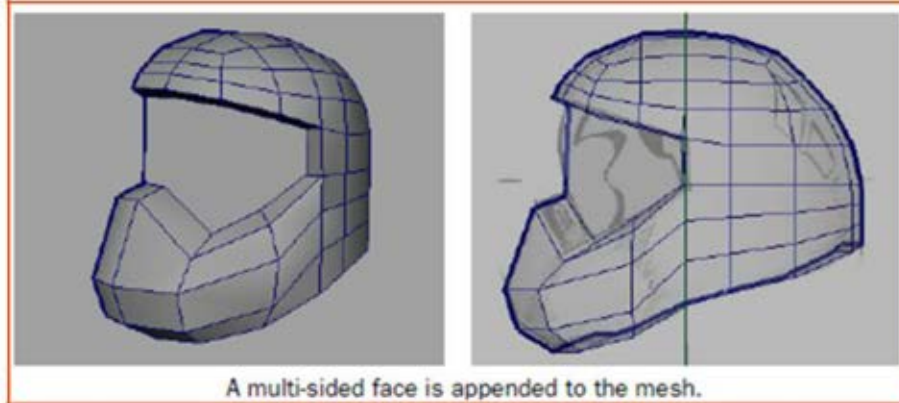
Fig.3.5.43: Multisided face apended to mesh

- Keep clicking the border edges around the face shield.
- Once done, Press Q key to exit.

Multi sided polygon are also known as N-Gons.
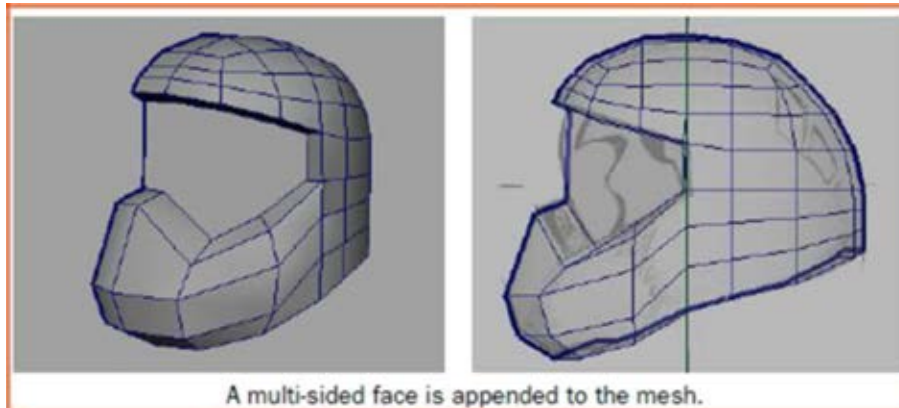
Fig.3.5.44: Multisided face apended to mesh

3.5.13 Splitting (dividing) Polygon Faces

Only some local areas of mesh cab be divided by use of split Polygon Tool.

To split the face shield vertically

- Use Command, Edit Mesh, Split Polygon Tool and In the Settings Editor of the same Enter below option
    - Split only from edges option should be kept On
    - Use of snapping points along edge option should also be kept On
    - Snapping tolerance should be 100

- View the inner edges by tumbling in perspective view

- Start the split by dragging the vertex from the top inner edge till the right side and drag the lower inner edge to indicate the end of the split.
  - Drag the mouse key to right
- press Y key to split the face and continue the splitting the face vertically

Click-drag on the inner edges to split the multi-sided polygon face.
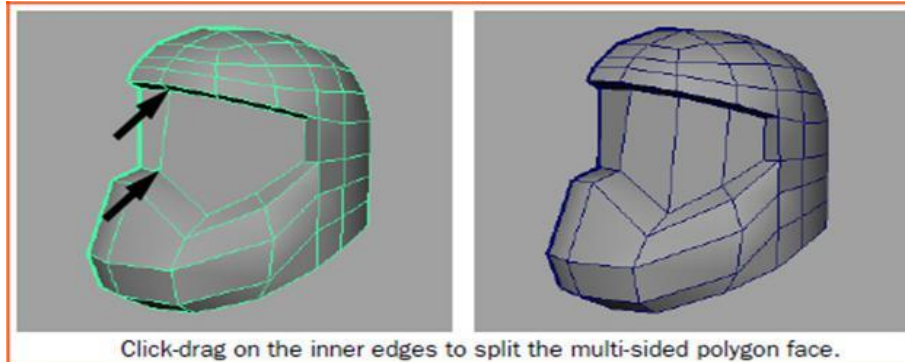
Fig.3.5.45: Drag the inner edges

One five-sided polygon face remains.
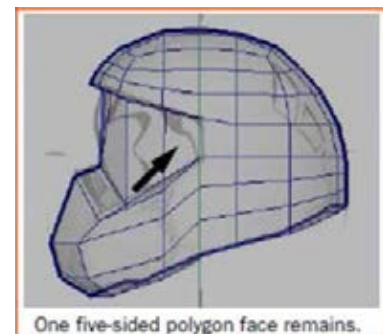
Fig.3.5.46: One five-sided polygon

To split the face shield horizontally

- Now, Drag the inner side edge to start the horizontal split.
  - Drag the front Border and leave the click at the middle point

Click-drag the inner side edge then the front vertical edge to split across the faces.
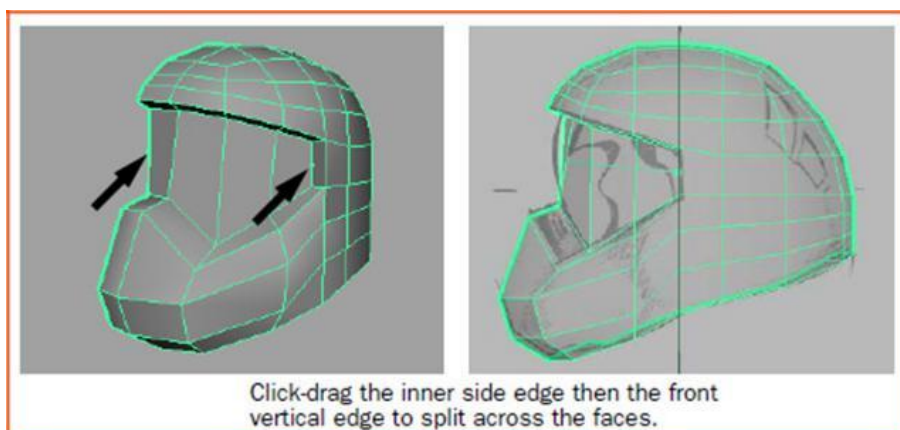
Fig.3.5.47: Splitting

- Press Y to split and Q to exit.
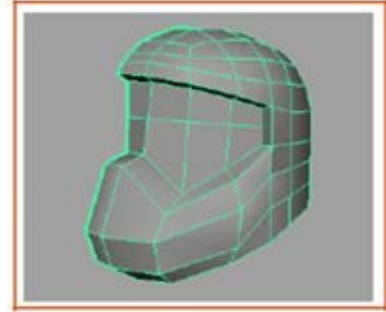
Fig.3.5.48: Splitting

To adjust the shape of the face shield

- Select the middle two vertices and move them outward using the move tool

- select the remaining vertices in perspective to reposition outwards. This should be done by keeping move setting to normal in move tool

- Now, reset the move tool settings to World before continue.

Select and move the middle vertices on the face shield
so it appears to protrude outwards a small amount.
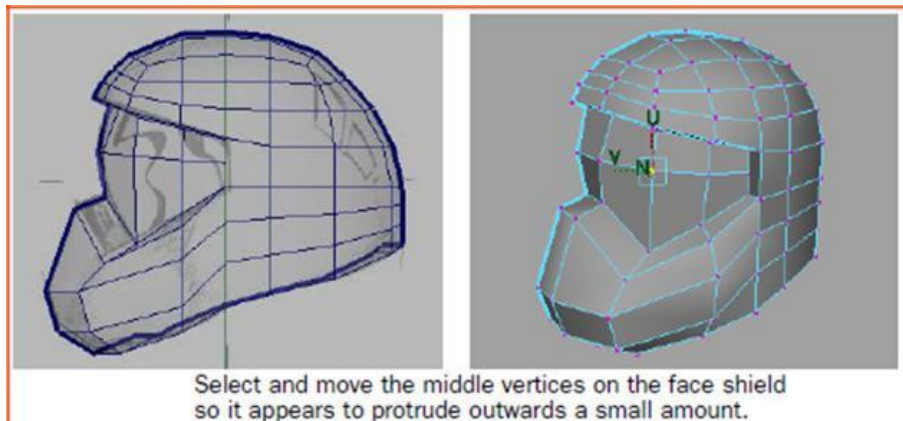
Fig.3.5.49: Adjust the shape of the face shield

To insert multiple edges for the diagonal grill vents

- to insert the edge loops from the mesh commands and in the loop tool option enter the following settings.

  - Multiple Edge Loops option should be On

  - Number of edge loops: 4

  - Auto Complete should be kept Off

Now you will see the grill vents when you click the border edge and in perspective view.

Select the border edge then
the edge opposite it.

Four edges are inserted
on the face.
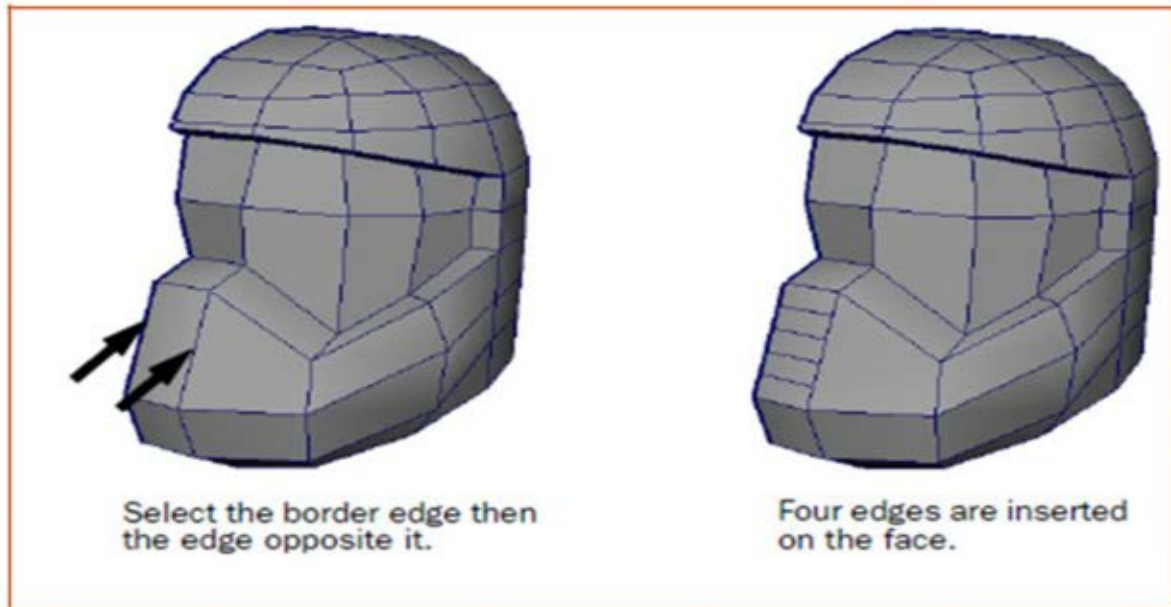
Fig.3.5.50: Grill vents

- Pressing the Y key complete the edge loop insertion and Q key to exit tool.

make the grill vents diagonal by selecting the right side vertices and moving them downwards by move tool.

Moving vertices along edge

- change selection to vertex and select the vertices on the right side

- In the move tools setting editor, select set to edge button.

Select the vertices on the
right side of the grill feature.
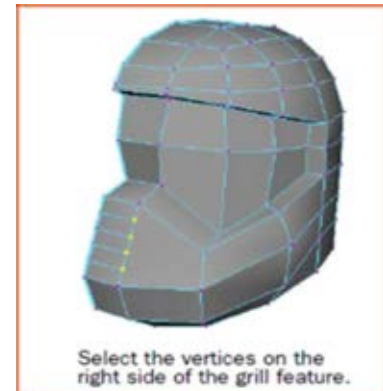
Fig.3.5.51: Grill vents

- Select an edge and with the move tool set vertices across that selected edge.

- Move Tool manipulator is shown.

- Move red arrow to make the grid diagonal.
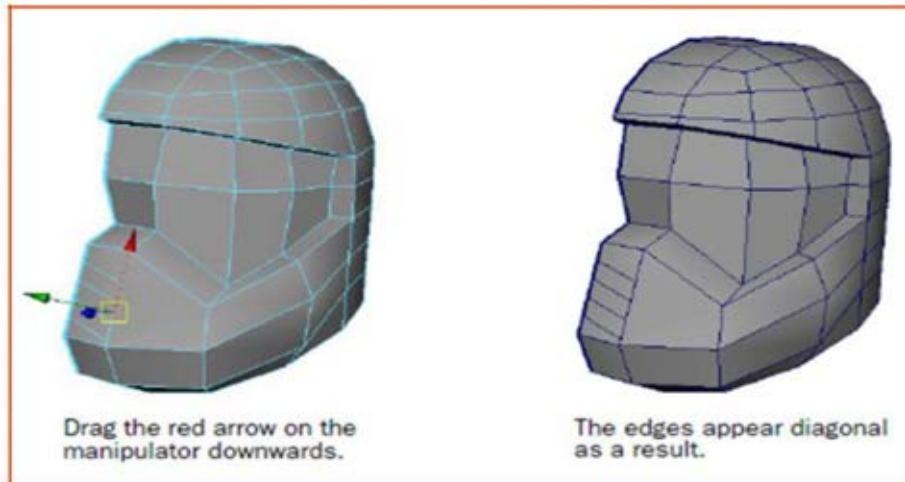
Fig.3.5.52

- Deselect vertices and reset move settings in Move tool.

Extruding faces for grill feature

Right-click helmet mesh and proceed to change mode to faces

- Select both diagonal faces.

- Go to Edit Mesh, Extrude. The Extrude manipulator appears.

