

BCA (DES)304- 3rd YEAR

ILLUSION-01

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BCA(DES)-304

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ROLE OF SELF INSTRUCTIONAL MATERIAL IN DISTANCE LEARNING

The need to plan effective instruction is imperative for a

Successful distance teaching repertoire. This is due to the fact that the instructional designer, the tutor, the author (s) and the student are often separated by distance and may never meet in person. This is an increasingly common scenario in distance education instruction. As much as possible, teaching by distance should stimulate the student's intellectual

Involvement and contain all the necessary learning instructional activities that are capable of guiding the student through the course objectives. Therefore, the course / self-instructional material are completely equipped with everything that the syllabus prescribes.

To ensure effective instruction, a number of instructional design ideas are used and these help students to acquire knowledge, intellectual skills, motor skills and necessary attitudinal changes. In this respect,

Students' assessment and course evaluation are incorporated in the text.

The nature of instructional activities used in distance education self- instructional materials depends on the domain of learning that they reinforce in the text, that is, the cognitive, psychomotor and affective. These are further interpreted in the acquisition of knowledge, intellectual skills and motor skills. Students may be encouraged to gain, apply and communicate (orally or in writing) the knowledge acquired. Intellectual- skills objectives may be met by designing instructions that make

use of students' prior knowledge and experiences in the discourse as the foundation on which newly acquired knowledge is built.

The provision of exercises in the form of assignments, projects and tutorial feedback is necessary. Instructional activities that teach motor skills need to be graphically demonstrated and the correct practices provided during tutorials. Instructional activities for inculcating change in attitude and behavior should create interest and demonstrate need and benefits gained by adopting the required change. Information on the adoption and procedures for practice of new attitudes may then be introduced.

Teaching and learning at a distance eliminates interactive

Communication clues, such as pauses, intonation and gestures, associated with the face-to-face method of teaching. This is particularly so with the exclusive use of print media. Instructional activities built into the instructional repertoire provide this missing interaction between the student and the teacher. Therefore, the use of instructional activities to affect better distance teaching is not optional, but mandatory.

Our team of successful writers and authors has tried to reduce This. Divide and to bring this Self Instructional Material as the best teaching and communication tool. Instructional activities are varied in order to assess the different facets of the domains of learning.

Distance education teaching repertoire involves extensive use of self- instructional materials, be they print or otherwise. These materials are designed to achieve certain pre-determined learning outcomes, namely goals and objectives that are contained in an instructional plan. Since the teaching process is affected over a distance, there is need to ensure that students actively participate in their learning by performing specific tasks that help them to understand the relevant concepts.

Therefore, a set of exercises is built into the teaching repertoire in order to link what students and tutors do in the framework of the course outline.

These could be in the form of students' assignments, a research project or a science practical exercise. Examples of instructional activities in distance education are too numerous to list. Instructional activities, when used in this context, help to motivate students, guide and measure students' performance (continuous assessment)



PREFACE


We have put in lots of hard work to make this book as user-friendly as possible, but we have not sacrificed quality. Experts were involved in preparing the materials. However, concepts are explained in easy language for you. We have included many tables and examples for easy understanding.


We sincerely hope this book will help you in every way you
Expect.


All the best for your studies from our team!

All the best for your studies from our team!

Unit 1 INTRODUCTION, MAYA INTERFACE

	Learning Outcome
<p>After going through this unit, you will learn:</p> <ul style="list-style-type: none">• Understanding <p>What is AUTODESK MAYA?</p> <p>Feature of Maya</p> <p>Pipeline</p>	

	Time Required to Complete the unit
<p>The time required to study thus Unit is broken as follows</p> <ol style="list-style-type: none">1. 1st Reading: It will need 2 Hrs for reading a unit2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit3. Self Assessment: It will need 3 Hrs for reading and understanding a unit4. Revision and Further Reading: It is continuous process	

	Content Map
<p>1.1 Intro of the AutoDesk Maya</p> <p>1.2 Explain different features of Maya</p> <p>1.3 Difference between 2d and 3d</p> <p>1.4 Maya interface</p>	

About Maya

Introduction to the Maya interface

The Maya Workspace

1.5 File > Project

To save Your Maya Scene

Importing, exporting, and referencing.

1.6 File> Import

1.7 File > Export All

1.8 File > Export Selection

1.9 File > Create Reference

1.10 Help > Maya Help

1.11 Think about sets and props

1.12 Summary

1.13 Self Assessment Test

1.14 Further Reading

1.1 Introduction



Autodesk Maya, commonly shortened to **Maya**, is 3D computer graphics software that runs on Microsoft Windows, Mac OS and Linux, originally developed by Alias Systems Corporation (formerly Alias | Wavefront) and currently owned and developed by Autodesk, Inc. It is used to create interactive 3D applications, including video games, animated film, TV series, or visual effects/ MEL .

1.2 Explain different features of Maya

Autodesk® Maya® 2013 software delivers practical toolsets to help create and maintain the modern, open pipelines you need to address today's challenging 3D animation, visual

effects, game development, and post production projects. Powerful new toolsets for dynamic simulation, animation, and rendering offer new levels of creativity, while everyday productivity enhancements help you finish faster. In addition, the Open Data initiative introduced in Maya 2013 offers tools to help facilitate parallel workflows and better complexity handling.

1.3 Difference between 2d and 3d

2D is an image drawn in the X, and Y dimensions. **3D** is an image drawn in the X, Y, and Z dimensions Concept of Computer Graphics and 3d

In this chapter you will learn about the stages of production and the CGProduction **pipeline**.

1.The Stages of Production:

The CG Animation industry's pipeline consists of three broad stages:

Preproduction, Production and Post Production.

In film, preproduction is the process in which the script and storyboard are written, costumes and sets are designed and built, actors are cast and rehearsed, a crew is hired, and the equipment is rented and setup. In production phase, scenes are taped or filmed in the most efficient order. Postproduction describes everything that happens afterward: the scenes are edited into story; a music score, sound effects, and additional dialogues are added; special visual effects may also be added. Although the work performed at each stage is radically different, this is useful framework for understanding the process of CG as well.

Preproduction

Preproduction for CG animation means gathering reference materials, motion tests, layout drawings, model sketches, and such together to make the actual CG production as straightforward as possible. Because the CG artist is responsible for defining his or her 3d scenes from the ground up, its essential to have a perfect plan of attack for a well-organized production. The more time spent planning and organizing for CG, the better. Whether you are working on a small job or a complex film, entering into production without a good plan of attack is not going to cause you trouble, but it will stunt the growth of your project. There are several parts in preproduction which you have to consider very well.

The Script

To tell a story, CG or not, you should put it in words. A story doesn't need to contain dialogue for it to benefit from a script. Even abstract animations benefit from highly detailed explanation of timing and colors laid out in a script. The Script serves as the initial blueprint for the animation, a place where you layout the all important intent.

The story board

The story board is a further definition of the script. Even a ruff storyboard with stick figures on notebook paper will be useful for production. You break the script into scenes, and then you break those scenes into shots. Then you sketch out each shot in a panel of a story board. The panels are laid out in order according to the script to give a visual and linear explanation of the story. Storyboards are useful for planning camera angles, position of characters, lighting, moods, and so on.

The conceptual art

Conceptual are the design elements that you might need for CG production. Typically, characters are drawn into character sheets in three different neutral poses: from the front, from the side, and from the angle called $\frac{3}{4}$ views. You can also create a color art for the various sets, props, and characters to better visualize the colors, textures, and lighting that will be needed.

Production

Production begins when you start creating models from the boards, model sheets, and concept arts. You model the characters, the sets, and the props, and assign textures (colors and patterns). The animators take the models and animate everything according to the

boards and scripts. The sequences are rendered in low quality for dailies and checked for accuracy and content. A CG production phase can involve a variety of steps. The specific steps are defined by the needs of the production. Most of CG techniques you will learn from this book are a part of production phase. We will peer into 3d workflow in the next lessons, but to make a long story for short, 3d scenes are created, lit and animated in the production phase.

Post Production

Once all the scenes have been setup with the props and characters and everything is animated, postproduction can begin. Post production for CG project is similar to postproduction for a film. This is where all of CG film's elements are brought to gather and assembled into final form.

Rendering

All CG scenes need to be rendered into their final image or movie files. Rendering is the process by which the computer calculates how everything in the scene should look and display it. Rendering makes great processing demands on your computer, usually requiring the

full attention of your PC, and it can take a good amount of time. You can render one scene in production, but ordering a computer that is rendering to multitask is not advisable unless you are using a dual-processor machine with plenty of memory. When everything is rendered properly, the final images are sorted out and assembly of the CG project begins. Rendering is discussed more in rendering chapter.

We will take a quick look at three more post production activities: compositing, editing and adding sounds. **Compositing**

CG is rendered in different layers and segments and needs to be put back together. In an particular scene, for example multiple character interact. Each character is rendered separately from the others and from the backgrounds. They are then put together in

compositing, the process of bringing to gather scene elements that were created separately, to form the final scene. Maya makes this process easier with Render Layers, which you will learn in rendering chapter. Compositing programs such as Shake and After Effects not only allow you to

compose CG elements together, they also give you some additional control over color, timing and host of other additions that you can make to the scene. Professionals consider it an integral part of CG creation.

Editing

The rendered and composited CG footage is collected and edited together to conform the script and boards. Some scenes are cut or are move around to heighten the story. This is essentially the same process as in film editing, with one big difference: the amount of footage.

Because creating CG is, on average, more time-consuming and expensive than shooting live-action, scenes and shots are often tightly arranged in preproduction boards so not much bandwidth is wasted. The entire production is edited with great care before hand, and the scenes are built and animated to match the story, almost down to the frame. Consequently, the physical editing process consists mostly of assembling the scene into the sequence of the story. This is also why a good preproduction process is important. When you plan out what you want to get, you are much more likely to get it.

Sound

Sound design is important to CG because viewers like to associate visual with audio. A basic soundtrack can add a significant punch to a simple animated by helping provide realism, mood, narrative, and so on, adding a greater impact to the CG. Sound effect such as foot steps are added to much the action on screen; this type of sound is also known in film as foley sound. Music is scored and added to match the

film. Quite often, the dialogue or musical score inspires a character's actions or body language. Again, this is much the same procedure as in film, with one exception. In the event that a CG project requires a dialogue, the dialogue must be recorded and edited

before CG production can begin. Dialogue is a part of preproduction phase as well as a component of post production. This is because animators need to hear the dialogue being spoken so they can coordinate the lip movements of the character speaking, a process known as lip-sync.

CG Production Pipeline

Because of the nature of the CG and how scenes must be built, a specific pipeline works best. Modeling almost always begins the process, which then lead into texturing and then animation (or animation then texturing). Lighting should follow, with rendering pulling up the rear, as it must. Of course the process is not completely linear, you will often go back and forth adjusting models, lights, and textures throughout the process. This book presenting all the major Maya operations in the same order you will use in real world CG project.

Modeling

Modeling is usually the first step in creating CG. You most often start a CG scene by creating the objects you need to occupy your space. It can end up taking majority of the time in your process. There are many modeling techniques that Maya provides. The choices are among polygon modeling, NURBS Modeling, and the third method that combined elements of first two, subdivision surface modeling. Having a good idea of your whole story via a storyboard helps a great deal when you are figuring out how to proceed with the modeling. Knowing how an object is used in a scene gives you its criteria for modeling. You never want to spend more time on a model than needed. Creating a highly detailed model for far-away shot will waste your time and expand your rendering times.

Character Modeling

Character modeling usually involves organic form such as animals, humans, aliens, and such as. Practically anything that is animated and portrays a character in a scene can be referred to as a character model. Your need to create these with animation techniques in mind, as well as accuracy of form. Some organic characters are built with patches of surfaces stitched to gather or as a single object

that is stretched and pulled into shape. Character models need to look seamless because most character animation requires the model to deform in some way to bend and wrap at certain areas such as the joints.

Architectural and Environment Modeling

Architectural and environment modeling includes the architectural previsualization for the design of buildings as well as the generation of the backgrounds for sets and environments. Typically it involves modeling buildings or interiors as well as mountains or anything that you required for scenery, such as benches, chairs, and so on. You should not create incredibly detailed environments, especially environments that use a lot of geometry, if they are not featured in a shot. The greater the amount of geometry, the slower your computer will run and the longer rendering will take. You can create a good deal of the environment using clever textures on simple geometry. Detailed maps on bare surfaces are used frequently for game environments.

Props Modeling

Props modeling covers almost everything else needed in the scene. In theater and film terms, a prop is an object used by a character in the action; anything relegated to the scenery or background is a scenic. For example, a prop can be a purse a character is carrying, a leash on an animated dog, or a car a character is driving. If the car or purse were just sitting in the background, it would be considered a scenic.

Texturing

Once the models are complete, it's a good idea to begin texturing and shading, the process of applying colors and textures to an object to make it renderable. When you create an object in Maya, for example, a simple gray default shader is automatically assigned to it that will let you see the object when you light and render the scene. Because the textures may look different after animating and lighting the scene, it's wise to leave the final adjustments for later.

Animation

Although modeling can take the biggest part of a CG artist's time, you can really make or break your scene with its animation. To animate something properly, you might need quite a lot of setup beyond just modeling. Depending on the kind of animating you'll be doing, you might need to set up the models for however you'll be animating them. For example,

for character animation you will need to create and attach an armature, or skeleton, to manipulate to make the character move, like a puppet, and do your bidding.

Lighting

CG is fundamentally all about light. Manipulating how light is created and reflected is what you're doing with CG. Without light we would not see anything, so it makes sense that simulating light is the most influential step in CG. Lighting can drastically alter the look of your scene; it greatly affects the believability of your models and textures and creates and heightens mood. Although you can set up some initial lights during the texturing of the scene, the serious lighting should be the last thing you do, aside from changes and tweaks.

The

type and number of lights you use in a scene greatly affect not just the look of your scene, but also the amount of time the scene takes to render. Virtual lights in Maya are similar to lights used in the real world, from a single point of light such as a bulb to directed beams such as spotlights.

Rendering

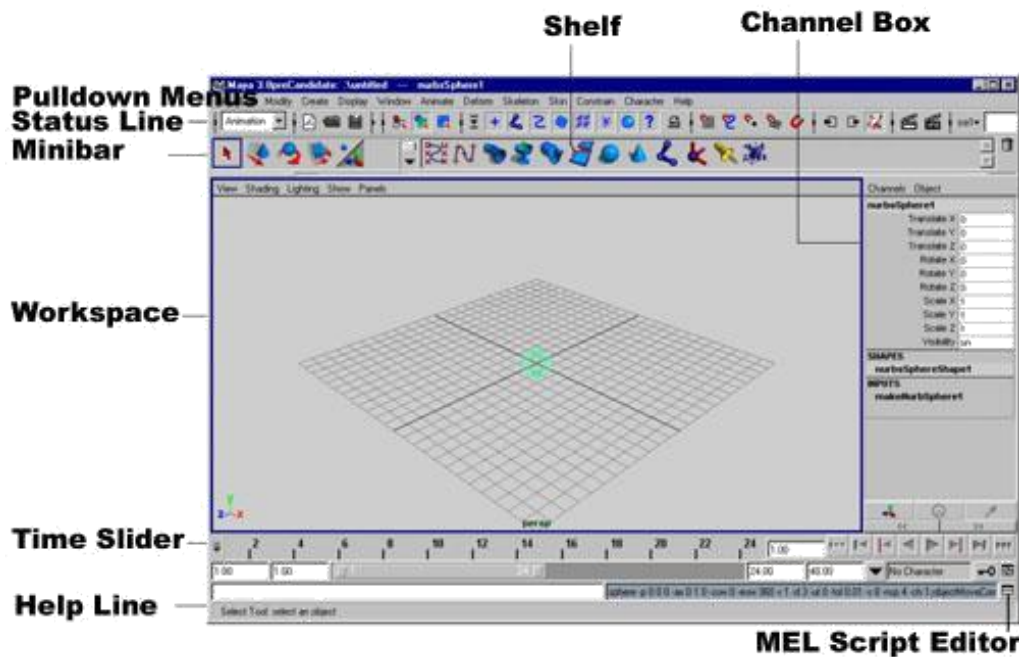
At this stage, your computer takes your scene and makes all the computations it needs to create raster images for your movie. Rendering time depends on how much geometry is used in the scene, as well as on the number of lights, the size of your textures, and the quality and size of your output. The more efficient your scene, the better the render times will be.

1.4 Maya interface

A tour of Maya Interface

In this chapter you will learn and explore the Maya interface.

Fig: Maya user interface:



This chapter is a look at how to access functions and a fairly complete rundown of the often-used windows in Maya to get you familiar with their workings.

The Title Bar

The title bar displays the Maya version number, the name of the scene you are working on, and the name of any object you have selected. It also includes standard Minimize, Maximize and Close Buttons.

The Menu Selector

The menu bar lets you quickly access numerous functions in Maya via pull-down menus. The contents of each pull-down menu give you access to related tools, commands, and settings, and, when available, the menu lists the keyboard shortcuts for executing tools or commands. Because Maya has so many menus, they won't all fit in a single-row menu bar. The Maya interface solves this space problem by partitioning menus in menu sets. A menu set is divided up based on tools and commands related to a particular **workflow**.

There are five menu sets available in Maya Complete: Animation, Polygons, Surfaces, Dynamics, and Rendering. Maya Unlimited has one additional menu set for Cloth. You can access these menu sets from the menu selector's drop-down list on the status line, as

shown in the illustration. After you have selected a menu set, you will notice that some of the options in the menu bar will change according to the set you chose.

Hot Keys for Accessing Menu Sets

Hot Keys	Menu set
F2	Animation
F3	Polygon
F4	Surfaces
F5	Dynamics
F6	Rendering

You can also choose a menu set by pressing the H key while you hold down the left mouse button in the view window. A marking menu will appear, containing each menu set. Regardless of the menu sets you're using, the File, Edit, Modify, Create, Display, Window, and Help menu options will always appear in the menu bar. These items are not specific to any particular workflow. Instead, they give you access to many of the common editing commands found in most software packages (such as Cut, Copy, Paste, Save, and Close) and allow you to create new objects (the Create menu), modify these objects (the Modify menu), access different windows (the Window menu), and choose how objects are displayed in the view window (the Display menu).

View Compass

The View Compass, lets you switch your view in the active panel. A panel, of course, is one of the working views in Maya; the workspace is shown through the panels in Maya's UI. By clicking one of the compass's axes, represented by the cyan, red, green, and blue cones, you can quickly change the active view to an orthographic view. Clicking the cyan cube at the heart of the View Compass returns you to your perspective view.

Tear-Off Menus

At the top of every menu is a double line. Clicking the double line allows you to tear off the menu and place it as a toolbox anywhere on your screen (or screens if you have dual displays enabled). These tear-off menus are also called floating menus. Creating a tear-off menu makes accessing menu commands easier, especially when you need to use the same command repeatedly. Let's say, for example, that you need to create multiple polygonal spheres. You can tear off the Create Polygonal Primitives menu and place it at the edge of your screen. You can then click the Sphere command as many times as you need without opening the dual-layered menu every time.

Tools and Commands

Tools and commands (also called actions) are two different things in Maya. As you browse through Maya's menus, you'll notice that some of the items listed include the word tool and others do not. The differences between a tool and a command are subtle. For example, the Create menu includes a tool called the CV Curve tool. When the tool is selected from the menu, Maya enters a mode in which that tool is active. In the case of the CV Curve tool, a control vertex is created each time you click your mouse button in the view window. To finish using the tool, you must press the ENTER (RETURN) key.

A command, on the other hand, can require some sort of input before it can be selected from a menu. The Edit | Duplicate command is a good example. Before you can select the Duplicate command from the Edit menu, you first must select an object or objects that you wish to duplicate. After the selections have been made, you can choose the command from the Edit menu and it is executed. The result, of course, is a duplicate of the selected object(s), and that's it the operation executed by the Duplicate command did its job and you can move on to your next task. Some commands don't require any input—they simply create an object when they're executed. For example, the Create | Locator command simply creates a locator.

The Status Line

The status line includes valuable tools you can use while you are working, such as selection masks, snapping modes, and a rendering button. We will explore some of these tools and buttons in the tutorial later in this chapter. We'll use others throughout the book. Figure 2-4 shows arrangements of useful buttons on the status line. Probably the most widely used buttons on the status line are the selection modes and selection masks. The selection modes section gives you three different options for selecting objects in the view windows. From left to right, these are Select by Hierarchy, Select by Object Type, and Select by Component Type. Once one of these options is toggled on by clicking it on the status line, the selection masks section will update to display the relevant selection types for that mode.

The Shelf

The shelf, located under the status line, contains buttons for accessing your most frequently used commands and tools. Figure below shows the buttons and tabs located on the shelf. These buttons have been organized into tabs respective to specific workflows. Choosing a tab displays shelf items in that tab. By clicking a button on the shelf, you can execute commands or launch tools without having to choose them from a menu. As you become more experienced in Maya, you will no doubt want to customize your shelf with tools or commands that execute custom settings.

The Toolbox

The toolbox, shown in Figure, contains shortcuts to the most commonly used tools for all workflows. The first three tools in the toolbox are the basic selection tools. You can select an object in the view window by clicking the Selection tool and then clicking the object in the view window. To select multiple objects, you can either hold down the SHIFT key while clicking objects in the view window or choose the Lasso tool in the toolbox and drag a selection around all of the objects that you want included in your selection. When selecting components (sub-objects of a shape), you can use the Paint Selection tool. This not only is useful for selecting multiple components at a time, but also keeps you from selecting components on the opposite side of the object you are

selecting from. The next four tools in the toolbox are called transform tools—the Move, Rotate, Scale, and Universal Manipulator tools. Figure shows a sphere that has been selected, and the Move tool is active. Notice that a transform manipulator appears at the sphere’s pivot point. Three arrows extend from the manipulator tool: one red, one green, and one blue. By clicking and dragging the red, green, or blue arrow, you can constrain the sphere’s movements to the X, Y, or Z axis, respectively. The Rotate and Scale tools have their own unique manipulators whose colors correspond to the same three axes. The Universal Manipulator displays a manipulator around the selected objects that gives you access to all three transform functions.

The Workspace

The Workspace is composed of one or more view panels used to access different parts of the user interface. By default, only one panel is displayed when you start up Maya. Figure below shows the Maya UI with three panels loaded: the Perspective view, the Hypergraph, and the Graph Editor. With all of these panels available, an animator can select objects in the Perspective view window or the Hypergraph and use the Perspective view, Graph Editor, and Channel Box to analyze or make edits to the animation data.

The Channel Box

The Channel Box, shown in Figure as below, lets you view, edit, and keyframe all of the keyable attributes on any node of the object that is selected. A keyable attribute is an attribute that a keyframe can set on to enable that attribute to be animated. You will soon learn that most nodes contain a lot more attributes than those displayed in the Channel Box. However, by default, only certain attributes are set up to be animatable. You can edit the values for the attributes in the Channel Box in two ways. You can click in the field containing the current value, type in a new value, and press ENTER (RETURN). Or you can click the attribute’s name in the Channel Box to highlight it, and then middle-mouse button-drag (MMB-drag from here on) anywhere in the view window. The value will change as if it were being controlled by an invisible or virtual slider.