- Using the Blue arrow extrude towards the Helmet to create vents.
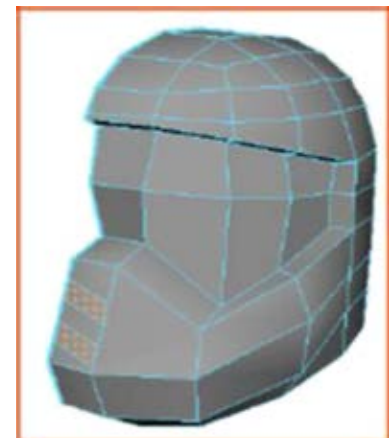
Fig.3.5.53: Shift select the thin Diagonal faces
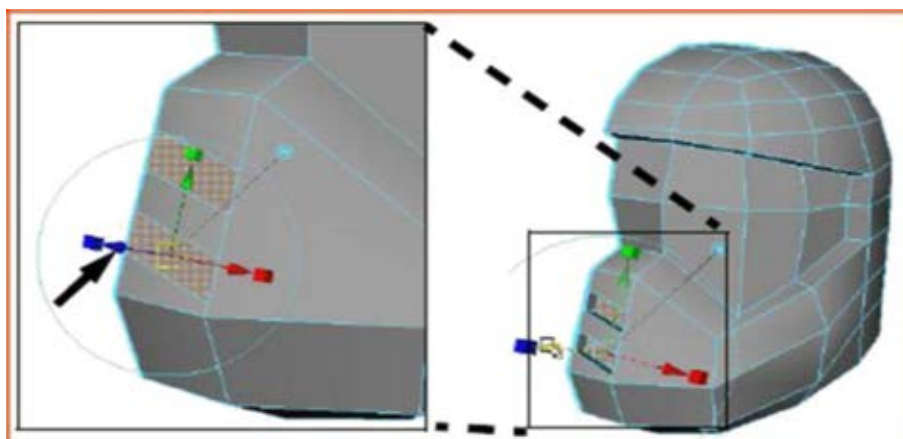
Fig.3.5.54: Two recessed vents for the grill

- Press q to exit

- Select two sides of faces by pressing down the shift Key and delete them.

- Save your work before proceeding to the next section.
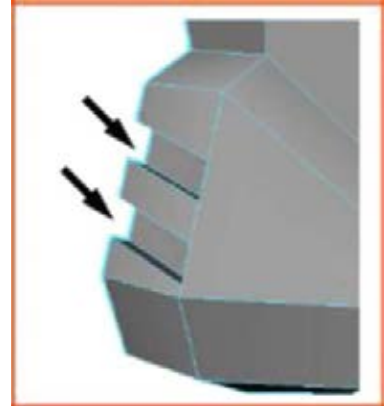
Fig.3.5.55: Delete two side faces

3.5.14 Terminating Edge Loops

Manually splitting multi-sided polygon (in 3-4 sided polygons)

- To begin with go to Edit Mesh, Split Polygon tool to Split the multisided polygon into 3 or 4 sided manually for the grid vent.
- In the perspective view drag top edge of the top grill and get the vertex position to bottom
- Now drag the top edge and slide vertex to the right end
- Split the face by pressing Y

Click-drag on the top side edge of the top grill vent.

Click-drag on the top edge of the n-gon.
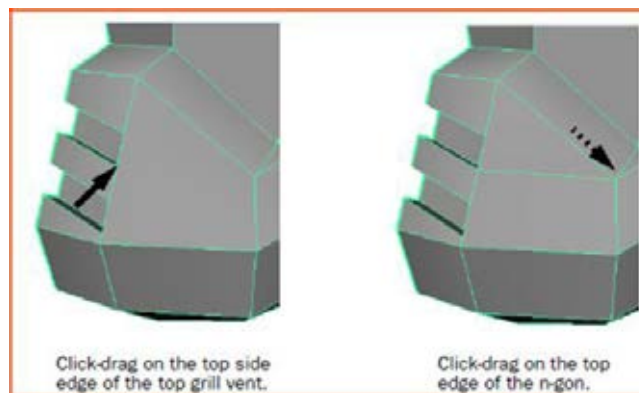
Fig.3.5.56: Split the face

- Similarly Split the bottom vents by click and drag of the mouse.
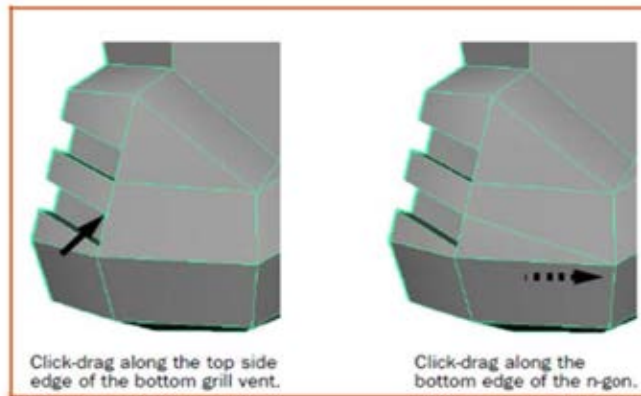
Fig.3.5.57: Split the Side edge

- Press Q key to exit after spitting the edges of the multisided polygon

3.5.15 To delete Construction History

Maya keeps a track of all the tools used to know the history of edited features. Construction history may be useful in cases when some attribute needs to be edited from an earlier stage.

Deleting construction history

- Change to object (selection mode), choose mesh

  - To delete display the channel box and see the history list

  - Choose to delete history in edit option

The construction history is deleted on the helmet mesh.
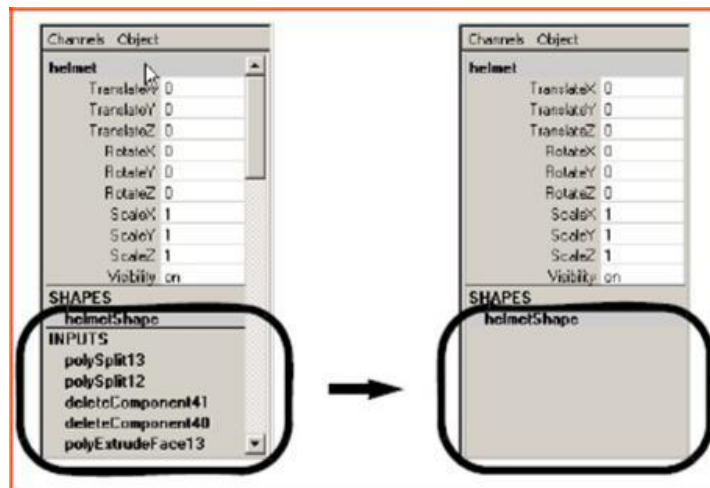
Fig.3.5.58: Deleting Construction History

3.5.16 Mirror Copying a Mesh

When half of polygon in created, other half maybe created by copying the first half around central axis. This may be done by mirroring the completed part using mirror geometry command under mesh

- Make sure vertices lie on symmetry axis.

- Select all vertices lying along axis of symmetry by use of box selection.

- Make sure Snaps are turned to grids on status line

- Show tool settings in move tool by clicking it. Ensure retain component spacing option is off. While being in front view, move red arrow towards right

Vertices are instantaneously snapped to grid and are initially not positioned at desired location. However, it would be noticed that vertices selected are aligned.

- Move manipulator to left till vertices snap to Y axis.
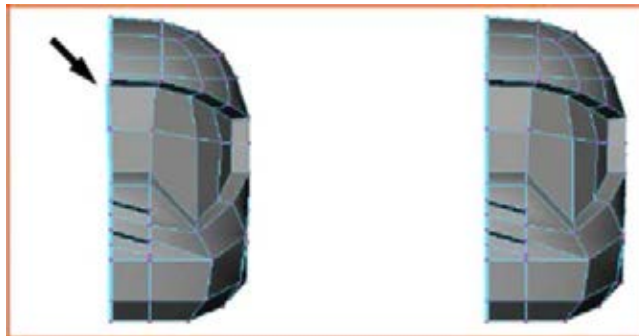
Fig.3.5.59: Drag the manipulator

- Turn off snaps to grid.

- Unselect vertices by clicking anywhere else.

To mirror copy the polygon mesh

- Change to object mode and select mesh.

- Choose mirror geometry under select mesh option. Put following details and pick mirror command

    a. Mirror Direction to be –X

    b. Merge with original option to be On

    c. Merge vertices to be On

Now opposite half has been created. Then two halves are combined into one and vertices merged.
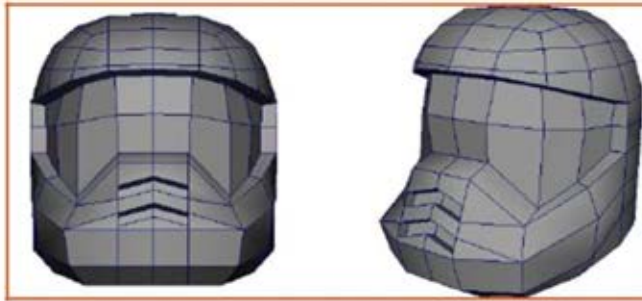
Fig.3.5.60: Create Entire model

3.5.17 Working with a Smoothed Mesh

Creating high resolution (smoothed model)

- Change selection mode object, select mesh

- Select Subdiv Proxy command under Proxy and Put

  following details

  a. Division Levels as 2

  b. Mirror Behavior as None

  c. Subdiv Proxy Shader are Kept on

  d. Press Smooth.

The low resolution and the smoothed high resolution version appear in the same location.

Fig.3.5.61

High resolution smoothen of mesh is formed in same location as original part.

- Select low & high resolution versions in Object Mode.
  Choose ~ Key (left of 1) for toggling between two versions (low & High).

- Select smoothed version in Object Mode. Now reposition to left by 25 units

Move the smoothed version so you can compare the meshes.
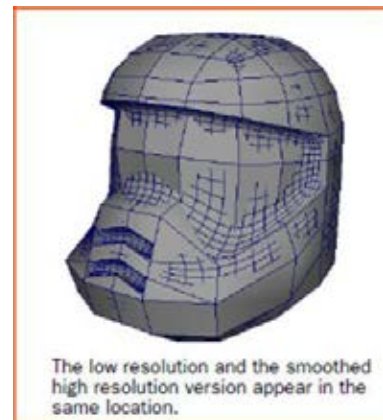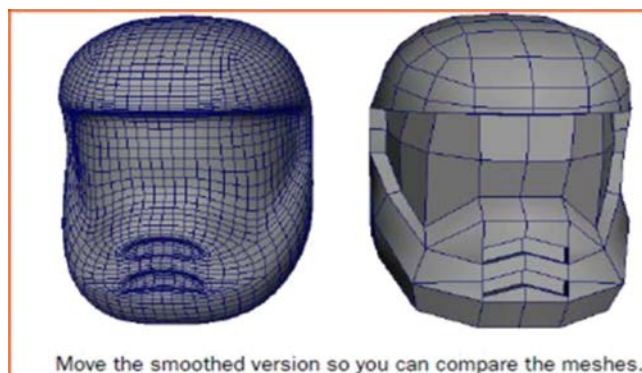
Fig.3.5.62: Move the smoothen version

3.5.18 Creasing and Hardening Edges on a Mesh

Edges may harden or crease on polygon. This process shows transition between faces highlighting practicality of model.

Displaying hard & soft edges

- Pick object selection mode by selecting low resolution mesh

- Pick hard/soft edges command in polygon under display option

Both solid & dashed lines are shown on wire mesh. Dashed lines show soft shaded & solid lines show hard shaded.

The low resolution version of the helmet displays both solid and dashed wireframe lines to indicate the hard and soft edges.
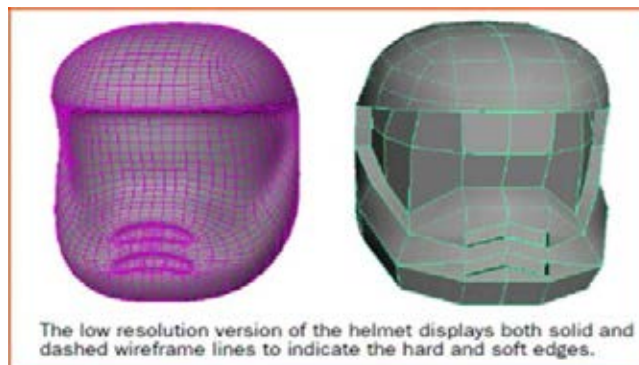
Fig.3.5.63: Solid and dashed frame lines

- To soften the edges on the mesh

- With the low resolution version of the helmet still selected, select Normals > Soften Edge.

All of the edges on the helmet mesh are set to be shaded in a softened fashion. The wireframe mesh updates to display as dashed lines indicating that all of the edges are set to be soft shaded.

The low resolution version of the helmet displays only a dashed wireframe when the Soften Edge command is set.
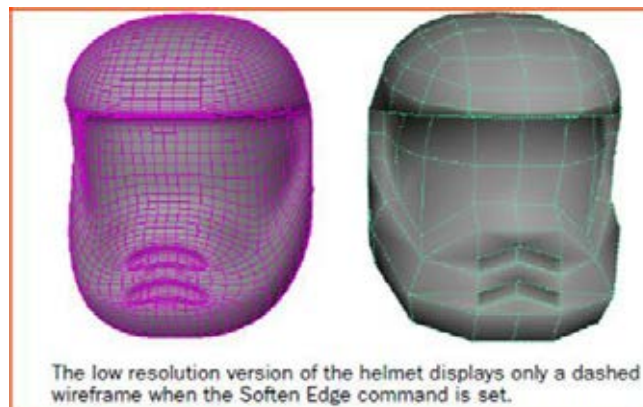
Fig.3.5.64: Dashed frame lines

Hardening edges around face shield

- Set selection mode to edge in low resolution mesh.