The Layer Editor

Just below the Channel Box is the Layer Editor. You can use the Layer Editor to organize your scene by grouping objects into layers. Layering provides you with a quick and easy way to

hide or show groups of objects by making a layer invisible or visible, or by making it renderable or unrenderable. What happens depends on whether the objects are grouped to a display layer or to a render layer. Click the Create New Layer button in the Layer Editor to create a new layer. Each layer is named and listed in the Layer Editor. Click the boxes to the left of the layer name to turn on or off the visibility of the layer (V) and to cycle through Selectable (the blank box), which makes the layer selectable, Template (T), in which the object can be seen as a wireframe and is not selectable, and Reference (R), in which the object can be seen as shaded and can be rendered but is not selectable. You can double-click a layer in this list to bring up that layer's Properties window. This window lets you rename the layer and assign a color to it. When a color is assigned to a layer, the objects in that layer will display their wireframe in that color in the view window. This does not, however, have any effect on the rendered color of any object.

The Time Slider and the Range Slider

the Time Slider and the Range Slider, along with other controls located along the bottom of the Maya Workspace window. You can scrub through an animation by clicking and dragging the Time Slider along the timeline. To play the animation forward or in reverse, you can use the DVD-like playback controls (the usual arrow buttons). You can set the total length of the animation by keying in the start and end times in their respective fields. The Range Slider sets the range of frames that will be displayed in the Time Slider. Use the Range Slider to limit how much of the total animation time you want to play back. This is especially helpful when you want to work on a small section of a longer animation.

The Command Line and Script Editor Button

You use the command line near the bottom of the Maya window, shown next, to type in Maya Embedded Language (MEL) commands. If you are more of a programmer type than an artist type, the command line is a real plus. You type the commands on the left side, and any error message or feedback is displayed at the right. The tiny box icon to the right of the feedback line is the Script Editor button, which lets you create and edit long MEL scripts. The Script Editor also shows all the errors and warnings for a particular piece of script.

The Help Line

The light-gray bar across the bottom of the Maya window is the help line, shown next. If you move your mouse cursor around Maya's user interface, the help line displays what each part of the interface does. When you use actions and tools, the help line tells you which tool you are using and what you should do next.

The Hotbox

If you hold down the SPACEBAR, the Hotbox will open. The Hotbox is a group of menus that provides an easy-to-access interface that you can place anywhere on your screen. The Hotbox is highly customizable to meet your particular needs. You can click Hotbox Controls in the Hotbox and then choose Show All to show all the menus available in Maya at once. Because you can potentially access all of Maya's tools and commands from the Hotbox, you could conceivably hide all of the other interface elements by choosing Display | UI Elements and disabling all of the checked items in that list. This means that you could display just the Workspace and nothing else. We won't be doing that in this book, but if you are short on screen real estate, it might be helpful to hide your menus and anything else you don't need and access them through the Hotbox instead.

Set Up a Project

A project is an assemblage of folders and subfolders that are set up on your hard drive to organize your Maya projects. It is likely that your Maya project will contain other files in addition to your Maya scene file, such as texture maps or cached animation data. It is therefore helpful for each project if you first set up a directory that contains subdirectories for all of the different elements the project includes. Fortunately, setting up this structure from Maya is easy in fact, Maya does it for you.

Focus and Shade in the View Window

You'll often work with dozens, or even hundreds, of objects in a scene. Every time you want to adjust the view to move closer to, or focus on, one or more objects, you may find it cumbersome to use the Tumble, Track, or Dolly tool. Instead, you can use hot keys from the keyboard that let you focus on a selected object or group of objects. Focusing on objects will frame or fit them to the bounds of your view window. It also sets the camera's center of interest at the center of the selected object or objects. This feature is especially helpful

when you select the Tumble tool in the Perspective view, because this tool orbits the camera around this center point.

The hot keys available for these focusing actions are listed and described here:

HOT KEY	FUNCTION
F	Focus on a selected object in a selected window.
SHIFT-F	Focus on a selected object in all windows.
A	Focus on all objects in a selected window.
SHIFT-A	Focus on all objects in all windows.

Display Options

So far, you have been viewing these objects in Wireframe mode. You can change the way a piece of geometry will display in a view window by setting the display options for that window. These options can be accessed via the View menu in the view window. You can also press a hotkey to choose a view mode, These display modes will activate your computer's hardware shading engine built into your video card and let you view the objects in your scene as shaded; shaded and textured; and shaded, textured, and lit.

HOT KEYMODE

- 1 Rough, NURBS, and subdivision only
- 2 Medium NURBS, and subdivision only
- 3 Fine NURBS, and subdivision only
- 4 Wireframe

- 5 Smooth shade, default light
- 6 Smooth shade with hardware texturing, default light
- 7 Smooth shade with lighting, hardware rendering lights if you have created lights; otherwise objects shown in black These display options can also let you view certain types of geometry at different levels of detail. Both NURBS and subdivision surfaces, two of the three geometry types in Maya, are mathematical representations of surfaces. Spheres in rough, medium, fine, Wireframe, smooth shade, and texturing .

Transform Objects

To get you moving along faster, you should learn and use the hot keys to select the items in the toolbox. From now on, try to get in the habit of using the hot keys to access these tools, as shown below.

HOT KEY

TOOL

Select tool

- W Move tool
- E Rotate tool
- R Scale tool
- T Manipulator tool
- Y Last used tool
- X Snap to Grid
- V Snap to Point

Create a Group Node (NULL NODE)

A group node is simply a transform node with no shape object associated with it. Often, objects are grouped together for organizational purposes—to keep similar things grouped

together. In our planetary project, we will use grouping to give us an extra transform node with an extra pivot point. Short cut key is CTRL + G.

Create a Hierarchy

Object1 is a main object so that is called as root object, another object called object2 is parented to object1 and that is called child object so we can say that both objects are connected in Hierarchy manner. Root objects moves then child objects move and child objects move independently but when child moves the root object will not move. If we take an example of our solar system, the sun will be the root object, earth will be the child of the sun, and the moon will be the child of the earth to monitor this hierarchical relationship, we will view the hierarchy in the Hypergraph.

The Outliner

The Outliner, shown in Figure as per below, is another way of displaying all of the objects in a scene. The objects listed here show the hierarchies in a way that's similar to that of a common Explorer (Windows) view used to browse file directory structures. To access the Outliner, choose Window | Outliner. To unfold a hierarchy, click the plus sign (+) icon to the left of the object's name. If you want to view all of the branches and sub-branches of a hierarchy, hold down the SHIFT key and click the plus sign.

The Attribute Editor

The Attribute Editor, shown in Figure as per below, displays all of the connected nodes and their material attributes for a selected object. Each tab represents a respective node and its attributes. One great aspect of the Attribute Editor is that it contains sliders, instead of text fields, that you can use to edit attributes—so you can see the effects of your changes. However, because it displays all

of the available attributes on any onenode, this may be more than you need to work with for your current process. For material editing, however, using the Attribute Editor is recommended. Short cut key is CTRL + A

The Script Editor

You access the Script Editor (see Figure below) by clicking the icon in the bottom- right corner of the screen at the end of the Command line or by choosing Window General Editors Script Editor. Since almost everything in Maya is built on MEL, every command you initiate generates some sort of MEL script or MEL argument. A history of these commands is available in the Script Editor.

Customizing the Interface

You've probably noticed that we've run into the same tools more than once as we've gone through the aspects of the user interface so far. Simply put, for everything you need to do in Maya, there are not only a few ways to do so, but at least a couple of ways to access the tools to do so. Most of Maya's commands and tools can be found in at least two places. This may be confusing at first, but you'll discover that in the long run it is most advantageous. It allows for the greatest flexibility in individual work flow and in part accounts for Maya being easily customized. Once you are confident with your Maya know-how, you'll develop your own ideas about how to use all the other user interface methods to customize your work flow. You'll want to return to this section when you're ready to do some serious **customization**. To customize Maya, you use the Preferences window (choose Window Settings/Preferences) By now, you should have a good idea of how to navigate the basic Maya interface. While we haven't shown you everything, you should have an idea of how to select nodes, edit their attributes, change the layout of the Workspace, use some hot keys, and access windows from the Window menu. Throughout the remainder of the book, we will explore all of these elements of the user interface in greater detail.

1.5 File > Project

To save Your Maya Scene

Importing, exporting, and referencing.

1.6 File > ImportSelect File > Import , to import the data from a file into the scene. In Import Option dialog box select the file type you are importing from the drop-down list. If you aren't sure what type of file you are importing, you can select Best Guess.

Depending on the file type you select, various file type specific options may be displayed.

1.7 File > Export All

In Export Option dialog box select the file type from the drop down list. Default file type is mayaBinary.

1.8 File > Export Selection

1.9 File > Create Reference

to reference the objects, animation etc. into a scene. In the Create Reference dialog box set the options as per required when

creating a file reference.

1.10 Help > Maya Help

The Maya Help is HTML-based, designed by module, fully searchable and displayed in your computer web browser. The Maya Help is topic based and displays the major functionality categories for Maya. The Maya Help can assist you in finding reference information about particular topics, how to perform specific tasks, and MEL command references. Select Help > Maya Help to launch the Maya Help.

1.11 Think about sets and props

1.12 Summary

In this chapter we covered intro of Autodesk Maya and workflow.

1.13 Self Assessment Test

Broad Questions -

1. What is Attribute Editor?
2. What is Hot Box?


Short Notes


- 1 Outliner
- 2 Shelf
- 3 Story board
- 4 Channel Box
- 5 View Compass

1.14 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training ...Autodesk Maya Press, **Marc-André Guindon**

UNIT 2 NAVIGATING AND CHANGING THE INTERFACE, PRIMITIVES

 Learning Outcome	
<p>After going through this unit, you will learn:</p> <ul style="list-style-type: none">• Poly primitive• Nurbs Primitive• Transformation	

 Time Required to Complete the unit	
<p>The time required to study this Unit is broken as follows</p> <ol style="list-style-type: none">1. 1st Reading: It will need 2 Hrs for reading a unit2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit3. Self Assessment: It will need 3 Hrs for reading and understanding a unit4. Revision and Further Reading: It is continuous process	

 Content Map	
<p>2.1 Camera Tools</p> <p>2.2 View menu</p> <p>2.3 Window menu</p>	

2.4 Display Menu

2.5 View Ports Display

2.6 Primitives

Explain in brief all Four Primitive types

2.7 NURBS Primitives, Polygon Primitives

2.8 Subdiv Primitives, Volume Primitives

2.9 Define and Differentiate NURBS and Polygons

NURBS Primitives >

Polygon primitives >

Subdiv Primitives >

2.10 Transforming objects and components

2.11 NURBS & Polygon Objects Component and SubDiv Components

2.12 Moving, rotating, and scaling objects

2.13 The Tool Box : Select, Move, Rotate and Scale

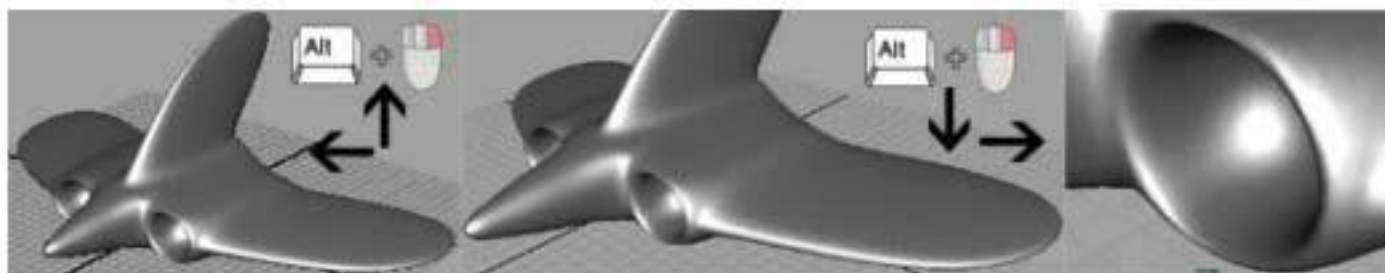
2.14 The Pivot Point

- 2.15 Duplication options
- 2.16 The Channel Box
- 2.17 Explain Construction history
- 2.18 Edit > Delete by Type > History
- 2.19 Selecting objects
- 2.20 Selection modes and masks
- 2.21 Using quick select sets
- 2.22 Hiding and templating
- 2.23 Layers – The Layer Panel
- 2.24 Summary
- 2.25 Self Assessment test
- 2.26 Further Reading

2.1 Camera Tools

Dolly Tool

The Dolly Tool gets its name from filmmaking where a camera, mounted on a wheeled tripod, is moved towards or away from the scene. In Maya, dolly allows you to view the items in your scene either close up or from further back.



Dollying the View

To dolly the perspective view

Enlarge the scene view to a single perspective view.

Do one of the following:

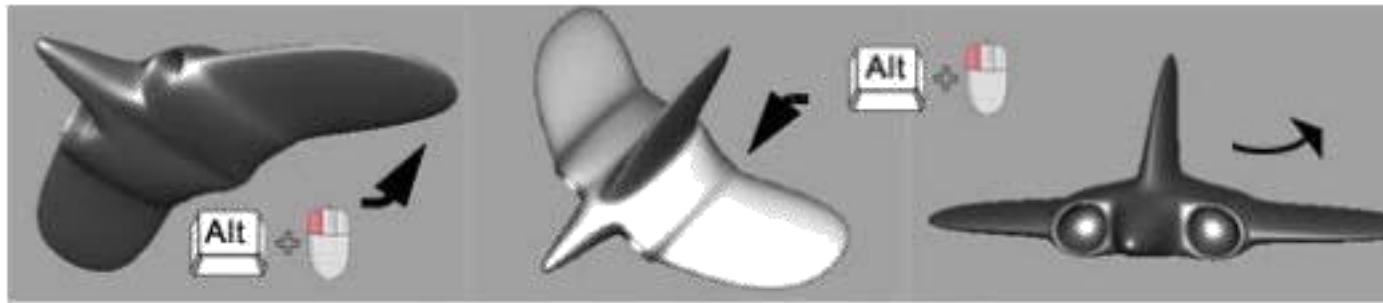
Press the Alt key and drag the mouse to the right while holding down the right button on your mouse. To dolly the camera outwards from the subject in the scene you can perform the same key and mouse combinations as described above but drag the mouse to the left. Dolly works in both the perspective and orthographic views.

Tip: If you make an error when adjusting your camera view of the scene, you can reset the camera to its default home setting. To

reset the camera view for a particular orthographic or perspective view: From the panel menu, select **View > Default Home** .

Tumble Tool

The Tumble Tool allows you to tumble or rotate the camera's view around a particular center of interest to achieve either a higher or lower vantage point, or a different side angle.



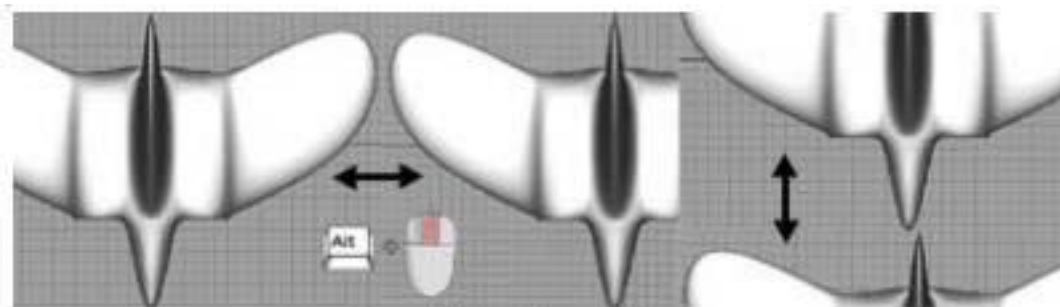
Tumbling the Perspective View

To tumble the perspective view

Press the Alt key and drag the mouse either left or right, or up or down, while holding down the left button on your mouse. Tumbling the view revolves the camera around the center of the scene view, in whichever direction you drag (left, right, up or down). The Tumble Tool does not work in the orthographic views.

Track Tool

The Track Tool allows you to move the camera up, down, or sideways in relation to the scene.



Tracking the View

To track the perspective view

Press the Alt key and drag the mouse in any direction, while holding down the middle button on your mouse. The Tracking Tool works for both orthographic and perspective views.

Note: Even though the objects appear to move across the screen when operating any of the camera tools, it is the viewing camera that is actually moved in relation to the scene, not the objects.

2.2 View Menu

View > Select Camera

Select the view's related camera. It is useful, if you want to edit the look-at and camera up nodes related with the camera.

View > Previous View

Select Previous View or press [to go back in the view history

View > Next View

Select Next View or press] to go back in the view history

View > Default Home

To reset the active view panel

View > Look At Selection

To point the camera at the selected objects but don't move the camera.

View > Frame All

Select Frame All or press a to show all the objects in an active view panels.

View > Frame Selection

Select Frame Selection or press f to show selected objects in an active view panels.

View > Predefined Bookmarks

Bookmark is a way to mark a view for future use, allowing you to keep a variety of camera views for a scene. There are four Predefined Bookmarks: Perspective, Front, Top and side. You can change the view in any of these Predefined Bookmarks.

View > Bookmarks > Edit Bookmarks

Bookmark the current view and create additional bookmarks of your own. You can also create a shelf button for a Bookmark by click Add to Shelf.

View > Bookmarks

Return to a Bookmarked view.

View > Image Plane > Import Image

To import a file to use an image plane and access the Image Plane's attributes.

2.3 Window Menu

Window Menu provides access to various editors, panels and windows. Some of them are:

Outliner

The Outliner shows a hierarchical list of all objects in the scene in outline form.

To show the Outliner select Windows > Outliner.

Menus of outliner:

Display

DAG Objects Only: Only show transformable nodes.

Shapes: Show shape nodes.



Attributes (Channels): Allow the display of attributes on nodes. Use the round plus and minus buttons to show a node's attributes.

Set Members: Allow the display of members under the sets.

Connected: Only show attributes that are connected another node, keyed, or connected by set driven key, a constraint, a motion path, or an expression.

Reveal Selected: Expands the outline to show the currently selected node(s).

Channel Names: Select what attribute names to show when Attributes (Channels) is on. Nice names are more readable. Long and Short names are the actual names of attributes, which you can use in expressions and MEL.

Sort Order: Select Scene Hierarchy to show the hierarchy. Select Alphabetical Within Type to show flat alphabetical lists of each node type.

Select Set Members: Selects the members of the highlighted set.

Show

Objects: Select which object types to show in the Outliner. Select Clear Below to turn off all filters.

Attributes : Select which attribute types to show in the Outliner.

Hidden: Hidden attributes.

Keyable : Keyable attributes.

Scale, Rotate, Translate: Scale, Rotate, or Translate attributes.

Driven by Anim Curve: Attributes with an animation curve. This includes attributes animated with keys, set driven keys, constraints, and motion paths.

Driven by Expression: These are the attributes controlled by expressions.

User Defined: User-defined attributes.

Invert Shown : Reverse the filters so visible objects are hidden and hidden objects are visible.

Show All: Turns off all filters in the Show menu.

Show Selected Type(s): Shows only object types of the same type as the current selection. This option lets you create a filter that limits the types of objects and attributes displayed in the Outliner to the same type of object or attribute as the current selection.

For example, if you select an object's Translate X, Y, and Z attributes in the Outliner and then select Show Selected Type(s), then all non-translation attributes will be filtered and only translation attributes will appear in the Outliner. The Show Selected Type(s) filter will remain active until you select another Show menu option (such as Show All).

Create Entry: Lets you save the current Show menu filter with a name. Create Entry is only available when the objects and attributes displayed in the Outliner have been filtered by the Show Selected Type(s) menu option.

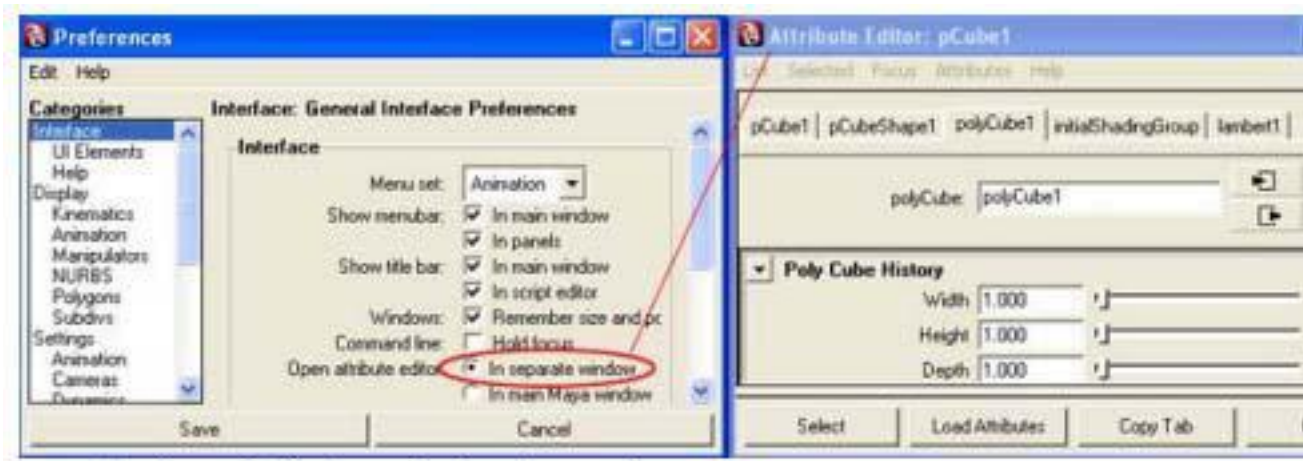
Delete Entry : Lets you delete a saved Show menu filter.

Show Auxiliary Nodes : Shows node types that the Outliner normally does not show because they are rarely needed.

Auxiliary Nodes: Lets you set what nodes are considered "auxiliary".

Attribute Editor Lists attributes on the selected object. Press Ctrl + a to open and close the attribute editor. Tabs across the top of the Attribute Editor let you select nodes connected to the shown node.

While the Channel Box provides a more compact view of keyable attributes, the Attribute Editor gives you full graphical controls to edit attributes rather than just text boxes. You can set an option in Window > Settings/Preferences > Preferences to have the Attribute Editor open in a window instead of the side panel.



Menus in the attribute window/panel

List

Use this menu to load attributes into the Attribute Editor and to define which items display in the Selected/Object menu.

Selected/Object

The Selected menu lists objects currently selected in the scene while the Object menu displays all the objects in the scene of a selected type.

Focus

This menu displays all nodes that have been selected in the scene while the Attribute Editor is open. The most recently selected node is at the top of the list.

Attributes

Use this menu to add, edit, and delete extra attributes for an object or node. These appear under the Extra Attributes section. You can also add, edit, and delete attributes using the Modify menu.