- Pick inner edges on face shield.
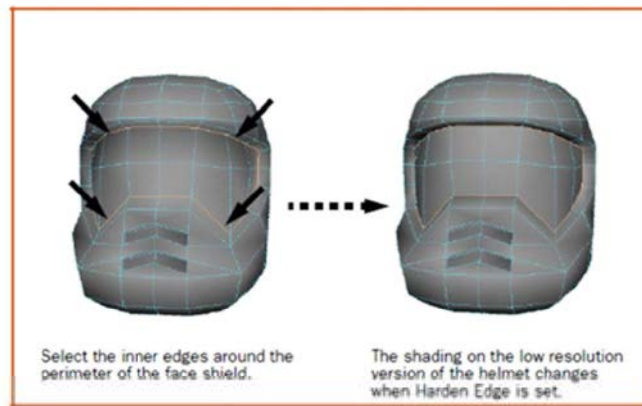
Fig.3.5.65

Turning on Keep Hard Edge attribute

- Choose Smoothed high resolution ver of mesh.

- Pick listed proxy to show attributes in input part of channel box

- Keep hard edge ON

Sharper transition between face shield & other part of helmet is now shown on smoothed version

- Choose all edges. And harden them.
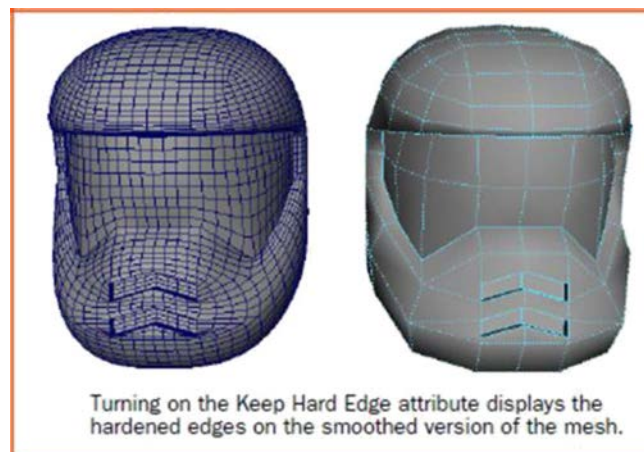
Fig.3.5.66: Harden the edges

Creasing edges on the mesh

- Choose lower outer edges

- Pick Crease Tool command under edit mesh option

- Add crease to the edges which has been selected by pressing & pressing & dragging middle mouse button

A thick line appears on the edges
where the creasing has been set.

Fig.3.5.67: Appearence of Thick Line

Notes

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UNIT 3.6: NURBS Modeling

Unit Objectives

Upon culmination of this, reader would be able to comprehend:

1. Application of 3D animation techniques on Maya Software-NURBS.

3.6.1 Introduction

Non Uniform Rational Be Splines (NURBS) are surfaces that create smooth forms that calculatedly defines curves and surfaces which can be easily model and shaped specifically by using variety of techniques.

NURBS surfaces are created using one or more NURBS curves that define the profile of the shape that you want for a surface, and then using a specific construction method to create the finished surface.

Maya has available Surfacing Tools that can create curve and surfaces for your profile by easy methodologies.

3.6.2 Creating a Profile Curve

Just like a potter's wheel Revolve is a technique to Model and create a Surface. You must first create a profile curve in an orthographic view and use the Revolve Tool to create a surface.

Fig.3.3.1: Creating a curve
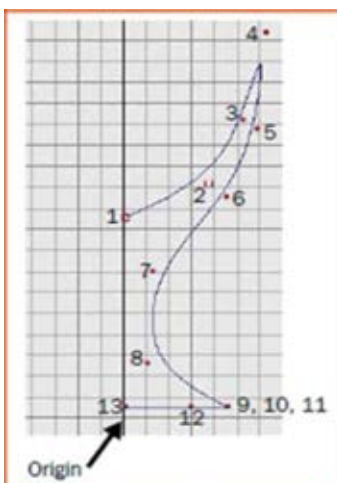
Fig.3.3.2: Creating a Profile curve
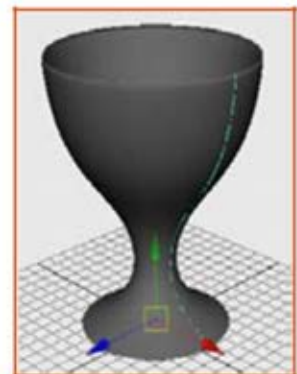
To create a profile curve

- Make sure you've done the steps in "Preparing for the lessons" on page 165.
- Begin with Panel, Layout, FourView

- Command Create, CV Curve tool
- Click three times in three spots to create an upward arc that will outline the shape of an egg holder. The first and last position should be on Y axis
- You can modify positions using middle Mouse Button.

- These become the control vertices (CVs) of the completed curve.

3.6.3 Creating a Revolve Surface

With the Revolve surface tool, a curve is rotated about an axis to create a surface. The user can define the axis of revolution.

To create a revolve surface

- With the Created Curve in Selection Go to Surfaces, Revolve. Watch this in Perspective view

Maya does not delete the profile curve. In a subsequent step, you'll edit the profile curve to alter the shape of the surface.

- Select the surface and rename it Eggholder in the Channel Box.

- Go to Shading, Smooth Shade All

You will see not the wireframe but a shaded egg holder. Named the file in channel box and Saved your Work

To edit a surface with construction history

- Go to Window, Outliner and Select the File

- In the Outliner, select the curve you revolved (curve1) by clicking on its name in the list. The curve becomes highlighted in the scene views.

- Select Control Vertex from the Front View by Right click.

- Adjust the Appeared CVs for the shape that you require

Fig.6.3.4: Construction history

Used Dolly and Tumble wherever necessary

An automatic egg holder will appear by calculation

Maya based on the Construction History

- If desired, save the scene for future review.

- Close the Outliner window.
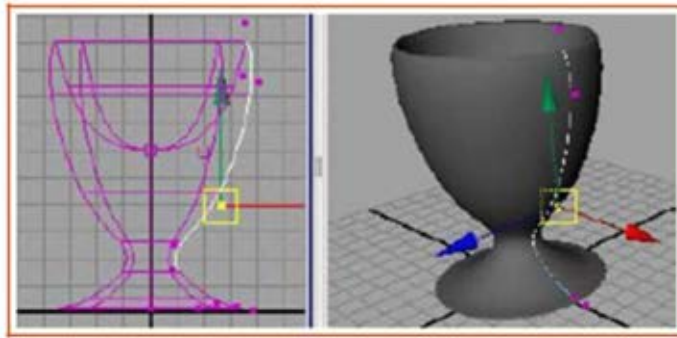
Fig.6.3.5: Creating a Profile curve

3.6.4 Sculpting a NURBS Surface

To prepare a sphere for sculpting

- Command Create, NURBS Primitives, Sphere in Reset Settings:

  - Radius: 6
  - Number of Sections: 30
  - Number of Spans: 30
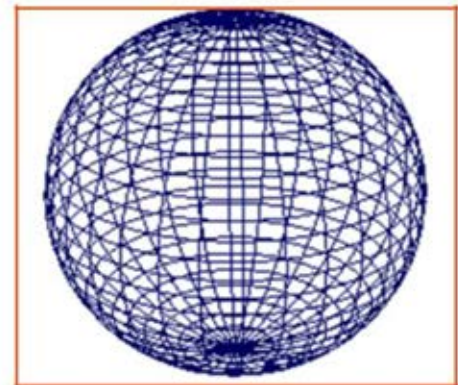
Fig.6.3.5: Prepare a sphere

- Always use Bigger Radius for comparison of size.

  - Name the Object Egg

- Rotate Z axis at 90 Degrees and Set Scale X to get an Oval Shape.
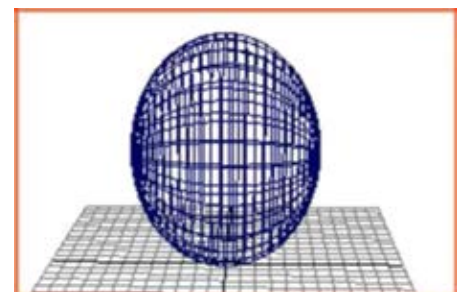
Fig.3.6.6: Egghead

3.6.5 Modifying the Surface Material for Easier Viewing

Brighten the surface to see a clearer effects .

To assign a Blinn surface material

- Select the egg head and press 5 numeric.

  - Then Right Click and Assign New Material, Blinn

  - Use the color attribute slider

3.6.6 Basic Sculpting Techniques

To practice sculpting using basic sculpting operations

- In Edit NURBS, Sculp Geometry Tools. Click Reset Tool

Fig.3.3.7: Edit NURBS

- Experiment with each of the four operations on the surface. Don't be concerned with the results. Just become familiar with the response to your mouse strokes

  - Select Pool Operation and Drag
  - Change Radius to 0.25 and 2 and then 2 and repeat this stroke to familiarize

This has no effect because the stroke radius didn't make contact with the CVs of either isoparm. Regardless of which operation you use, only CVs are affected by the strokes.

- Change the Radius(U) to 2 and repeat the prior strokes.

- Use Flood Erase Tool to erase the changes.

- Select the Pull operation with a Radius(U) of 0.5. Drag along a vertical isoparm. For comparison, drag along a horizontal isoparm.
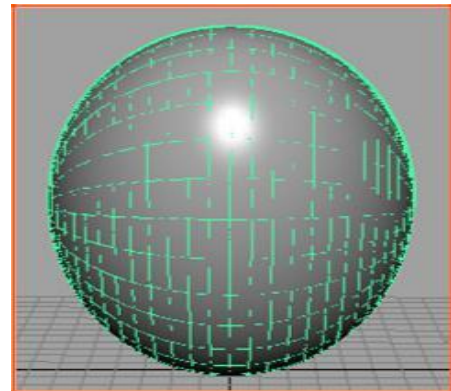
Fig.3.6.8: Change the radius
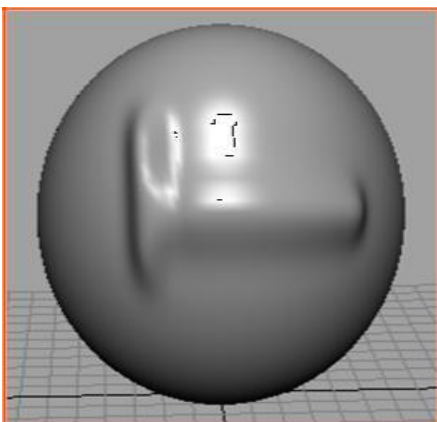
Fig.3.6.9: Wireframe on Shaded

Before taking the snapshot for this Fig, we set the Wireframe on Shaded on the Display tab to None (Window > Setting/Preferences > Preferences). This turned off highlighting of the surface isoparms, making surface alterations easier to see. Consider switching between the off and on settings for Show Wireframe as you learn the Sculpt Geometry Tool.

- Flood-erase the changes to the surface as you did previously.

- Rotate the camera view so the X axis of the View Axis points toward you. Draw a vertical Pull stroke again.

- Erase all changes again, then reposition the camera view so the Z-axis of the View Axis points toward you.
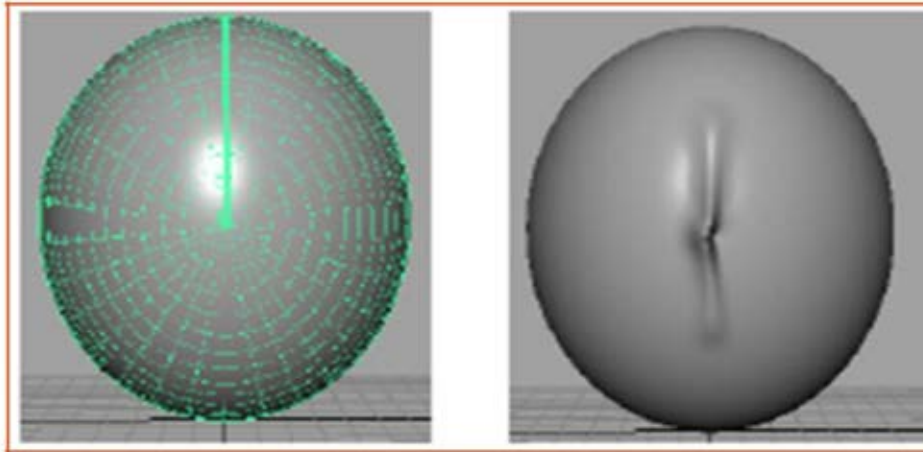
Fig.3.3.10

To practice additional sculpting techniques

Using Sculp Geometry Tool. Set Max Displacement to 2

- Pool a vertical stroke then change Displacement to 1.

- Pool another stroke close. The displacements sets distance of the stokes.

- Erase the changes and set Displacements back to 2.

- Pull another vertical stroke.

- Set opacity to 0.2 value.

- Draw another stroke

- Opacity Value Sets the scale influence and effect in the

  Max Displacement Settings. Use low values for Push or Pull and use the mouse click for small surface for smaller strokes

  - If You may need to click the closest intersection of two isobars if the radius and obesity brush point is small.

- With Opacity set to 1, erase all changes to the surface again.
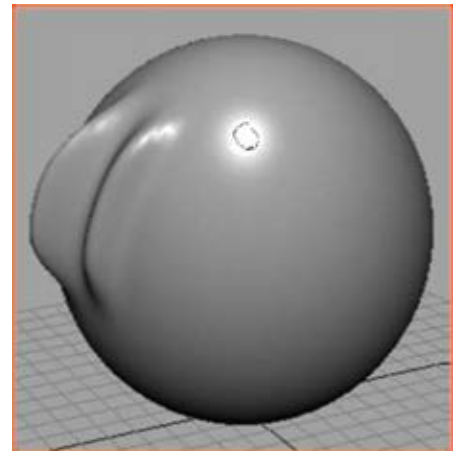
Fig.3.3.11: Wireframe on Shaded

3.6.7 Sculpting a Nose

Now you'll begin sculpting Egghead's face, starting with a simple

nose. **To sculpt a nose for the character**

- In the Perspective view position the View Axix point towards you.