Context menu

Output connection node

If you set a key for the attribute or connect a texture to it, the resulting output connection node name displays as the first menu item. To load the attributes for this node into the Attribute Editor, select it.

Create New Expression

Select this option to create a new expression for the attribute.

Set Key

Select this option to set a key for the attribute. This option disappears from the menu if you have already connected a texture to the attribute.

Set Driven Key

Select this option to link the attribute values.

Break Connection

Select this option to break the connection between the attribute and a key or texture.

Create New Texture

Select this option to connect a texture to the attribute.

Color Chooser

This option displays for color attributes only. Select it to open the Color Chooser.

Lock/Unlock Attribute

Select the Lock option to lock an attribute value so that it cannot be changed. Use Unlock Attribute to unlock the value.

Ignore/Don't Ignore when Rendering This option displays only for attributes that are connected to keys or textures.

Select the 'Ignore when Rendering, option to ignore the connection when rendering. If the attribute has a map button, the button changes to indicate that the connection is ignored. Select the Don't Ignore when Rendering option to render with the set connection. For details, see Rendering.

Attribute Editor > Attributes > Add Attributes...

New tab

Attribute Name: Type the name of the attribute you are adding.

Make Attribute Keyable: Turn this option on to make this attribute keyable.

For information about keyable attributes, see Animation.

Data Type : Select the data type for the attribute:

Vector: Creates a vector attribute consisting of three floating point values.

Float: Creates a floating point attribute.

Integer : Creates an integer attribute.

Boolean : Creates an attribute consisting of an on/off turn.

String : Creates a string attribute that accepts alphanumeric entries as data entry, such as a filename.

Enum : Creates an attribute that accepts selections from an “enumerated” or drop-down list.

Attribute Type

Select a type:

Scalar : Creates a per object attribute that you can set to a single value that applies to every particle in the object. A vector scalar is

considered a single value with three numbers. If you select Scalar, you can specify Minimum, Maximum, and Default values for a Float or Integer attribute.

Per Particle (Array): Creates a per particle attribute. You can set this type of attribute to different values for each particle. If you

select Per Particle (Array), you can also create a counterpart initial state attribute by turning on Add Initial State Attribute.

Add Initial State Attribute : Turn on to create a corresponding initial state attribute for the added attribute. Without this

corresponding attribute, you can't save a particle object's current attribute values for initial state usage. You must write a creation

expression if you decide to initialize the custom attribute's value upon rewinding the animation. If you know you're going to write a creation expression for a custom attribute, you can set Add Initial State Attribute to off when you add the attribute. Otherwise, set Add Initial State Attribute to on whenever you add a custom per particle attribute.

Numeric Attribute Properties: For scalar attributes, Minimum and Maximum set the lowest and highest values you can enter for the attribute in the Attribute Editor or Channel Box. Default sets the default value for the attribute.

Enum Names: When you're adding a new Enum attribute, you need to define the list of acceptable strings. There are two default strings, “Green” and “Blue”, in the Enum Names list that you can change. To change, select Green or Blue and then enter the new string in the New Name text box. To add a new string, click the blank entry below the last list item and type the string in the New Name text box.

Note: Keywords must not be used as the Enum names.

Window > View Arrangement, Saved Layouts Let you select a layout and layout/content presets. These are the same as the

layouts/presets available using the quick layout buttons or the Panels menu in a panel.

Quick Layout Buttons

The quick layout buttons let you switch to one of a few common panel layouts quickly.

Window > Save Current Layout

This command will save the Maya's current layout of panels. The saved layout will be available in saved layouts menu.

Window > Frame All in All Views, Frame Selection in All Views Tracks and dollies all view panels to show all objects or the selected objects. To show all objects or the selected objects in a specific view panel, use the panel's View menu.

Window > Settings/Preferences > Preferences

Shows the Maya Preferences window. The Preferences dialog box sets preferences for many functional elements of Maya, detailed in the following sections:

- Interface preferences:
 - o UI Elements preferences
 - o Help preferences
- Display preferences
 - o Kinematics preferences
 - o Animation (Display) preferences
 - o Manipulators preferences
 - o NURBS preferences
 - o Polygons preferences

- o Subdivs preferences
- Settings preferences
- o Animation (Settings) preferences o Cameras preferences
- o Dynamics preferences
- o Files/Projects preferences o Modeling preferences
- o Rendering preferences o Selection preferences o Snapping preferences o Sound preferences
- o Timeline preferences o Undo preferences
- o Save Actions
- Modules preferences
- Application preferences

Preferences > Interface > Menu set

This determines which menu set displays in the main Maya menu bar on start-up. The default is Animation Preferences > Setting >Time

Sets the working time unit for animation. The Time Slider displays time values in the unit chosen. You can specify the time unit as frames or as clock values. \

Frame selections include:

- 15 fps
- Film (24 fps)
- PAL (25 fps)
- NTSC (30 fps)
- Show (48 fps)
- PAL Field (50 fps)
- NTSC Field (60 fps)
- 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 40, 75, 80, 100, 120, 125, 150, 200, 240, 250, 300, 375, 400, 500, 600, 750, 1000, 1200, 1500, 2000, 3000, and 6000 frames per second.

- Clock values include:

- o milliseconds
 - o seconds

- o minutes
 - o hours

Preferences > Undo

Undo: Select On if you want to be able to undo operations. This is the default.

Queue: Select Infinite to perform an unlimited number of undo operations. This option can use a lot of memory. Select Finite to limit the number of undo operations you can perform (specified in the Queue Size box). The default is Finite.

Queue Size: If Finite is the selected Queue setting, specify here the number of undo operations you can perform. The default is 50. Window > Settings/Preferences > Hotkey editor

Lets you assign predefined commands, MEL scripts, or marking menus to keys and key combinations. Categories and Commands Maya includes a large number of useful predefined hotkey commands. You can

use these commands instead of writing your own MEL script. Click a category in the Categories list to see the list of available pre-defined Commands in the category. Click a command in the Commands list to see its current hotkey(s) or assign it to a new key.

Current hotkeys

List box

Shows all hotkeys that activate the selected command.

Remove

Select a hotkey and click Remove to unassign the hotkey.

List All

Opens a window listing every assigned hotkey and its command.

Restore Defaults

Returns all hotkey assignments to their "factory defaults".

Assign New Hotkey

Key

Type a keyboard symbol in the text box, or use the pull-down list next to the text box to select other keys. If you type an upper-case letter in the text box, Maya requires you to type the letter with the shift key to activate the hotkey. Modifier

Select a modifier to add to the key.

Direction

Select when the command activates: when you press the key down, or when you let the key back up (release). Add to Recent Commands List

Select whether Maya should add the command to the Recent Commands list when you activate the hotkey. Edit area

New: Create a new user-defined command which you can then assign to a hotkey.

Edit: Edit the selected user-defined command in the Commands list.

Delete: Delete the selected user-defined command in the Commands list.

Name: The name of the selected command.

Description: A description of the command's purpose and effect. Category: The category in which the command appears.

Command: The script that runs when the command is activated.

Accept: Click to save the command you are creating or editing. This button is only available after you click New or Edit to create or edit a command.

Cancel: Click to cancel editing a command. This button is only available after you click New or Edit to create or edit a command.

Search: Lets you search for text in the name or script of all defined commands. Use asterisks as wildcards.

Following are some unmapped keys:

KL NOT UY9) ! @#

\$%^&*(F7 \;_|:

" ? Home End

Note: Hotkeys/Shortcuts in Maya are case sensitive. i.e. you can assign 'z' and 'Z' to two different commands.

Window > Settings/Preferences > Shelf Editor

The shelf editor provides a dialog box with which you can create and edit shelves. Shelves

Click the Shelves tab to display existing shelves. From here you can create, delete, and

rename shelves and change their order. Shelf Contents

Click the Shelf Contents tab to display the contents of a specific shelf. From here you can move and delete shelf items, change an item's label and tooltip, as well as change its icon and icon name.

Edit Commands

Click the Edit Commands tab to view and edit the MEL code associated with a tool or action.

Display Menu is a part of common menu set from where you can control the Visual elements of the Maya.

Display > Grid

Shows or hides the grid in all view panels.

When the grid is visible, you can turn it off in an individual panel using the panel's

Show > Grid item.

Grid Option dialog gives following option

Size

You can change the size and length of the grid, set the number of subdivision lines, and the increment for the grid lines.

- Length and width: Sets the number of units for the length and width of the grid. The default is 12 units.
- Grid lines every: Displays a grid line every n units. The default is 5.
- Subdivisions: Specifies the number of divisions between major grid lines. Setting the Subdivisions option to a value greater than 1 specifies that each main grid interval is subdivided by the amount specified. The default is 5.
- Axes: Specifies a color for the X and Z axes on the grid. The default is dark grey.
- Grid lines & numbers: Specifies a color for the grid lines and the grid line numbers. The default is light grey.
- Subdivision lines: Specifies a color for the subdivision lines. The default is light grey.

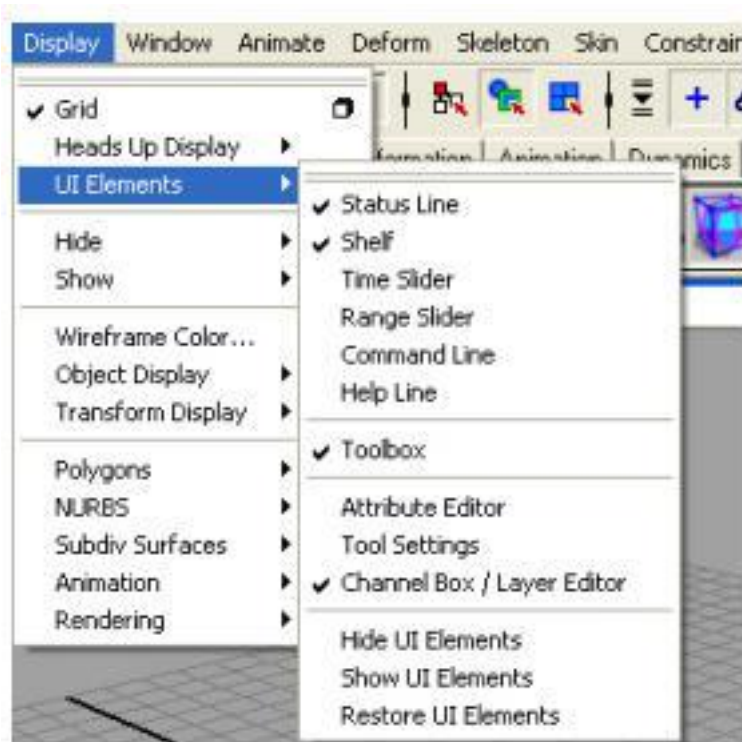
2.4 Display Menu

You can turn on and off the display of grid elements, including axes, thicker lines for axes, grid lines, subdivision lines, and grid line numbers.

- Axes: Turns on or off the display of the axes. The default is on.
- Thicker line for axes : Turns on or off the display of thicker lines for the axes. The default is on.
- Grid Lines : Turns on or off the display of the grid lines. The default is on.

- Subdivision lines: Turns on or off the display of the subdivision lines. The default is on.
- Perspective grid numbers: In the Perspective view, you can set the grid line numbers to display on the axes, along the edge of the grid, or just hide them.
- Orthographic grid numbers: In the Orthographic views (top, side, front), you can set the grid line numbers to display on the axes, along the edge of the grid, or just hide them.