- Reset Sculpt Geometry Tool

- Keeping Radius One and opacity 0.2

- For Soft Edges click the Gaussian Brush

- At the middle of the Egg stoke downward from top to tip of an imaginary nose

- Use many strokes to create the nose bridge for nostrills stroke left to right of the tip of few times
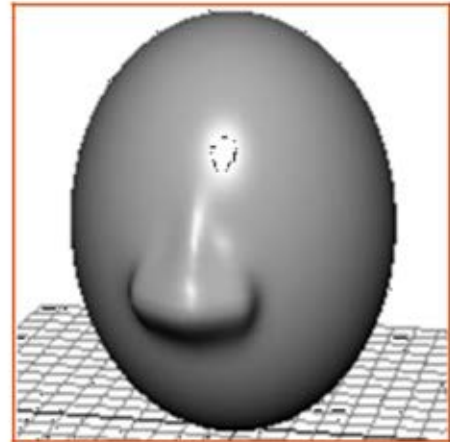
Fig.3.3.12: Sculpting a Nose

3.6.8 Sculpting Eye Sockets

Eye sockets provide an inset and backdrop for eyes.

To sculpt eye sockets for the character

- Keeping the Push operation Selected, using Strokes Settings Turn ON the reflection.
- keep the reflection axix to X
- You will see identical sockets for the eyes
- Click the mouse to create Push For the Eyeballs
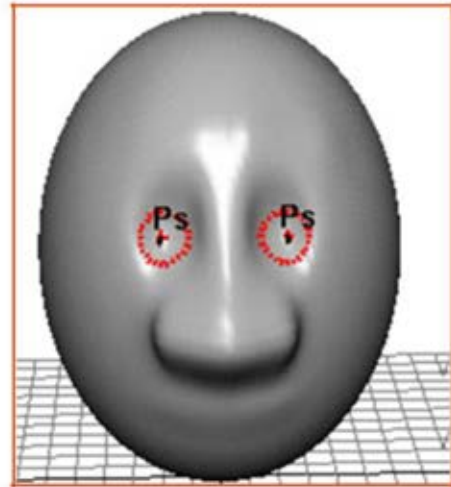
Fig.3.3.13: Sculpting Eye Sockets

3.6.9 Sculpting Eyebrows

Eyebrows help define how stern or pleasant a face appears.

To sculpt eyebrows for the character

- keep the Pull operation On and keep the same settings as Eyes.

- Draw strokes above he curve of the Eyes to build Eyebrows. Smoothen as require
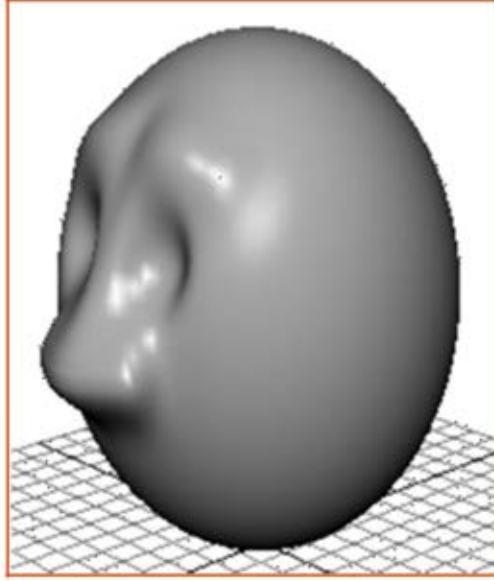
Fig.3.3.14: Sculpting Eyebrows

3.6.10 Sculpting a Mouth

With the Original Sphere, Span and Section a delicate shape of the lips is difficult. that is why we will insert Isoparms

To insert additional isoparms

Fig.3.3.15: Sculpting Mouth

- Select The Egg, Go to Tool box.

- Click Select Tools.

- Click Isoparm below the Nose.
  - Holding Shift Key, Click next to Below so they Turn Yellow
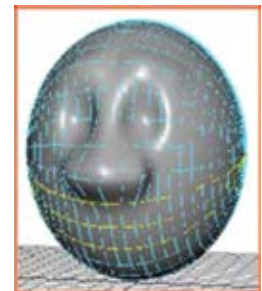
Fig.3.3.16: Additional Isoparms
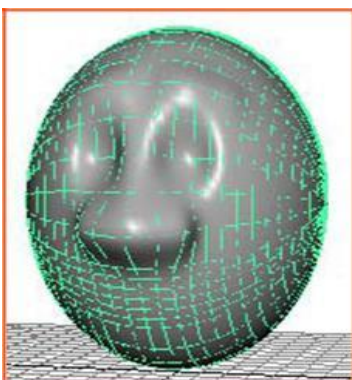
- Command Edit NURBS, Insert Isoparms.
Turn On between Selections and Enter the Value 2 for Isoparms.
- Click On Insert
- This will give enough CV's for the delicate nature of Mouth

Fig.3.3.17: Insert isopams

To sculpt a mouth for the character

- • Go to Sculpt Geometry tool

- • Select Push Option. Enter 0.2 Value for Radius and Keep reflection ON

- • Start at the Centre below Nose Bridge for Lip Division and make a horizontal stroke

- • Now use the Pull Operation.

- • Setting Radius 0.3 and Draw Strokes for Upper and Lower Lip

Fig.3.3.17: Insert isopams

3.6.11 Sculpting Other Facial Features

You can now optionally add other facial features. Consider these tips:

- • Insert Isoparms wherever require and for chin, Cheeks and forehead use Radius more than 1 and Maximum Displacement ranging .5 to 1

To import existing models into your scene

If you saved the Eggholder scene in the prior lesson, you can import the egg holder into this Egghead scene, then position Egghead into the egg holder.

- • Import the Egg Holder into the Eggscene by File,Import and selecting Directory.

- • Increase (or decrease) the scale of the egg holder (or Egghead) as necessary for a snug fit.
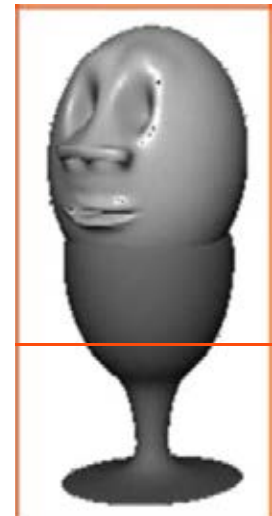
Fig.3.3.18: Sculpting other facial feature

Notes

_____
_____
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_____
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_____

UNIT 3.7: Animation

Unit Objectives ⌖

On completion of module you can:

1. Application of 3D animation techniques on Maya Software-Animation.

3.7.1 Introduction

A frame is the unit of calculation in Animation and techniques of scale, rotate, move are applied to it at set time to create illusion of motion. The scale is called frame per second. Setting different numerics to keys give the result of playback, Maya provides automatic calculation of attributes to play frames back in time to result in changing movements.
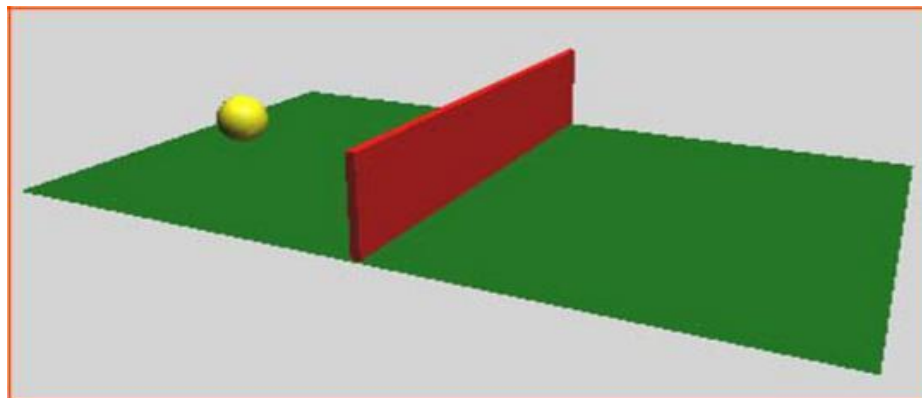
Fig.3.7.1: Scene

3.7.2 Setting the Playback Range

To open the scene

*   Make sure you've done the steps in "Preparing for the lessons" on page 217.

    *   Open file name that is already saved on your interface that is named Keyframing.MB in your interface

This file can be found in the GettingStartedLessonData directory that was installed with your Maya software, or from the drive where you copied the Getting Started Files.

GettingStartedLessonData/Anim/Keyframing.mb

This scene has a Ball placed on Y axis near the Ground.

Setting the Playback range

To To Animate this you have to set the position at different time ranges.

- Look over the playback controls, as shown in the Fig.below.
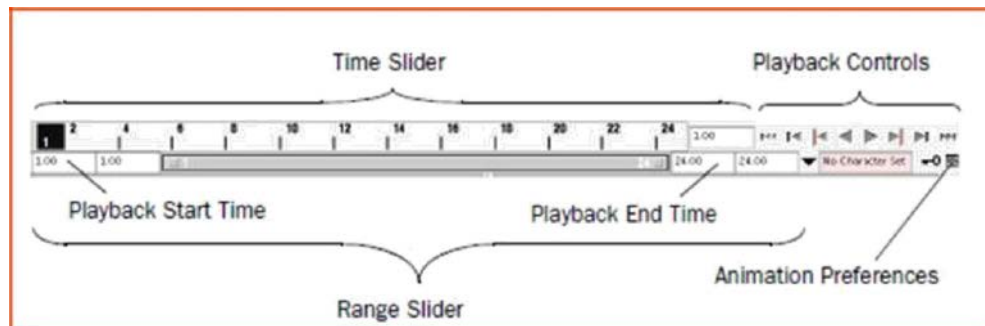
Fig.3.7.2: Playback Controls

We will use Time and Range Slider. This slider helps you to control your animation with Specific time of Playback and Scroll. The Time Slider Keys are Red. There are buttons for Stop, Pause, Play and Rewind, Forward. The Playback Speed by the Animation preferences button

The Playback Controls control animation playback. You may recognize the conventional buttons for play and rewind (return to the start time). The stop button appears only when the animation is playing. To find out which operation a button represents, hold the mouse pointer over it.

The Animation Preferences button displays a window for setting animation preference settings such as the playback speed.

The Range Slider controls the range of frames that play when you click the play button.

- In the playback End Time Box enters 72

- A frame rate of 24 frames per second (fps) is the frame rate used for motion picture film. For video, the frame rate can be 30 fps (NTSC) or 25 fps (PAL) depending on the format being used.

- with the range 1 to 72 you can create 3 sec of Animation. (72 Frames/24 frames per Sec=3 sec.For a motion picture film 24 frames/sec used.

3.7.3 Setting Keyframes

In the following steps, you use keyframes to set the starting and ending positions of the ball's movement.

- Define Key frames for the start and End postions of Ball Movements

- When you click the rewind button in the Playback Range the current frame is changed to 1
- Select the Ball and Click on Animation and Select the Key

- This will set the key at 1 for all Attributes of the Ball. Even if you transform X and Y attributes we will learn X,Y,Z Attributes Movement.

- The Red marker in the time slider is call Tick. It Indicates the Set keys

for frame 1. With the ball selected, ticks in the Time Slider indicate where you've set keys.

- Go to frame 72 and using the Move Tool drag the X axis to the right corner edg.
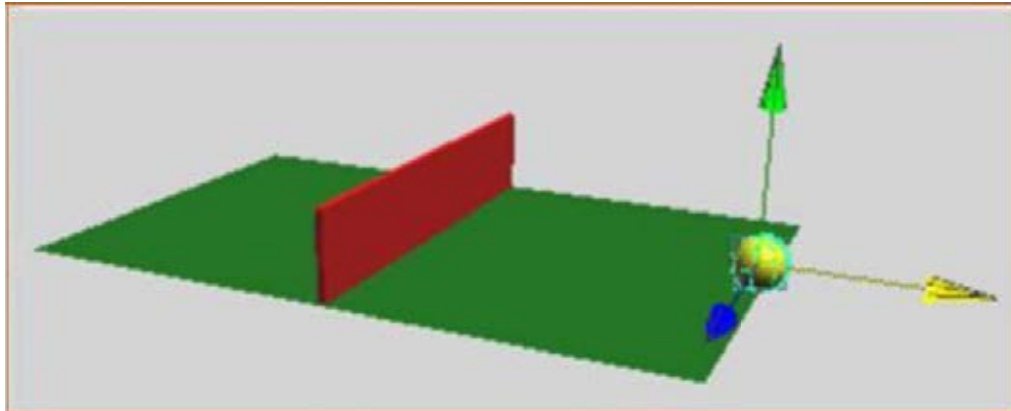
Fig.3.7.3: Set the starting and ending positions

- Setting Key frame at 72

- Click on Start Time and play Animation.

Maya Creates Automatic Motion between positions. The Default frame play is 1 to 72. The ball travels through the fence at this stage.
press Stop on playback to stop animation.

To set intermediate keyframes

Go to frame 33 or so—at At the place where the Ball sits on the middle fens ,Go to that Frame

- With the Move Tool drag the Ball across the Y axis to make it slightly above the fence .
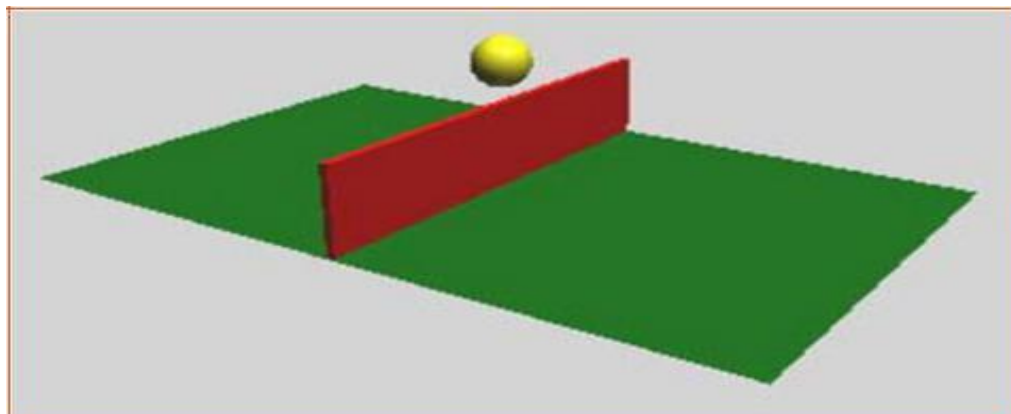
Fig.3.7.4: Set intermediate keyframes

- Set a key and play the animation
- Ball should now fly over the ground and over the fence and back to the ground in a continuous.
- Press stop after seen over a few times.

In subsequent steps, play the animation after each key you set. It's generally useful to check your work in progress after each key, especially when you are learning.

To set keyframes to make the ball bounce

- At Frame 50 move the ball to make sit on the ground, set a key.
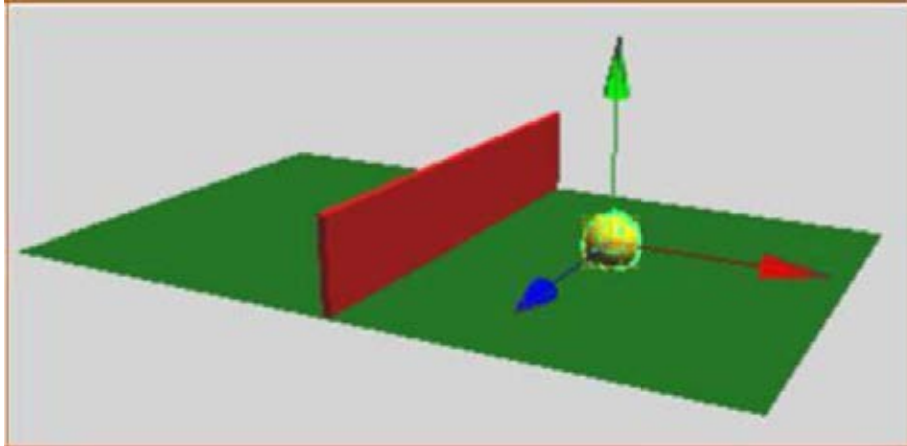
Fig.3.7.5: Set keyframes

- At frame 60,move the ball a little up again but not a over the height of the fence, set a key
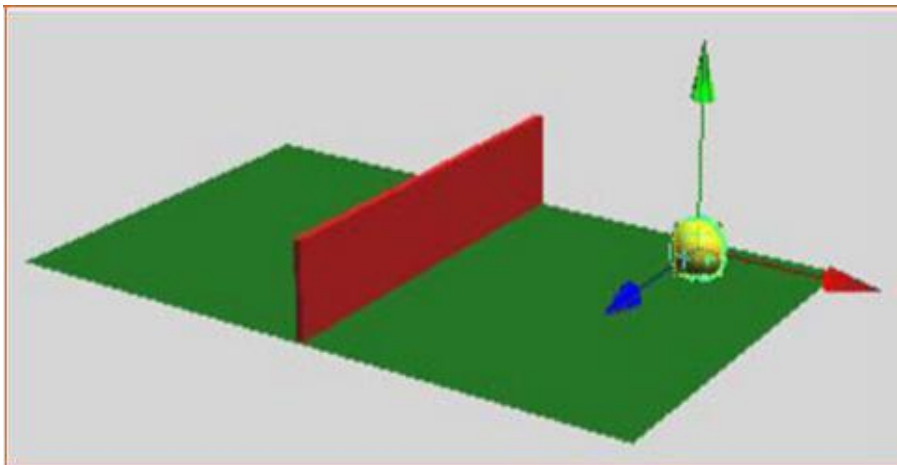
Fig.3.7.6: Move the ball up

Play the animation and watch the ball bouncing and travelling over the fence

3.7.4 Using the Graph Editor

To edit animation curves using the Graph Editor

Select the Ball, Go to Window, Animation Editors, Graph Editor
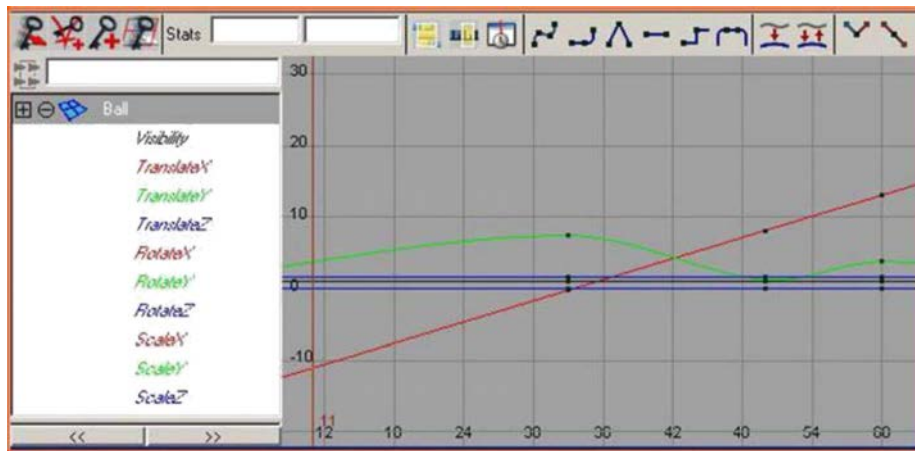
Fig.3.7.7: Animating curves

This Editor displays many animation curves for each key attribute of the ball

• Shifts Select, Translate X and Translate Y in the left Column of the editor

• In the Graph Editor Window, go to View, frames Selection to Display the animation curves.

• Select the point on the Translate Y (green) curve at frame 50. This causes a pair of tangent handles to appear

Fig.3.7.8: Translate X and Translate Y

at the point. Each end point of the newly displayed straight line is a tangent handle. The handles let you control the curvature near the key point.

In the Graph Editor, select Keys > Break Tangents.

- A Select Translate Y (Green Curve) at frame 50.

- To see this Select Keys,Break Tangents to Move Handles by themselves.

- Use Move tool for right and left tangent

  to move it a little
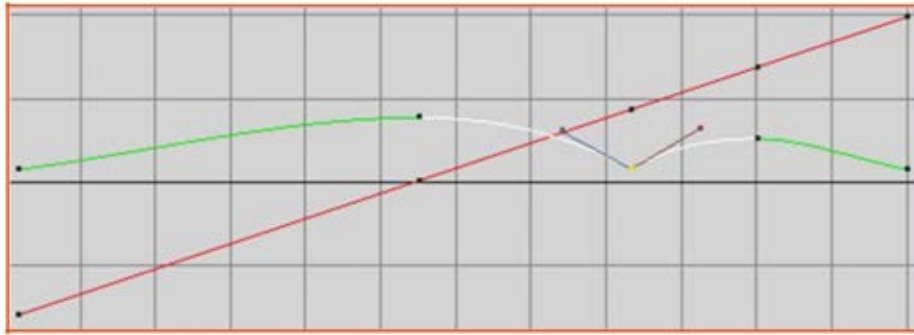
Fig.3.7.9: Selecting right tangent

This sharpens the bounce to simulate the effect of gravity and elasticity.

3.7.4 Changing the Timing of an Attribute

Using the graph Editor you can increase the speed of a Ball and Make it finish the journey across the table in 48 frames(2 sec.)

To speed up the animation of the ball's movement

- Drag a selection Box along both curves key points

- Select the scale tool

- Hold the middle mouse button in graph anywhere

- You will see the question mark icon which indicates the scaling point.
- Drag the mouse button without releasing it to a left until the right
  Key points are positioned at frame 48
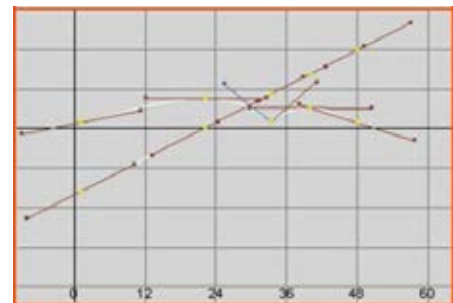
Fig.3.7.10: Ball's movement

3.7.5 Fine Tuning an Animation

The following two Figure show examples of curves after modification. The two graphs are identical, except the curve points are selected in the second Fig. The second graph shows the position of the tangent handles.
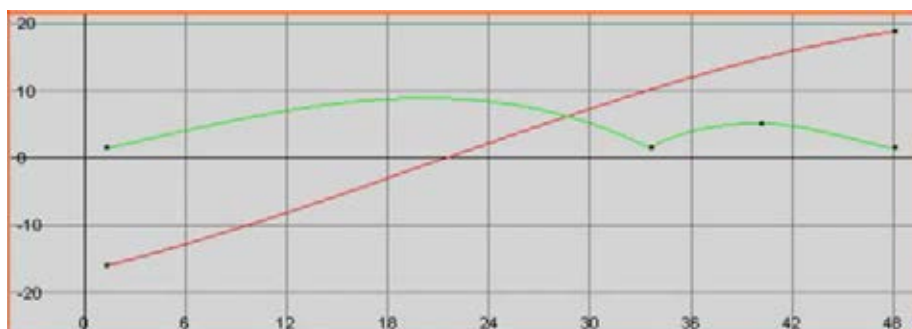
Fig.3.7.11 (a): Fine Tuning an Animation
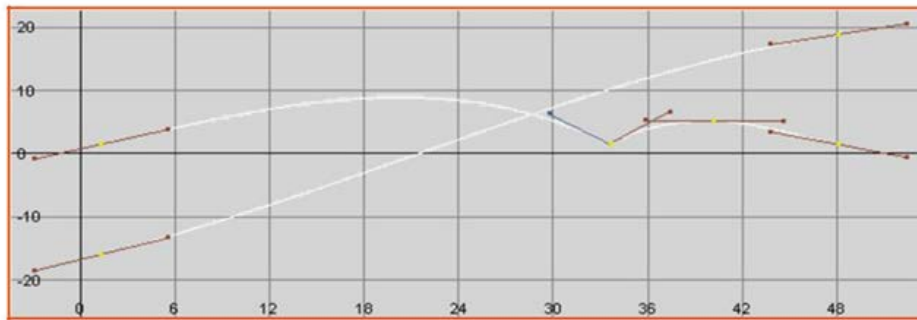
Fig.3.7.11 (b): Fine Tuning an Animation

3.7.6 Deleting Extra Keyframes and Static Channels

To delete static channels

Go to Edit, Delete all by type, Static Channels or Use command Edit, Delete by Type, Static Channels to remove unnecessary keys for objects in the scene. Alternatively, you can remove the static channels for a selected object with Edit > Delete by Type > Static Channels.
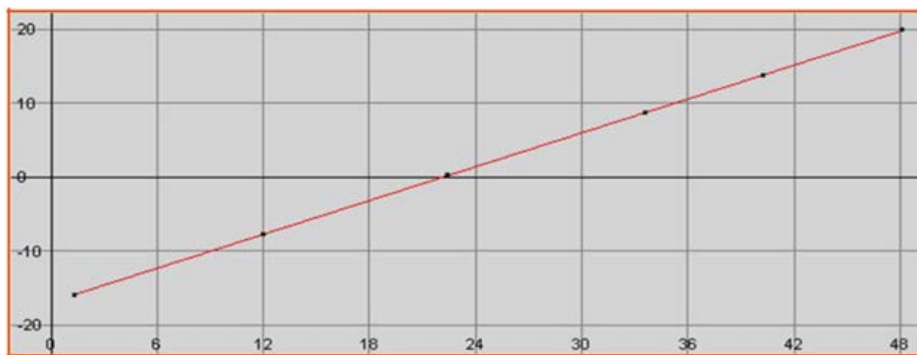
Fig.3.7.12: Delete static channels

3.7.7 Using Playblast to Playback an Animation

A graph work on animation is seen when you play a scene however the speed and quality need to be precise as per the rendering to the frame. Hence there is a Playback facility to get more accurate timing

To preview the animation with more accurate timing

• Command Windows, PlayBlast.

• The Interface will process the animation by the each frame.

• once done Playback Window appears

• Use Play to watch

4. Testing and Other Terminologies

Unit 4.1 Testing and Other Terminologies

Key Learning Outcomes

On completion of module you can :

1. Paraphrase how to test an deliverable output.

2. Familairise with UV mapping.

UNIT 4.1: Testing and Other Terminologies

Unit Objectives

On completion of module you can:

1. Paraphrase how to test an deliverable output.

2. Familairise with UV mapping.

4.1.1 Testing of a Model/Project

Testing

Testing is a way of proofreading your work or checking if all functions as planned out. In animation it is a way on ensuring key areas are met during the process to understand if objectives are met. The team of designer, modeler and animator get together to test each stages of development of base and system.

Test planning process

In the testing period, requirements of both the production and function need to be checked, below are steps to ensure that.

1. **Stage #1: Review and analyze the requirements:** With review the team also has to analyze the items that need to be tested. The determinants and requirements for the test are based on how the end user responds to the system and should be calculable and understandable. The ability of models performance are its functional attributes. Some requirements are performance based depending on the end goal. These are documented for analysis and included in the final document for review

2. **Stage #2: Scope of testing:** Determining the scope is identifying test specifics of items, it details which items performance can be tested and is related to the teams handling those items. Tests are work scope specific and not generic, hence they run parallel with other tests. A good scope is beneficial to management to understand team work covered and test outcomes against set deliverables

.

3. **Stage #3: Design the test strategy according to the scope:** A test strategy document is prepared by the test team to define test goals and objectives of team and items. It gives team members roles, timelines and expected outcomes. Also includes calculable risk, reporting structure and follow up plans for management

4. **Stage #4: Identify the required tools needed for testing and management:** The tools required for testing and performances are identified based on automation capabilities. These tools are specific related to Command line Interface and GUI to track progress of tests and allocating tasks as per feedback

5. **Stage #5: Estimate the test effort and team:** Correctly estimating the team progress and outcomes to avoid last minute concerns or mis management of resources. The right way would be to identify team strengths, decide accurate number of resources to items and see the outlook of team towards project. The is a compulsory phase for team to keep check on deliverables against responsibilities set

6. **Stage #6: Define test schedule:** Once items are identified as per tests, tests deliverables are set and team estimates are calculated a thorough test schedule should be defined on basis of test strategy

7. **Stage #7: Enablement plan:** The team must be equipped with the right knowledge and system expertise as per those test parameters. They should be trained on all projects and specifications must be followed as per path.