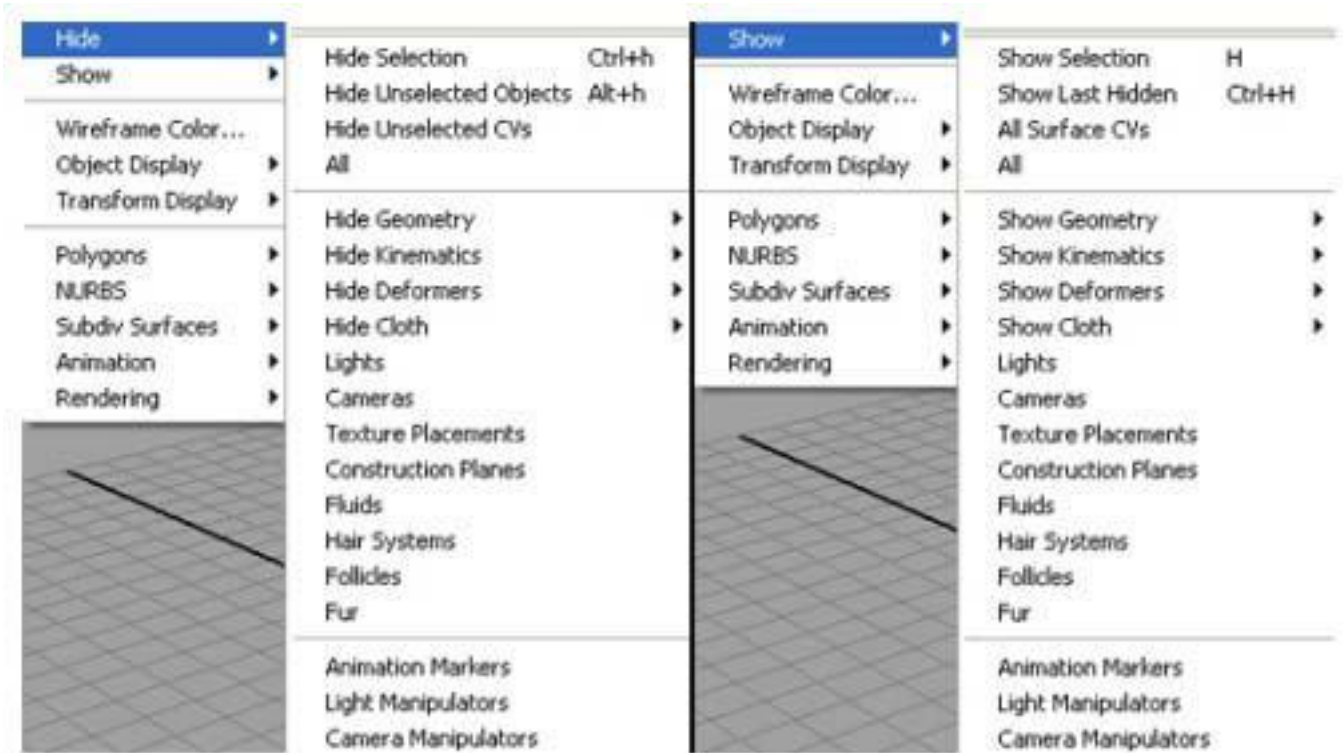
The items in this menu control the visibility of various user interface elements, including the Status Line, the Shelf, the Time Slider, and so on.



- Hide UI Elements: Hide all UI parts so only the panels and menus are visible.
- Show UI Elements : Show all UI parts.
- Restore UI Elements: Restores the visibility of UI parts to their state before you selected Hide UI Elements. If certain parts were hidden before you selected Hide UI Elements, they will still be hidden.

Display > Hide, Show

Use Display > Hide to hide items you aren't working on and reduce visual clutter. This is handy if you want to remove an object from the view, but do not want to delete it or move it.



To redisplay items, use the Display > Show submenu, which includes the same selections as Display > Hide.

The Hide/Show menu items are:

Hide/Show Selection : Hides/Shows selected object(s).

Hide Unselected Objects/Show Last Hidden : Hides all unselected objects. To make them visible again use Display > Show > Show Last Hidden

Hide Unselected CVs/All Surface CVs : To control the display of CVs, select the CVs that you want to remain visible, and then use Display > Hide > Hide Unselected CVs to hide all the other CVs on that surface. This affects the display of CVs in component selection mode, as well as CVs displayed in object selection mode by the use of Display > NURBS Components > CVs. To make hidden CVs visible again use Display > Show > All Surface CVs.

All: Hides/Shows all objects, whether they are selected or not.

Hide/Show Geometry: Displays a menu that lets you select the type of geometry you want to hide/show.

Hide/Show Kinematics: Displays a menu that lets you select the type of kinematics you want to hide/show.

Hide/Show Deformers : Displays a menu that lets you select the type of deformers you want to hide/show.

Hide/Show Cloth: Hides/Shows cloth objects (Available only if you have Maya Unlimited).

Lights: Hides/Shows lights.

Cameras: Hides/Shows cameras.

Texture Placements: Hides/Shows texture placements.

Construction planes: Hides/Shows construction planes.

Fluids, Hair Systems, Follicles, Fur : Hides/Shows fluids, hair systems, follicles, or fur.

Animation Markers: Hides/Shows animation markers.

Light Manipulators : Hides/Shows light manipulators.

Camera Manipulators: Hides/Shows camera manipulators.

Display > Wireframe Color

Lets you set the wireframe color of the selected objects. You can leave the color selection window open and keep selecting

and applying colors.

Display > Object Display

The items in this submenu control the display and select ability of the selected

objects.

Template / Untemplate : Makes an object unselectable, for use as a reference in your scene.

Templated objects appear slightly dimmed. You cannot select or snap to templated objects.

Bounding Box / No Bounding Box: Draws a box around the total space occupied by each object.

Geometry / No Geometry : Shows or hides the actual geometry of the object (for example, the surface or polygon mesh). This lets you turn on the display of components (such as CVs) but turn off the actual object itself.

Ignore Hardware Shader / Use Hardware Shader : Lets you ignore hardware shaders on multiple polygon or NURBS objects. The objects then appear with their untextured default shaders. Use Hardware Shader lets you show the hardware shaders for multiple polygon or NURBS objects.

Fast Interaction: Improves performance by displaying fewer geometric entities (such as polygons), especially when moving the camera (for example, tumbling the scene view).

2.5 View Port Display

When you have scene with lots of objects, materials, lights etc., scene becomes heavy and machines speed also become slow. To solve this problem you can switch to the following view panels display.

Low Quality Display

Select the specific NURBS object and press 1.

Medium Quality Display

Select the specific NURBS object and press 2 .

Better Quality Display

Select the specific NURBS object and press 3.

Wireframe Display

Press 4 to view all the objects of scene in wireframe.

Shaded Display

Press 5 to view the shade of the objects.

Texture Display

Press 6 to view the Texture given to the objects.

Light Display

Create a new Light and Press 7 to view the Light effect in the scene.

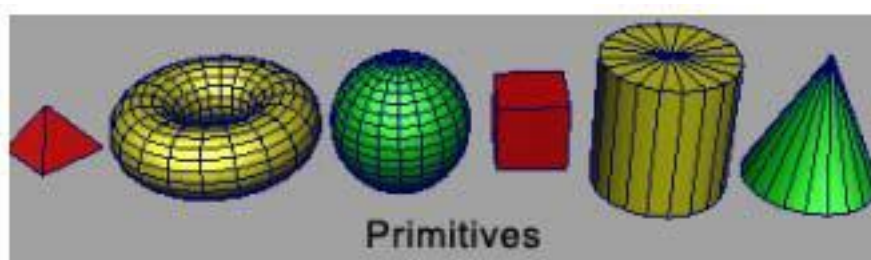
2.6 Primitives

Primitives are simple 3D objects created in the shape of common geometric forms, which can be moulded or expanded to add

more detail. It Includes spheres, cubes, cylinders, planes, cones and toruses.

Type of Primitives:

- 1) NURBS Primitives: Create various geometric primitives shapes using NURBS surfaces or curves.
- 2) Polygon Primitives: Create polygon-based geometric primitives.
- 3) Subdiv Primitives: Create various geometric shapes using unique Subdivision primitives with the characteristics of both polygons and NURBS.
- 4) Volume Primitives: It is use in combination with lights and Volume Fog to produce foggy atmospheric volume effects.



2.7 NURBS Primitives, Polygon Primitives

NURBS

NURBS (Non-Uniform Rational B-Splines) are one of the geometry types you can use to create 3D curves and surfaces in Maya. NURBS are useful for constructing many types of organic 3D forms because of the smooth and minimal nature of the curves they use to construct surfaces. NURBS surface types are widely used in the fields of animation, games, scientific visualization, and industrial design. NURBS can be converted into

Polygons.

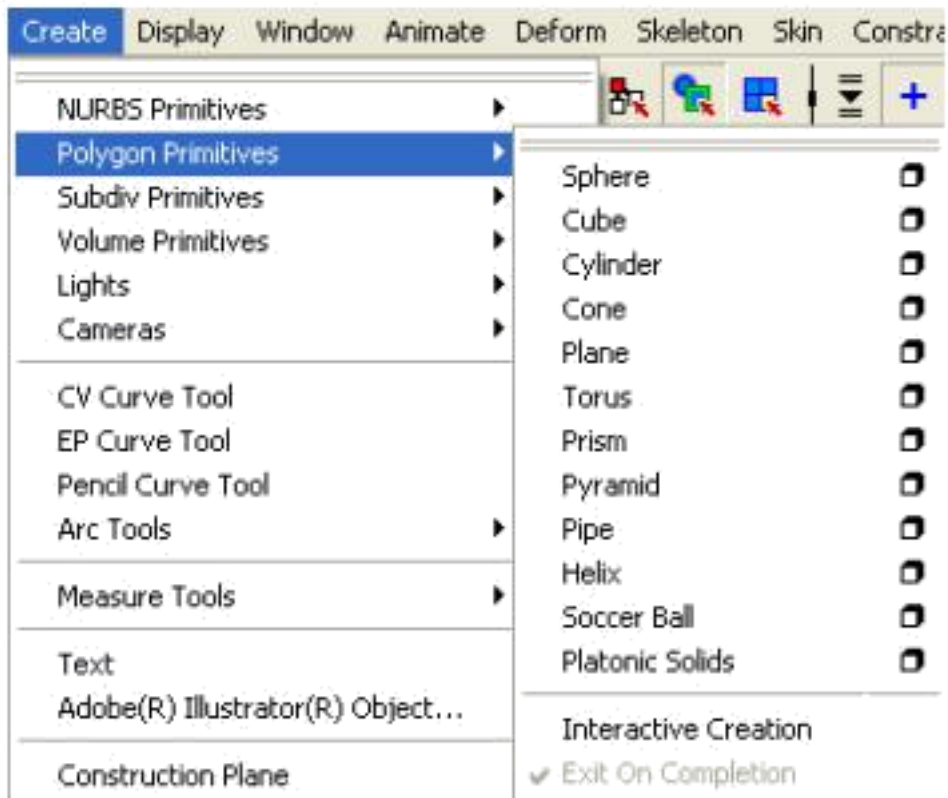
Polygons

Polygons are straight-sided shapes (3 or more sides); defined by vertices and the edges. The interior region of the polygon is called the face. Vertices, edges, and faces are the basic components of polygons. You select and modify polygons using these basic components.

Polygon Primitives

Polygon Primitives can be created from Create Menu.