8. **Stage #8: Determine and procure the test environment:** Determine software's, hardware and network set up to match test requirements. The right environment influences the strength of environment

9. **Stage #9: Identify test metrics:** For Quality compliance and auditing checking test metrics or indicators states performance improvement instances. These indicators are measured and show the product and system quality

10. **Stage #10: Create the model test plan, reviews and approved:** A final test plan which is documented includes parameters and items to be tested, timelines to conduct tests, systems and processes to attempt testing and resources responsible for same

4.1.2 Introduction to UV Mapping

UVs (pronounced U-VEEZ) are texture coordinates that define axes system and are along with vertex components of polygons and surface meshes. The space determines image placing and texture mapping on 3D surface and is called as UV texture space. UVs are markings that connect the surface texture and mesh with pixels and vertices. Without UV coordinates rendering on surfaces or polygons cannot be done. Maya automatically applies UVs but sometimes they don't match the surface edits done, hence always rework them as per the model edits. UVs are to be done after modelling and prior to use of textures as after will affect the appearance of the model when changing or editing, the UV coordinates will have to be updated when you edit. To produce textures on polygons and sub divisional surfaces understanding UV us crucial to create textures, hair etc. on three dimensionally models.

UVs and texture mapping

There is a difference between texture mapping of NURBS surfaces and Polygon and sub divisional surfaces. The texture coordinates (UVs) appear automatically and irregular on polygons, sub divisional surfaces as NURBS are rectangular or square that have specific UVs. Thus the control vertices are easily repositioned and textures comply with changes. With irregular coordinates they manually need to be modified to fit mapping of texture

UV mapping

It means creating specified UVs for two dimensional representation that can be created and edited on flat images to apply textures as it is proportional to the end image and application of texture in 3D surface mesh. It determines accuracy of textures on polygonal surfaces. Use UV texture editor to view and edit textures as many tools are provided to edit and manipulate textures, you can also set background to texture images for quick coordinates.

UV mapping tips

- UV texture editor is the main tool that gives you various tools to create and edit your polygonal surfaces to create finest textures. Arranging your co ordinates is a skill that needs to be acquired to apply different textures. Apart from creating textures you can fit an image by applying UVs. Rendering affects the type of textures that can be used eg for models or games:

Keep UVs within the 0 to +1 texture coordinates: A grid work marking beginning at 0 to 1 is displayed in texture space for UVs. The co ordinates are set at 0 to 1 in Maya and you should fit your image in these co ordinates as it is the object that gets affected in the three dimensional view. Even though they can be scaled, to avoid seeing repeated images or wrapped images around vertices keep surface positioning at 0 to 1. Sometimes you may require repetition like a brick texture across a roof.

Avoid overlapping UV shells: UV points interconnect lines that is the UV shell. If you want texture to be repeated using Move UV shell you can place the image shell to be copied on the image to be duplicated. If you do not want repetition then you should avoid overlapping or separate shells by the Layout feature

Spacing
Having UV shells close to each other will improve texturing by having maximum space to texture, but avoid extreme proximity as they may bleed into one another.

Snapping
Lock your transformations using UV texture editor, even multiple UVs can be locked with the Preserve Component Spacing Option in the Move tool. The snapping function tool is relatable for this

To snap to...	Hold	Icon
Grid intersections	x	(In the Status Line)
Other UVs (points)	v	(In the Status Line)
Pixels		(In the UV Texture Editor toolbar)

Fig.4.1.1: napping UVs

5 Maintain Workplace Health and Safety

Unit 5.1 Maintain Workplace Health and Safety

MES/N 0104

Key Learning Outcomes

At the end of this module, you will be able to:

- Understand and comply with the organization's current health, safety and security policies and procedures.
- Understand the safe working practices pertaining to own occupation.
- Understand, the norms and policies of the government related to health and safety, which also includes some emergency procedures for accidents, fires and illness or others may involve evacuation of the premises
- Identify the people responsible for health and safety in the workplace, including those to contact in case of an emergency.
- One should be fully aware about the security measures such as fire alarms, safety exit, medical and first aid availability.
- Identification of aspects for potential risk at workplace is must for owns and others health and safety.
- One should ensure health and safety of others and himself at workplace through precautionary measures.
- Identification of opportunities related to health, security and safety should be done and recommended to the designated person.
- Identify and correct risks like illness, accidents, fires or any other natural calamity safely and within the limits of individual's authority.

UNIT 5.1: Maintain Workplace Health and Safety

Unit Objectives

- After the completion of the unit, the major things covered will be:
- Making certain of own health and safety, and that of the other people around by taking necessary precautionary measures.
- Recognize the risks like illness, accidents, fires or any other natural calamity and correct them ensuring the limits of individual's authority.
- Recognize the people in charge of health and safety in the workplace, including those to contact in case of an emergency.

5.1.1 Introduction

Emergency evacuation is needed when staying within the building not safe anymore. Every organization has an evacuation procedure. Every organization has a safe place within the organization compound or outside the organization compound where all employees are expected to assemble in case of an emergency evacuation. The team leader guides the team and takes them to safe place. It is very important in these cases, to assemble at the safe area immediately.

If you do not reach the safe area on time, the team leader who is responsible for your safety will send someone to look for you. This will put the other person's life in danger.

Conditions for Evacuation
 Emergencies which require evacuation include:
   Destructive burning objects
   Sudden Violent Explosions (Explosions)
   Overflowing conditions of water (Flood)
    Violent ground shakes (Earthquake)
    Storms or violent wind calamity (Hurricanes)
    Cyclones and tornados
   Toxic material releases
   Civil disturbances
   Workplace violence

Fig.8.1.1: Conditions for Evacuation

Every company has:

An evacuation policy. All the TLs are responsible for informing their employees about it. When the TL is informing you about these details, pay attention. This negligence could cost lives.
A designated place for emergencies. Ensure that you know where it is.

A "buddy system" for individuals with special needs or disabilities. If you are a buddy to someone, ensure that your buddy is safely out of the premises with you.

Floor plans with evacuation routes in work areas. Ensure that you understand it so that you can use it in time of need.

Assembly areas. These are the areas where you are required to assemble after evacuation.

Periodic evacuation drills. Ensure that you pay attention during those drills. You need to save your life   and you can be helpful in saving someone else's life too.

5.1.2 Mock Drills/ Evacuations

Fire safety and evacuation does the duty of planning outline duties of the staff and the responsibilities at the time of emergency. For ensuring the awareness of the duties and responsibilities of the staff ongoing training is required. Fire drills serve as an opportunity for staff members to demonstrate, under simulated fire conditions, that they can perform those duties and responsibilities safely and efficiently. It's also a time for them to show that they are aware of defend-in-place strategies and can take advantage of your facility's fire safety features and egress facilities to protect the people in their care.

In order to evaluate staff response to a stimulated responsibility fire drills are more than an exercise for them. It is a test for ones safety from fire at the facility. Fire drills may not always be smooth. That's okay, so long as staff and management learn from them and correct mistakes made. It's important, therefore, that there be a critique of each drill so that any problems encountered can be addressed. Perhaps the problems are due to incomplete or outdated fire safety/evacuation plans. Perhaps there's a need for additional staff training.

The two most important aspects for fire safety and preparedness are following:

First is an action plan in case of any emergency, which details the measures when fire occurs

Second is the prevention plan, which illustrates methods for prevention during fire. You need to participant in fire drills arranged by organization for your personal safety and also for others safety. These drills help you in understanding the safety signage and action plan of organization in case of fie

Fig.8.1.2: Mock Drills

5.1.3 Medical Emergencies

Everyone plans for emergencies. That is the reason why we keep a first aid kit with ourselves. At work, however one is exposed to a lot of stress and physical activity. This could lead to certain medical emergencies. It's better to be prepared with the first aid measures and knowledge of implementing them on ourselves and on others. This module equips you with that information. Pay attention to these medical emergency procedures to understand how to conduct you in theses crucial movements. Pay attention during these sessions. You might be able to save your own and your friend lives.

5.1.2.1 Dealing with Medical Emergency

A medical emergency is an accidental injury or a medical crisis that is severe. These could be situation where:

The person is unable to breathe

Heart failure and strokes

Severe bleeding

Shock

Poisoning

Burns

A medical emergency requires your immediate attention, sometimes even before you call emergency services for help

It is crucial that you know the Emergency Medical Service (EMS) number, for your own safety and the safety of others.

DO Not

Give the victim anything to eat or drink.

Restrain the victim.

Splash or pour any liquid on the victim's face.

Move the victim to another place (unless it is the only way to protect the victim from injury).

Bleeding

Use a pressure bandage to the wound and apply pressure with the help of your palm.
Elevate the wound to slow the bleeding.
Pressure points when necessary apply additional pressure to help reduce bleeding.

Fainting

Fainting is a brief loss of consciousness that is due to a momentary reduction of blood flow to the brain.

A brief loss of consciousness causing the casualty to fall to the floor.
A slow pulse.
Pale, cold skin and sweating.

Causes of fainting:

Less intakes of food and fluids which causes dehydration.
Low blood pressure.
Lack of sleep.
Over exhaustion.

First Aid for Fainting:

Allow the victim to rest on his/ her back and pull his legs about heart level.
Check the victim's airway to ensure it is clear.
Be aware of the patients breathing, coughing, or movement.

Loosen clothing (neck ties, collars, belts etc.).

Call for EMS after waiting for one minute for to patient to gain consciousness.

Shock

Shock is a phenomenon which is caused due to the failure of circulatory system which leads to insufficiency of oxygen in the tissues. It treatment does not reach in time, vital organs may fail, which may cause death in worst condition. It is worst at time of fear and pain.

First Aid for shock:

Keep the victims lying down (if possible).

List the leg upward for about 10 to 12 inches and see if there is any back injury or broken bones.

Keep the body of the victim covered to maintain the body temperature.

Allow fresh air and space to the victim.

Place the victim on his/her left side if he/she starts vomiting.

Loosen restrictive clothing.

Muscle Cramps

To counter cramps stretch the affected muscle.

Firm massage to the cramped muscles may help.

Moist heat to the cramp might be beneficial.

Call for medical help if the same persists.

Rest- avoids movements and activities that cause pain.

Ice- helps reduce pain and swelling.

Compression- light pressure from wearing an elastic wrap or bandage can help reduce swelling.

Elevation- raising the affected limb about the level of the heart reduces pain and swelling.

Fractures

A fracture is a break or crack in the continuity of the bon

Dislocation

A dislocation is the displacement of one or more bones at a joint. It occurs usually in the elbow, shoulders, finger, thumb, and the lower jaw.

First Aid for Dislocations & Fractures:

Immobilize the effected part.

Stabilized the effected part

Use a cloth as a sling.

Use board as a sling.

Carefully transfer the victim on a stretcher.

Call a doctor.

5.1.4 First Aid

First-aid boxes should be clearly marked and located so that they are Readily accessible in an emergency. They should not be more than 100 meters away from any place on the work site. Ideally, such kits should be near a wash-basin and in good lighting conditions. Their supplies need to be regularly checked and replenished. The contents of a first-aid box are often regulated by law, with variations according to the size and the likely industrial hazards of the enterprise.

Fig.8.1.3: First Aid Box

A typical basic kit may include the following items in a dustproof and waterproof box:

Sterile bandages, pressure bandages, dressings (gauze pads) and slings. These should be individually wrapped and placed in a dustproof box or bag. Sufficient quantities of the different sizes should be available at all times to treat small cuts and burns. Medical adhesive tapes (strip plaster) for fixing bandages and dressings are also needed.

- Cotton wool for cleaning wounds
- Scissors, tweezers (for splinters) and safety pins
- An eye bath and eye wash bottle
- Ready-to-use antiseptic solution and cream
- Simple over-the-counter medicines such as aspirin and antacid
- A booklet or leaflet giving advice on first-aid treatment

First aid requires some training, but this is not difficult to arrange in most places. The names and location (including telephone number) of those responsible for first aid should be put on a notice board. Worker involvement, especially for emergency situations, is strongly advised and everyone should know the procedures for obtaining medical assistance. Small establishments without their own facilities should keep contact with a nearby clinic or hospital, so that the time between the occurrence of an accident and medical assistance is very short, preferably much less than 30 minutes. Transport to the clinic or hospital should also be pre-arranged. An outside ambulance may be called in, if necessary. It is also desirable to have a stretcher available.

Notes

6. Communication Skills and Professional Skills

Unit **6.1** Communication Skills

Unit **6.2** Professional Skills

Key Learning Outcomes

Towards the end you will be able to:

- Read and understand the script and character descriptions.
- Read the work plan and production schedule to ensure that progress is in line.
- Collaborate effectively and communicate clearly with the one who are working with the previous or next scenes/shots.
- Understand the modifications required from the Director, Animation supervisor and Producer.
- Discuss the challenges faced during production and discuss ways to address such challenges in future projects.
- Make decisions in order to be able to work collectively and independently, where required.
- Comprehend shot break up and plan time & effort which may be required for every element of hot.
- How to plan the tasks and prioritise various activities & individual timelines and delivering on schedule.
- Work efficiently a team member and help the team achieve overall timelines.
- Prioritise work-products and tasks based on requirements

UNIT 9.1: Communication Skills

Unit Objectives

Upon culmination of the unit, you will be able to:

- Read and understand the script and character descriptions.
- Clearly communicate and collaborate effectively with colleagues who are working with the previous or next scenes/shots.
- Discuss various challenges faced during production and also ways to handle such challenges in future project

6.1.1 Introduction

The transferring act of any relevant information from one entity to another is known as Communication.

Definition of communication is very simple but the process is complex.

There are various types of communication.

It is very necessary to communicate in an effective in individual level and also at educational level.

To develop good communications skills:

Fig.9.1.1: Communication Skills

6.1.2 Understanding the Basics of Communication Skills

1.Recognize the correct meaning of communication: One has to understand the basic meaning of communication before one communicate. Without proper understanding one will be in a state of no knowledge.

2. Say with confidence what you think: Show Confidence in what you communicate. If you think you are worthy be confident in speaking. Be aware of your own opinion first, before you deliver it. Take time to make your opinion firm. The important point here is that opinion may vary from person to person.

3. Rehearse: be prepare, rehearse before you go out to deliver. Practice before hand, this not only brings clarity but also boosts confidence.

6.1.3 Engaging Your Audience

Make eye contact. Always maintain the eye contact whether you are a listener or a speaker. Maintaining eye contact creates rapport and also gives confidence.

One of the technique is to consciously look into one of the listener's eyes and then move to the other eye. Moving to and fro between these two makes the eyes to sparkle.
One trick is to make a T mark on one of the listener'place and once you do that keep following that T mark, this changes the look and contacting person

Use gestures. It is always good to use small gestures not only for individuals but also small Groups. Gestures should increase along with the increase in group size which a person is addressing

Fig.9.1.2: Eye contact

Don't send mixed messages. Be firm in a friendly manner. Emotion should not be mixed with the message. Make your words gel up with you emotion tone and everything

Fig.9.1.3: Use gestures

Being aware of what body is trying to communicate. Body language may say a lot which is much more than words Open stance having arms in relaxed position at side's signals that A person is approachable and open to new ideas and hearing others. On the other hand, having Arms crossed each other and shoulders hunched, indicates lack of interest in the conversation or lack of willingness to communicate. Many a times, communication is halted much before it starts by means of body language which tell others that person is not interested in talking.
Correct body posture along with an approachable stance may make a difficult conversations become more easy and smooth

Manifesting constructive attitudes & beliefs. Attitudes which a person brings to communication has a big impact the manner in which a person composes himself and interacts with others. It is advisable to be patient, honest, sincere, optimistic, accepting and respectful with the others. Being sensitive to other's feelings and having belief in others' ability, helps communicate better
Develop effective listening skills. A person must be able to listen carefully to other word of other person and enter into a communication based on what other person is talking about. Generally there is a basic tendency to listen to only the last part of the sentences. This makes a person's mind closed to memories or ideas when other person is talking.

6.1.4 Using Your Words

Enunciating your words. Speak slowly and clearly, don't stutter. If people always asks to repeat what you said, then try articulating the sentences better.

Pronouncing your words correctly. People will judge your competency through your vocabulary. If you aren't sure of how to say a word, don't use it. Improve your vocabulary by reading new words in daily routine

Using the right words. If you are not entirely convinced of meaning of a word, please do not use that word. Get the dictionary and look up for meaning of that word in dictionary. Also, practice learning a new word each day and try using it in some conversations during the day.

Slowing your speech down. You would be perceived as nervous and anxious if you try talking fast. On the other hand, it should also be ensured, not to become that slow that people start to complete your sentences in order to help you complete your sentences.

Developing your voice. High/whiny voice is not taken as one of authority generally. Rather, soft and high voice may make you sound as prey to hostile/aggressive college or tell others to take you casually. It should be practiced in order to lower the pitch of the voice. Singing may be tried, but it should be done in an octave lower on your favorite songs. After practicing this for some time, you would realize that your voice is beginning to lower.

Animating your voice. Monotone should be avoided and dynamics should be used. Pitch should change frequently, both, raise and lower. Radio Jockeys are good example of this technique

6.1.5 Communication Process

Process of communication has many components. These are:

Sender: sender is one who sends the message. Martin would be the sender. He will also need a message that is actual information which is to be conveyed. Martin would also require to encrypt/encode his message that means converting thoughts in form of words, which can be sent or conveyed.

Communication channel: Communication channel is the way or passage by which a communication is sent. Various communication channels are writing, speaking, audio & video transmission, electronic transmission by mean 0f texts, emails etc. and non-verbal communication like gestures, body language. Martin's communication must reach a target which is known as receiver.

Receiver: Receiver need to decrypt/code the message, which essentially means processing message received mentally. If it cannot be decrypted, communication fails. Taking example, if you send message in language which is foreign to receiver, then it will not be understood by him and communication will fail.

Feedback: Feedback is the message which is sent by a receiver back to the sender. Like, team member of Martin may ask some questions to Martin in order to bring more clarity to his communication sent in first place.

Putting together all these components will create a model of process of communication:

Sender is one who encrypts/encodes the information which is to be sent

Sender is also the one who communication channel through which message needs to be sent

Receiver is one who receives the information.

Receiver is also the one who decrypts/decodes the information by processing it.

Receiver can also give feedback about information back to sender
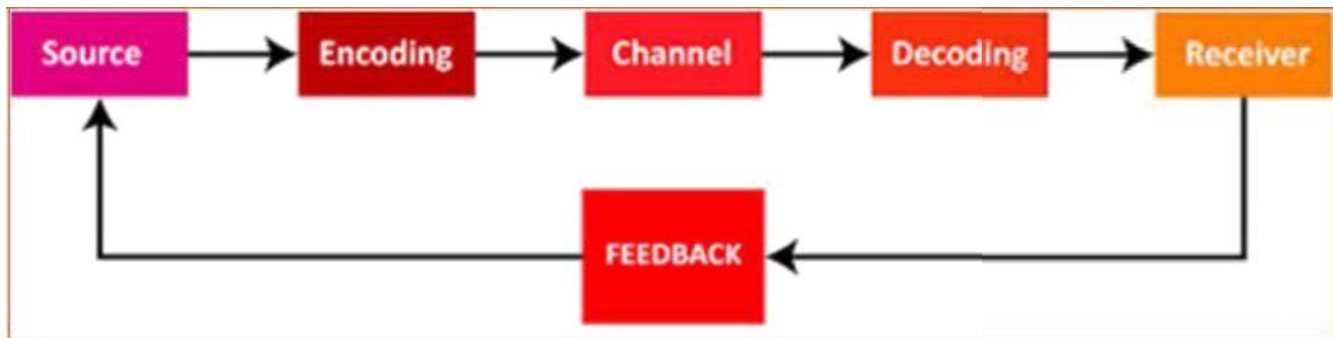
Fig.9.1.4: Communication Process

6.1.6 7 Major Elements of Communication Process

7 major elements of communication process are:

Sender , Ideas, Encoding, Communication Channel, Receiver, Decoding, Feedback

Communication is the process of exchanging information or ideas between individuals who may be holding various positions in the company in order to achieve harmony. This process is not static but dynamic in nature. Process of communication mostly should be a dynamics and continuous interaction which is affected by several variables.

Sender: sender is someone who is intending to transmit a message with the idea of passing an information to other people. Sender also is known as communicator.

Ideas: Idea is central to communication and is subject matter of whole communication. Idea may be an attitude, opinion, views, feelings, suggestions or orders.

Encoding: Idea is both intangible and theoretical, so it warrants use of some symbols like actions, picture, words etc. Changing the idea into these symbols defines the process of encoding.

Communication Channel: Individual intending to communicate needs to pick a channel or medium for transmitting the information or ideas etc. It is transmitted to receiver by mean of some medium that can be informal or formal

Receiver: Individual who is required to receive or for whom information is meant is the receiver. Receiver strives to Interpret the information to best of his ability to achieve desired goals.

Decoding: Individual receiving the information or symbol from communication channel needs to convert the information in the form so that it is understandable and comprehendible.

Feedback: This is the process of making sure that message has been received the receiver and also, it has been interpreted or understood in same form as meant by the sender in first place.

6.1.7 Listening Skills

Listening is most crucial skill for communication process

Largely, we devote our most time to listening than any other type of skill

Like other skills, Listening takes practice
Real Listening is an active process
Listening requires attention

Effective Listening

Effective Listening is process of analyses of sounds, organizing these sounds in small patterns, interpreting these patterns and then comprehending the information by understanding the meaning
Most of the issues we face with other people in our life are mostly due to lack of listening or ineffective listening.

Fig.9.1.5: Effective Listening

Fallacies about Listening

"Listening is not a problem with me"
"Hearing and Listening are one and same thing"
"Good readers are also excellent listeners"
"Smarter individuals usually make good listeners"
"Listening ability generally increases with the age"
" Art of Listening is very difficult art to learn"

Objectives of Listening

* Learn
* Increase understanding
* Advise/counsel
* Relieve boredom
* listening to music

Importance of Listening

Fig.9.1.5: Listening

Communication process incomplete if it does not involve effective listening. An alert and good listener encourages better speaking (by speaker).
Good listener learns way more than any indisciplined listener
Good listener may reorganize unclear/ambiguous speaking in a manner to construe clearer understanding.
Disciplined listener is in position to identify assumptions, attitudes and prejudices

6.1.7.1 Active Listening Process

STEP 1 - HEARING: Process or function of observing sound is hearing; particularly the sense which receives tones and noises as input or stimuli. Listening process's first step is hearing and it involves perception of sound by sensory organs of human body i.e. ears. Person who is listening processes sound which has been perceived. Hearing should be attentive and with concentration, in order for learning to become.
STEP 2 - FILTERING: Sensing & filtering the perceived sound is the next step. Perceived message may be classified as "wanted" or "unwanted". All the "unwanted messages" are discarded. Process of filtering subjective in nature i.e. judgement of an individual comes to play and the individual may decide to retain only certain part which makes sense to her/him.

STEP 3 - COMPREHENDING: Understanding, grasping and comprehending what the speakers wanted to speak.
STEP 4 - REMEMBERING: Remembering for future reference.
STEP 5 - RESPONDING: This the process at the end of the communication, can be immediately after or later, can be in form of feedback also.

Fig.9.1.6: Listening Process

6.1.7.2 Barriers to Effective Listening

There are two types of barriers to effective listening:

Physical Barriers
People – Related Barriers
Physiological Barriers
Psychological Barriers
Physical Barriers
Noise
Poor acoustics

Defective mechanical devices
Frequent interruptions
Uncomfortable seating arrangements
Uncomfortable environment
Message overload
Physiological Barriers

State of Health: Any type of physical health problems like fever etc makes hard for the listener to focus and understand. Thus, state of health of not only listener but also the speaker affects the listening ability.
Disability: Disabilities like having disability in hearing or listening leads to poor listening. Speaker's accent and his pronunciation also affect the listening thing and makes it difficult for listener to understand.
Wandering attention: There is a difference in between the rate by which a human mind process word and in the rate in which the speaker speaks. Human mind processes words at 500 words per minute, whereas speaker speaks at a rate of 150 words per minute. This time difference gives time for listener to wander.

Psychological Barriers
Being unsure of the speaker's ability: Listener must have full understanding of what the speaker is speaker. But, sometimes there is a pre-notion about the speaker this leads to assumption of the speaker.
Personal anxiety: Sometimes the listener is already worried with his personal concerns and worries. This makes it difficult to perceive what is being said by the speaker. As he is already involved in his worries.
Attitude: The listener may be in a state that he already knows everything and thus does not welcome any type of information. No matter how
Impatience: The listener has to listen and wait for the speaker to end. There are some eager listener who wait for the spender to end and then start from there. This results in him speaking and thus creates a barrier in listening.
Emotional blocks: Sometimes our prejudices in some thoughts/concepts can make it challenging for us to actively listen to thoughts/concepts which are not in line with ours. As a result, we can wrongfully hear that idea in first place or may distort it in our mind to make it compatible to our thoughts or in some cases, we may entirely stop it by not hearing it at all. If we are blocking off some idea entirely, then in most cases, reason for that is painful thoughts or memories linked with that idea.

Tips for being a Good Listener
Give your full attention on the person who is speaking. Always focus on the speaker and don't look here or there, like out of the window.
Make sure your mind is focused. If we assume that we know what person is going to say next, then it becomes easier for mind to get distracted, but we may be wrong. Change body position, try concentrating on words of speaker if you feeling that the mind is getting distracted.
Before you start talking, letting the speaker finish is good practice. When somebody is speaking, he would like if he is not interrupted in between. It you interrupt, that would give impression that you were not listening, but you may have been listening.
Finish with listening first, then start to talk if all the time you are thinking, what you are going to talk next, them it would be impossible for you to listen well.

Try listening and understanding for core ideas. The core ideas cover the main points of the speaker. It can have mentioned in the beginning, at end or in between. One should pay attention on words like such as "My point is..." or "The thing to remember is..."

Ask questions. Ask the speaker if you are not able to understand what he wanted to deliver. For example, did you mean profit for organization or for an individual?

Give feedback. Nod your head, ask queries, and give responses. This all things work as feedback and feedback gives a good scope of improvement and ideas to better understand.

6.1.8 Speaking Skills

Speaking is the most frequently required skill in professional environment. Effective speaking is the ability to express one's message effectively to the audience through spoken words. Speaking is an process in building meaning that involves receiving, producing, and processing information verbally in an interactive manner
Importance of speaking for your job role

As an animator, it is very important to be effective at speaking. So, how you speak to the patients creates an image in the mind of the patient. You have to speak politely with the patient so that they do not get hurt. But if you want to give some instructions to the patients without hurting them, you have to speak effectively. Practice is the key for effective speaking.

Components of Speaking Skills

The important components of speaking skills are:

Tone
Comprehension
Grammar
Vocabulary
Pronunciation
Fluency
Body language
Rate of Speech

Fig.9.1.7: Speaking skills

Tone: Tone is the combination of the type of emotion, level of emotion and volume that one uses in speaking and also emphasis on certain word in the phrase. If you speak with lack of energy and in a monotonous tone, then certainly the patient will get bored.

Awareness: For oral communication, it is must to require a subject to respond, to speak as well as to start it.

Grammar: There are people who speak good but not good grammar. The usefulness of grammar is also in learning the right way for improving expertise in language both in oral and written forms.

Vocabulary: All one needs is words to communicate, and bank of words is vocabulary. One should have strong vocabulary to replace his thoughts into words.

Pronunciation: Pronunciation is the way to produce clearer language when you speak. It deals phonology which is system of contrastive relationships between sounds of speech which form the basic part of a language Pronunciation is the knowledge of studying about how the words in a particular language are produced clearly

Pronunciation plays a critical part in speaking too, as to make the process of communication easy to understand.

Fluency: Fluency is the ability to talk or speak with accurate pronunciation. Fluency means speaking at a normal speed without hesitation, repetition and self-correction. To be fluent it's important, that you don't use fillers like "you know", "I mean", "ums", "ers", "aaahhhh", etc.