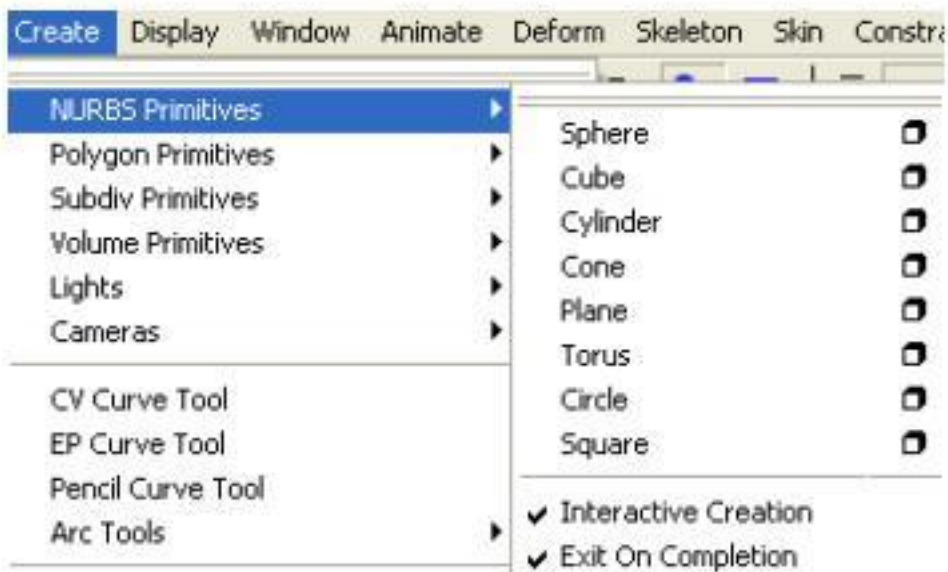
Create > Polygon Primitives



NURBS Primitives

NURBS Primitives can be created from Create Menu.

Create > NURBS Primitives



Interactive Creation

With Interactive Creation you can position and scale primitives as you create them using your mouse, without having to use transformation tools and is by default on. This option stays on until you turn it off Exit on Completion This option interacts with Interactive Creation. When Exit on Completion is turned on, you must select a primitive type again in order to create another primitive. When this option is turned off, you can interactively create multiple primitives of the same type, until you select another tool.

To create a polygon Primitive, choose shape from the create menu like:

Create > Polygon Primitive > Sphere

and follow the onscreen instructions to create the primitive interactively. You can also click on option box to open the create sphere option dialog box where you can specify the following options:

1. Radius: Specifies the distance from the center of the sphere in all directions.
2. Divisions: The values you enter in these options change the primitive by adding or taking away faces of the polygonal surfaces.
3. Axis: By default, a primitive is created along the Y axis. You can change a primitive's default orientation before you create it by changing the Axis option.
4. Create Uvs: These will create UV coordinate (texture coordinates) for the Primitive.

Similarly you can draw other polygon primitives. The unique options for each are given below:

Cube

1. Width: Specifies the width of the cube.
2. Height: Specifies the height of the cube.
3. Depth : Specifies the depth of the cube. Cylinder

1. Radius: Specifies the distance from the center of the cylinder.

2. Height: Specifies the Height of the Cylinder. Cone

1. Radius: Specifies the distance from the center of the Cone.

2. Height: Specifies the Height of the Cone. Plane

1. Width: Specifies the distance along X-axis.

2. Height: Specifies the distance along Y-axis. Torus

1. Radius: Specifies the distance from the center of the torus in all directions.

2. Section Radius: Specifies the size of the sections that make up a torus. Change this value to increase or decrease the radius of these sections.

3. Twist: The Twist option value specifies the twist angle of the torus. Change this value to adjust the distance around the torus in all directions. Prism

A prism is a polyhedron with two polygonal faces lying in parallel planes and with the other faces parallelograms. It has following options:

1. Length: Enter values or use the slider to specify the length of the prism (the distance between the two polygonal faces).

2. Side Length : Enter values or use the slider to specify the side length of the prism's polygonal caps.

3. Number of Sides: Enter the number of sides for the ends of the prism.

The above example is a triangular prism (3 sides). The size and volume of the prism increases with the number of sides if the edge length and length/height are kept constant.

Pyramid

A pyramid is a polyhedron with a polygon base and triangles with a common vertex for faces. It has following options:

1. Side Length : Enter values or use the slider to specify the side length of all faces.
2. Number of Sides in Base : Select the number of sides for the base of the pyramid (3, 4, or

5). Pipe

The options are very similar to the options for the cylinder polygonal shape, with the addition of Thickness (which specifies the thickness of the wall).

1. Radius: Specifies the distance from the center of the pipe in all directions.
2. Height: Specifies the height of the pipe.

3. Thickness : Specifies the thickness of the pipe walls. Helix

A helix is a curve in three dimensional space that lies on a cylinder, so that its angle to a plane perpendicular to the axis is constant.

1. Coils: Specifies the number of coils.
2. Height: Specifies the height of the helix.
3. Width: Specifies the width of the helix.
4. Radius: Specifies the radius of the helix coils.
5. Direction: Specifies the direction of the helix's twist: clockwise or counterclockwise.

Soccer Ball

The soccer ball is a truncated icosahedron: thirty-two faces, alternating hexagons and pentagons.

1. Radius: Enter values or use the slider to specify the radius of the soccer ball.
2. Side Length : Enter values or use the slider to specify the side length of the soccer ball.

Platonic Solids

You can create many different types of polygonal platonic solids. Platonic solids are shapes where all sides are equal, all angles are the same, and all faces are identical. These are:

- Tetrahedron : four triangular faces
- Octahedron: eight triangular faces
- Dodecahedron : twelve pentagonal faces
- Icosahedron : twenty triangular faces

You can switch between these types by selecting Solid Type in the Attribute Editor or in the option box for Platonic Solids.

1. Radius: Enter values or use the slider to specify the radius of the platonic solid.
2. Side Length : Enter values or use the slider to specify the side length of the platonic solid.
3. Platonic type: You can switch between platonic solid types in the options for these shapes. To create NURBS primitives using create menu:

Select Create > NURBS Primitives, then follow the onscreen instructions to create the primitive interactively. You can also select the primitive's option box from the list of primitives. For example, Sphere > , Cube > , Cone > , Cylinder > , and so on.

Sphere

1. **Pivot:** By default, the Pivot is set to Object, and the primitive is created at the origin. Specifically, its rotate and scale pivots are at the origin. If you set Pivot to User Defined, you can enter values in the Pivot Point X, Y, and Z boxes to position the pivots (and the primitive).
2. **Axis:** Select X, Y, or Z to specify a preset axis direction of the object. Select Free to enable the X, Y and Z Axis Definition boxes. Enter new values to select your own axis direction. Select Active View to create the object perpendicular to the current orthographic view. The Active View option has no effect when the current modeling view is a camera or perspective view.
3. **Start and End Sweep Angles:** These options let you create a partial sphere by specifying a degree of rotation. Degree values can range from 0 to 360 degrees. The following example shows the top view of a sphere with an End Sweep Angle of 180 degrees.
4. **Radius:** Sets the width and depth of the primitive.
5. **Surface Degree:** A Linear surface has a faceted appearance; a Cubic surface is rounded.

6. Use Tolerance : You can use this option to improve the precision of the primitive's shape. If set to Global tolerance, the Positional tolerance value in the Settings part of the Preferences window is used. Lower values increase surface precision. If set to Local, you can enter a value in the

options window to override the Positional tolerance value in the Preferences window. If set to None, tolerance is ignored and the sphere is

created with the specified number of sections and spans.

7. Number of Sections: Sets the number of surface curves created on the sphere in one direction. Surface curves, also called isoparms, show the

outline of the surface shape. The more sections (and spans) a surface has, the more precisely it shows surface deformations.

8. Number of Spans: Sets the number of surface curves created on the sphere in the direction that crosses the Section direction. A value less

than 4 gives a crude sphere.

Cube

A cube has six sides, each selectable. You can select a side of the cube in the view, or click its heading in the Outliner. Options unique to cubes follow:

1. Width, Length, Height: Sets the cube dimensions.

2. U/V patches : Sets the number of U and V Patches between the edges that make up the cube. This value changes the number of spans and sections.

Cylinder

You can create a cylinder with or without end caps. The options unique to cylinders pertain to end caps. You can create caps for either, both, or no ends of the cylinder. You can also create caps as separate transform nodes so you can manipulate them independently of the cylinder.

Cone

You can create a cone with or without a cap on its base. Its other options are similar to those of other NURBS primitives.

Plane

A plane is a flat surface made up of a specified number of patches. Its options are similar to other NURBS primitives.

Torus

A torus is a 3D ring. It has options similar to other NURBS primitives.

Circle

A circle is a curve, not a surface. Its options are similar to a sphere.

Square

A square is a group of four curves, not a surface. Its options are similar to other NURBS primitives.

Transforming objects and components Transformations change an object's position, size, and orientation without changing its shape. Transformations are relative to an object's (or component's) pivot point, and take place along/around either the world axes, object axes, or

local axes.

World space, Object space and Local space

3D positions and transformation exist with coordinate systems called spaces.

World space is the coordinate system for the entire scene. Its origin is at the center of the scene. The grid in the view panel window shows world space axes.

Object space is the coordinate system from an object's point of view. The origin of object space is at the object's pivot point, and its axes are rotated with the object.

Local space is similar to object space, however it uses the origin and axes of the object's parent node in the hierarchy of objects. This is useful when you haven't transformed the object itself, but it is part of a group that is transformed.

2.8 Subdiv Primitives, Volume Primitives

You can create Subdiv Primitives by clicking Create > Subdiv Primitives.

2.9 Define and Differentiate NURBS and Polygons

NURBS are smooth and rounded and are controlled by area nodes, but polygons are made of flat faces from straight edges.

Polygons are used to model mechanical objects and NURBS are used to model organic stuff.

2.10 Transforming objects and components

Transformation tools

The upper half of the Tool Box contains the tools for transforming objects (selection, move, rotate, scale) within Maya. When you move your mouse cursor over any transformation tool icon you see the name of the tool appear next to the mouse cursor.

The tool's name also appears in the Help Line at the bottom of the Maya window. The Help Line has an additional purpose: it displays summary instructions as you use tools that require several steps.

Selection and de-selection of objects

Before you can transform an object, you must ensure it is selected. You can select objects by clicking them directly, or by dragging a rectangular bounding box or a boundary around some portion of the object to indicate what you want selected. To deselect an object, you simply click somewhere off of the selected object.

To transform an object

To Move

Select the Move Tool or press `w`. Use the position manipulator to change the position of the selected objects.

To Rotate

Select the Rotate Tool or press e. Use the rotation manipulator to rotate the selected objects. The selection rotates around the pivot of the key object.

To Scale

Select the Scale Tool or press r . Use the scale manipulator to scale of the selected objects. The selection scales from the pivot of the key object.

To Move, Rotate and Scale

Select the object and then select Universal Manipulator tool or press ctrl + t which combines the function of Move tool, Rotate tool and Scale tool.

Note: Always Off the Caps Lock while using Maya Shortcut Keys.

For example,

- To use the Move Tool to adjust the position of a cylinder Create a polygon cylinder

Select the Move Tool from the Toolbox.

A move manipulator icon appears over the primitive cylinder in the scene view.

The Move Tool Manipulator has handles that point in the direction of the three fundamental axis directions of 3D space: X, Y, Z. The handles are

colored red, green, and blue based on their function related to the X, Y, Z axes and control the direction of the movement along an axis.

When you click a specific handle, it indicates that the move is constrained to that particular axis direction.