Body language: Body language means communicating through body posture, gestures, facial expressions and tone of voice. Body language must be in sync with your words; otherwise it is likely to confuse the customers. Positive body language is important in supporting your words and ensuring that your message is understood correctly.

Rate of speech: A slow rate of speech makes the conversation disinteresting. Speak at a moderate pace and with appropriate volume. An animator should match his rate of speech with that of the patient. As an animator, in order to demonstrate effective oral communication (listening and speaking skills) you should:

Listen patiently and answer questions that patient may have.

Communicate the observations to the nurse. When you see any abnormality or unusualness in the patient's condition, inform directly to the concerned person.

Discuss procedures with the patient and make him/ her feel comforFig.while performing daily activities like grooming, bathing, elimination, transporting etc.

6.1.9 Reading Skills

Reading is a process of extracting useful meaning of stored information or ideas.

Thing that has to be read can be written are printed: "his main reading was detective stories".

By mean good reading skills, readers are able to understand and comprehend the meaning of writing in order to achieve the goals of reading. Reading skill assessment would be recommended for the cases where reading skills are found to be lacking

The Purpose and Importance of Reading

It improves conversational skills.

Helps in learning and understanding new words

Developing vocabulary, language skills

To get knowledge

It adds in mental development

The way to understand reading

Calling words – will be able to recognize word reformation and structure.

Understand words – ability to understand the meaning within the context of the words.

Types of readings

Reading according to purpose

Search Reading means skipping more than reading this means the reader searches for the relevant information and subsequently skipping the irrelevant ones

Fig.9.1.8: Types of readings

6.1.10 Writing Skills

The medium by which one can communicate by representing language through sign and symbl inscription is known as Writing. Its plays a vital role of communication. This skills allows you to clearly communicate your message with ease to a far larger audience as compared to other modes of one-to-one communication.

Importance of writing skills for Data Entry Operator

As an animator you will use your writing skills to write mails, reports and communicate effectively at work. This module will start with generic writing and then we will practice report writing. Effective report writing is a pre requisite in many jobs. As an animator it's very crucial to have effective writing skills because often you will communicate with others in the organization through mails or written reports. Good writing skills help you as:

Good vocabulary and excellent spelling and grammar knowledge helps in maintaining error free data.

This will help in interacting internally with the management with the help of writing mails, reports, etc.

Whenever you are writing, it's important that you plan, organize, and write:

Assemble all useful information
Determine what's important
Choose what to leave out
Group the information logically
For a brief writing style
Omit needless words

Combine sentences

Rewrite

Notes

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UNIT 6.2: Professional Skills

Unit Objectives

Upon culmination of the unit, you will be able to:

- Learn how to make decisions which will help you work better independently and collectively.
- Will be able to create effective plans and time required for each element.
- Will learn how to set priorities and execute plan so as to meet deadlines and be on time
- Be an efficient team worker
- Set work products priorities and tasks based entirely on requirements.

6.2.2 Decision Making

In order to keep you work intact and to work effectively, you need to manage the below mentioned points. Let us understand all of them one by one.

People often find it to make a decision.

But one cannot run away from it, one has to make decision at every aspect, ranging from basic issues like what to have for breakfast, to many life changing decisions like which career path to choose and many other decisions.
Some people keep on searching information to make a strong basis of decision making.

Fig.9.2.1: Decision Making

What is Decision Making?

It simply means choosing in between two or several options available in form of actions.
In the wider sphere, decision-making involves selection of best solution from various possible solutions to a problem. It can be intuitive or reasoned or hybrid of two.

Intuition

Intuition is doing what your 'gut feeling' says about possible courses of action. Intuition is nothing but a combination of events from past and also personal values. Intuition reflects the learning of life and thus can be taken into account. But it is not necessarily based on real life events, it is based on perceptions also.

It is therefore worth examining and assessing this "gut feeling" meticulously, especially in cases where you may have a strong sense of feeling for or against any specific action. Many a times, "Gut feeling" may go wrong and have repercussions also.

Reasoning

When one uses facts and figures to come to a decision it is known as Reasoning. Reasoning basically deals with facts and figures. Sometimes, emotional aspects affect the decision. Also, issues from past also affect the decision implementation.

When decision has to be made quickly, then is mostly based on intuition.

More formal, structured approach is used for taking and making complicated decision with includes both reasoning and intuition

It is critical that you are cautious of spontaneous responses to any situation.

Effective Decision-Making

Decisions must be such that it is compatible with both personal and organizational levels. One has to be committed to the decision personally, so as to be able to persuade others of its good things.

Any Effective decision making process has to make sure that one is able to do so.

What may inhibit Effective Decision-Making?

Quite a lot of issues and challenges may inhibit effective decision making. These may be:

Not Enough Information: One should have necessary and sufficient information to make it a basis of decision making. Without this there will be no point to support your decision. One must priorities the information which has to be gathered to come to a decision.

Too Much Information: Too much information is often conflicting so too much information also goes in the wrong direction.

This is sometimes called analysis paralysis, this leads to being delay in the decision making.

Often one needs more information to come to a decision.

The problem can be reduced be sitting together, and dividing that which information is relevant or not.

And then deciding that which information can be used to come to a decision making process.

Too Many People: coming at an effective and optimal decisions by a committee is quite difficult. Each individual on committee may have his/her own views and beliefs or values. And while it's important to know what these views are, and why and how they are important, it may be essential for one person to take responsibility for making a decision. Many a times, arriving at any decision is a better outcome than not taking a decision.

Vested Interests: Decision making process is also largely affected by the vested interests of the decision makers. Vested interests may not be explicitly mentioned but cause crucial obstacle. As they are not explicitly expressed, it is quite difficult to clearly identifying. However, someone who is outside the system, but in similar in position, may be useful in addressing these issues in effective decision making

Emotional Attachments: People are often very attached to the status quo. Decisions tend to involve the prospect of change, which many people find difficult.

No Emotional Attachment: Sometimes it's difficult to make a decision because you just don't care one way or another. Here, structured process of decision making may many time assist in identifying consequences of specific actions, that may be were not thought of before.

Most of the above issues may be addressed using a structured process of decision making which will help in:

- Reduce more complicated decisions down to simpler steps;
- See how any decisions are arrived at; and
- Plan decision making to meet deadlines.

There are many type of techniques which are used for decision making process. These range from simple thumb rules to complex processes and procedures. Nature of decision which is to be made and associated complexity determines the type of decision making process to be used.

6.2.3 Analytical and Critical Thinking

Analytical and Critical thinking is a process used to thinking about and evaluating information to reach to a conclusion It means that you shouldn't automatically accept that information is legally acceptable. Instead, you should collect all evidences, analyze all aspects rationally and objectively, so as to reach your own conclusion
Importance of analytical and critical thinking for Data Entry Operator
As an animator, you need to work on different software in the system. To operate this function effectively you just need not to copy paste the data instead you need to analyze the information and evaluate the same. So, this skill helps in,
Analyzing the information and activities according to the needs, requirement and dependencies to meet your work requirements and requirement specifications.
Providing opinions on work in a detailed and constructive way to provide solution to the different situations

6.2.4 Plan and Organize

Efficient use of your time is done by planning and organization.
Complete plan for projects and tasks ensures that one takes care of all required steps which are needed for success.
For tracking progress of planning you may make use of various tools of the organization. Collaboration and information sharing is facilitated with organizational plans with different team members who may be playing a particular role in task completion activities. Just changing the company's processes allows one to generate an effective system for planning.

Fig.9.2.2: Plan and Organize

6.2.4.1 Steps in Planning and Organizing

Step 1: Ascertain the underlying goals and scope for the process of planning. Define the areas/steps for accomplishing the project successfully. It is also important to identify the roles of employees in the team.

Step 2: Divide the bigger/major tasks into small achievable steps which are required completing whole task, thus creating a to-do task list for the entire project. Upon breaking down the task, each smaller activities is assigned to each individual, thus giving each person a specific role & responsibility.

Step 3: Establish the timelines of process completion. Complete all task before the deadline passes. Keep margin with every individual.

Step 4: Keep on reminding yourself about the deadlines with the use of alarms pop ups, setting markers on calendars.

Step 5: Identify areas which may become obstacles or problems for completion of activities. Generate an plan of action in order to overcome these challenges to keep work on schedule.

Step 6: Make use of any good project management program for planning and executing tasks and activities which may be important for success of the company. It may also be used for keeping track of growth and progress of the team members, through the program.

Step 7: Schedule meeting for planning tasks when there is active participation and suggestions & feedback are required from others who may be working on project. It should be tried to keep meeting focused to ensure that they are productive and efficient.

Step 8: Keep communicating with all team members who may be working on specific projects.

This would ensure that the team members are well informed and are in position to update their task lists and corresponding timelines as required

6.2.5 Time Management

The art of organizing, arranging, budgeting and scheduling the available time for working effectively and with high productivity is known as Time Management. So, time management primarily focuses on increasing productivity, efficiency and effectiveness. Hence, time management helps an individual increase productivity and be more organized.

Time management is the process by which one focuses on Controlling the time which is invested in particular activity in order to bring about rise in productivity and efficiency.

Management of time can be assisted by many skills, channels or tools, and special techniques which are helpful in managing it while trying to complete projects, tasks or goals.

Fig.9.2.3: Time

Why Time Management?
Saves Time.
Reduces Stress

.

Increase Throughput.
Have better control over our job responsibilities.

How to Use time effectively?
Create an effective plan.
Setting goals and aims.
Set deadlines of goal.
Deputation of responsibilities.
Prioritizing activities.
Spending appropriate time on each activity

Fig.9.2.4: Use Time Effectively

Fig.9.2.5: Time Management

Time Management Process

Cost your Time.
Making activity logs.
Setting Goal
Creating planning.
Setting Priorities.
Scheduling.

Costing your Time: Calculate your cost per year
Cost per year= (salary + taxes + office equipment + space of office + profit generated)

Fig.9.2.6: Costing your Time

Fig.9.2.7: Making Activity Logs

Making Activity Logs:

Make an estimate of time you spent on daily wok jobs
Mark your critical areas.
Finding the high productivity time of your day.

Goal Setting:

Having long term or life time goals assist in charting out career path and course of life
Break your bigger goal in smaller goals.
• Create a daily To-Do list daily.

Fig.9.2.8: Setting Goals

Judge you performance by updating and updating your list daily.

Fig.9.2.9: Planning

Planning:

Create your action plan –List all steps toward achieving your goal

Prioritizing:

Prepare your to-do list.
Do consider the value of task before preparing your to-do list, checking the task's worth.
Give your task priorities, completes the most priority task first.
Scheduling:

Fig.9.2.10: Prioritizing

Make an estimate of feasible task
Plan time efficiently.
Keep time to deal with unexpected jobs.
Minimize your stress, commit only that you can achieve

Time Management Matrix

Fig.9.2.11: Time Management Matrix

6.2.6 Team Work

Team work is the process of working together in cohesive manner with a number of people so as to achieve a common target or goal.

Teamwork is one of most critical component of a company, mostly it is imperative that colleagues work together cohesively, giving their best in any situation.

Essentially, Teamwork is cooperation among people who use their individual knowledge/skills and give/take feedback positively, in spite of conflicts which may be there between team members.

Working in teams is one of the major reason behind revolutionary changes in contemporary organizations. Nature of teamwork

Team members actively work together to combine their individual specialties to achieve common goal.

Teamwork is the base on which foundations of a highly efficient and productive team is laid upon.

The most important features of team work along with your attitude are:

Shared Responsibility

Every member should feel equally responsible for the outcome.

Allows team members to take up primary roles for finishing targeted tasks and allow members to do their task towards achieving the goal.

Open Communications

Presence of trust and open, honest communication.

Permits team members to speak in an open manner with each another.

Available for feedback.

Provide scope of misunderstandings and conflicts resolution.

Keep the following in *mind*

Better working environment.

Consistent Communication

Relieves stress from individual

Teamwork decreases the errors.

It also keeps channel of communication open.

Characteristics of Effective Team Members

Team members progress toward success together.

Team members avoid letting down others for their individual profit

Team members welcomes others' ideas.

Team members share information and ideas.

6.2.7 Customer Centricity

Customer-centricity: A very obvious word used in business with nobody actually thinking its meaning in the literal sense. But, what does it actually mean?

Customer Centricity putting customer at center of whole sales process and subsequently creating a positive experience with him not only at the point of sale (POS) and but also post-sale.

Customer centric approach may provide differentiating quality or attribute to a company by making it stand apart from its competitor who may not be providing same experience to customer.

It is putting the customer at the center. Acknowledging that, at any moment of time, keeping customers on top and creating a value for them, will definitely create a long lasting business value which would be much beyond a simple focus on customer.

Qualities of a Customer-Centric Company

Many organizations say that they focus on customer and they are customer centric in operations and vision. Companies that prioritize their customers see better result in business, earn more compliments and build products which are more innovative. Only few of the companies that claim to be customer-centric are really one. 5 quality check of a customer centric company:

Accessibility: Customer-centric organizations allows customers to connect to them easily whenever require ensuring that site and customer community are mobile and search optimized, available on social platforms and making it obvious for customers' to reach you.

It ensures communicating in easy and user friendly manner and not in a way with ambiguities.

Responsive: Customer expect a quick response of company on the social media every time they approach them. This is easily manageable by making sure you are present only on possible channels and also able to monitor these. And remember, perseverance is very important in this.

Empathetic: Must respond with empathy! One should listen and not just hear, consider like solving or resolving issue of a friend and helping them solve the issues..

Cohesive: It's hard to provide your customers with fast, truthful information if your departments exist in disconnected silos. One might want to know when your next product will be released; someone else may need more information about the features included in a particular package. Unless your company has a good way to communicate and collaborate internally, you won't be able to provide these answers quickly or honestly.

Nimble: The feedbacks, ideas and even criticism play a very important role in the lifecycle of business. So, one has to welcome all important feedbacks and thus must always be welcomed. This helps in business growth.