In the side view, drag the green Y manipulator handle to move the primitive cylinder upwards in the Y direction. Move it upwards enough so

that the bottom of the cylinder is aligned with the X axis (the thick dark line of the grid)

- To use the Rotate Tool to adjust the position of a cylinder Display all four views by positioning the mouse cursor in the view and tapping the spacebar of your keyboard. The four view panel appears. Position the mouse cursor in the top view and tap the spacebar once. The top view appears in the workspace. With the cylinder selected, choose the rotate tool from the Tool Box. A rotate manipulator icon appears over the primitive cylinder in the scene view. The Rotate Tool Manipulator consists of three rings (handles), plus a virtual sphere enclosed by the rings. The colors of the handles correspond to the X, Y, and Z axes. The handles are colored red, green, and blue based on their function related to the X, Y, Z axes and control the direction of the rotation around an axis. In the top view, drag the red X manipulator ring to rotate the primitive cylinder as shown in the image below. You are rotating the cylinder on X axis.

TRANSFORMING COMPONENT

Choose Display > Component Display > Rotate Pivots and Display > Component Display > Scale Pivots.

To keep the pivot in place while working with components When you transform components, Maya creates a temporary pivot at the center

of the selected components. Because the pivot is always at the center of the selection, selecting or deselecting additional components moves the pivot. You can lock the pivot in place so it won't move as components are added to or removed from the selection.

Press the Insert key to show the pivot point manipulator.

Move the pivot point.

Click the circle at the top of the pivot point manipulator to lock or unlock the pivot point for component transformations. When the circle is filled, the pivot is locked.

2.11 NURBS & Polygon Objects Component and SubDiv Components

Components of NURBS Objects:

1. Isoparms: Isoparms are the lines that symbolize cross section in U and V directions. It can be inserted, removed, used to make curves and snapped to.
2. Control Vertex: A point that does not exist on the surface but used to controls the shape of a NURBS curve or surface.
3. Hull: A line that connects CVs. Hull is useful to show the CVs in a crowded scene and also to select an entire row of CVs at once.
4. Surface Patch: A rectangular portion of a surface bounded by adjacent edit point isoparametric curves

Components of Polygon Objects

1. Edge: A straight line between the two ordered vertices. Press F10 for edge selection mode.
2. Vertex: A corner shared by two or more polygonal faces. Three or more connected vertices make a face. Press F9 for vertex selection mode.
3. Face: Three or more connected edges made face. A face with three sides is a triangle, with four sides is a quad, and with more than four sides is a n-gon.
Press F11 for face selection mode.
4. UV: Coordinate systems for 2D surfaces required to display or render a texture on a mesh. Press F12 for UV selection mode.

2.12 Moving, rotating, and scaling objects

To Move

Select the Move Tool or press `w`. Use the position manipulator to change the position of the selected objects.

To Rotate

Select the Rotate Tool or press `e`. Use the rotation manipulator to rotate the selected objects. The selection rotates around the pivot of the key object.

To Scale

Select the Scale Tool or press `r`. Use the scale manipulator to scale of the selected objects. The selection scales from the pivot of the key object.

To Move, Rotate and Scale

Select the object and then select Universal Manipulator tool or press `ctrl + t` which combines the function of Move tool, Rotate tool and Scale tool.

2.13 The Tool Box : Select, Move, Rotate and Scale

Transformation tools

The upper half of the Tool Box contains the tools for transforming objects (selection, move, rotate, scale) within Maya. When you move your mouse cursor over any transformation tool icon you see the name of the tool appear next to the mouse cursor.

The tool's name also appears in the Help Line at the bottom of the Maya window. The Help Line has an additional purpose: it displays summary instructions as you use tools that require several steps.

2.14 The Pivot Point

The pivot point

Pivot points control how objects rotate and scale, and also represent the exact locations of objects in space. All transformations to an object are relative to the pivot point.

You can change the pivot point of an object or the selected components by pressing `Insert` or `Home` and using the pivot point manipulator.

2.15 Duplication options

Duplicate creates a copy of the selected object in your scene.

Duplicate Special: Duplicate Special creates one or more copies of the selected object in your scene optionally with transformations applied to each duplicate it creates.

The options available with Duplicate Special command are:

1. Geometry type : It provides you with two options: a. Copy: Makes a copy of the duplicated object

b. Instance: Instanced objects are light weight reference of the original object. Instanced objects are connected to the original object that means if you make any change to the original object, duplicate copy also changes.

2. Group Under: Group under lets you group the duplicated object under

one of these:

a. Parent

b. World

c. New Group

3. Smart Transform: If on, Smart transform applies the same transformation, which you apply to the duplicate object without changing the selection to the subsequent duplicates of the selected duplicate.

4. Move, Scale And Rotate: Defines the offset, angle or size variation for the duplicated copy or instance.

5. Number of copies: You can specify the number of copies to create with each duplicate special command. Minimum is 1(default) and maximum is 1000.

6. Duplicate Input Graph: Turn this option on to force the duplication of all nodes whose connections are leading up to the selected object.

2.16 The Channel Box

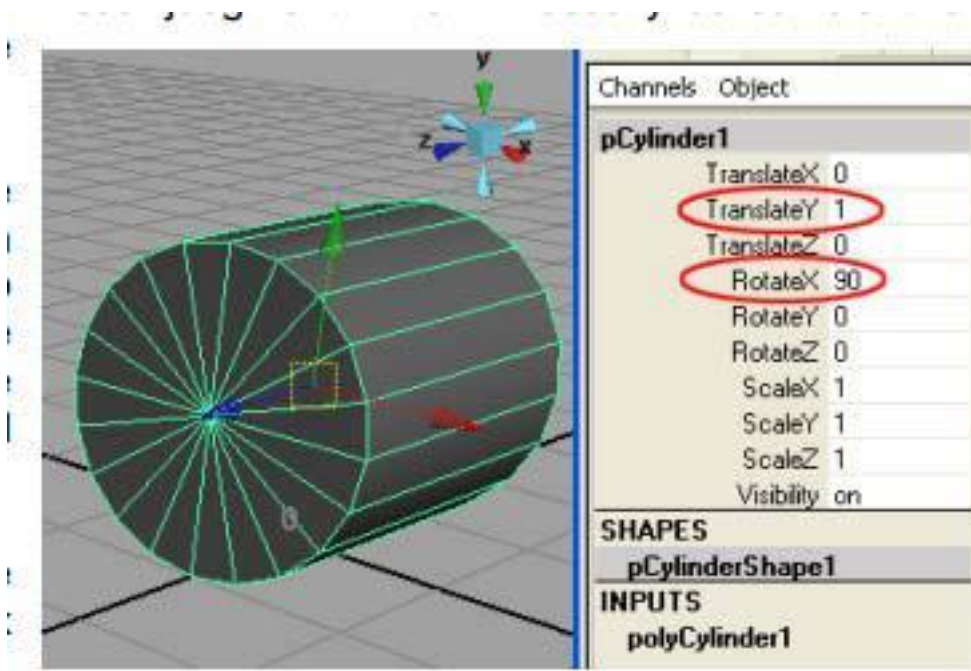
The Channel Box is an editing panel that provides you access to an object's transformation information and much more. It provides information on three distinct areas for any type of object: The transform node, shape node, and input node.

Nodes are where information about object types is kept track of within Maya. Nodes are comprised of attributes. Attributes refer to information related to what the node is designed to accomplish. In this case, information about the primitive cylinder's Y axis rotation is referred to as the Rotate Y attribute. When you moved and rotated the cylinder primitive using the Move Tool, you

were doing this by your own visual judgment. This will usually be sufficient for many of your creative applications.

If you need to control the attribute of an object with more accuracy you can do this by entering the precise values into the appropriate attribute field of the Channel Box.

To move and rotate the base using the Channel Box With the cylinder selected, view the Transformation attributes in the Channel Box. Specifically, view the values for Translate Y, and Rotate X.



In the Channel Box, adjust the attribute values so they match the above image by clicking in the field and entering the correct numerical values.

This accurately positions the cylinder in your Maya scene. Maya named the cylinder primitive when it was first created. Rename the cylinder to something more meaningful to your project. To rename the cylinder primitive using the Channel Box

Naming Objects: In the Channel Box, click in the field with the name pCylinder1. Rename the primitive object by typing a new name Wood as shown in the right side figure and then press Enter.

2.17 Explain Construction history

In Maya most of your actions creates nodes in the construction history of the objects you work on. At each point in your work, the current scene is the result of all the nodes you've created so far. For example if you create a curve-edged shape of bottle and apply revolve to the curve a new revolve node is created. The new node has the shape of the curve as an input. It has attributes that control how it creates the surface from the curve. And it has the resulting surface as its output.

This chain of nodes, from the curve to the revolve node to the surface, is called the surface's construction history. The most important thing about construction history is that you can change it. You can reshape the curve, or change the attributes on the revolve node, and the resulting surface updates automatically.

2.18 Edit > Delete by Type > History

Removes construction history from the selection, “baking” it in its current state.

2.19 Selecting objects

Select the objects by clicking them directly, or by dragging a rectangular bounding box or a boundary around some portion of the object to indicate what you want selected.

When you select the multiple objects, the last selected object is drawn in a different color from other selected objects. This is known as the key object. When you transform the multiple objects, the transformation uses the key object’s pivot point.

2.20 Selection modes and masks

Select the objects by clicking them directly, or by dragging a rectangular bounding box or a boundary around some portion of the object to indicate what you want selected.

When you select the multiple objects, the last selected object is drawn in a different color from other selected objects. This is known as the key object. When you transform the multiple objects, the transformation uses the key object’s pivot point.

2.21 Using quick select sets

Using Quick Select Sets

Quick select sets are useful to quickly select commonly used sets of objects/components and by saving a complex selection, you can

re-use it later without having to reselect each object. Select the objects or components, from Create > Sets > Quick Select Set. Type

a name for the set.

2.22 Hiding and templating

Hiding the Objects

To hide the selected objects, Select Display > Hide > Hide Selection. To Redisplay the last objects you hide, Select Display > Show > Show Last Hidden.

Select Display > Show > All to show all hidden objects.

To change the display of all panels, use the items in the Display > Hide and

Display > Show submenus.

To change the display of one panel, use the items in the panel's Show menu.

To show a specific hidden object, select the object's node in one of the editors and select Display > Show > Show Selection .

Select the object's node from Outliner or Hypergraph, to select a hidden object. Select Display > Object Display > No Geometry , to hide the actual geometry of an object while leaving other components visible.

Select Display > Object Display > Bounding Box to show only an object's bounding box.

Templating the Objects

Template is the action of making an object unselectable. The object is still visible, but changes to a gray color to indicate that it cannot be selected or changed. In other software packages it is known as freeze or ghost. It is very much useful, when you have a large scene with lots of objects, templating the display of some of the objects in your scene allows you to more easily select only the objects you want.

Select the objects you want to template and select Display > Object Display > Template.

To make a template object selectable again, from Hypergraph or Outliner select the templated node and then, from the main Maya window, select Display > Object Display > Untemplate.

To select the templated object, from Hyper graph or Outliner select the templated node OR click "Select by hierarchy and combinations" icon in the Status Line (toolbar) and set the selection mask to Template.

2.23 Layers – The Layer Panel

Layer editor is window that helps you organize large-scale pieces of the scene so you can show, hide, or edit them all at once. It is generally located below the channel box.

The Render Layer editor is available from Window > Rendering Editors > Render Layer Editor , and the Display Layer editor is available from Window > General Editors > Display Layer Layers menu

Create Empty Layer: Creates a new display layer, depending on the selection in the drop-down list, with a default name, for example layer1.

Select Objects in Selected Layers: Selects the objects contained in the selected layer(s).

Remove Selected Objects from Selected Layers : Removes all objects from the selected layer(s) and assigns them to the default layer. The selected layer(s) becomes empty so you can assign other objects.

Membership : Opens the Relationship Editor for removing or adding objects to layers.

Attributes : Opens the Attribute Editor for the selected layer(s).

There are some attributes in the Attribute Editor not available through the Edit Layer window.

Delete Selected Layers : Deletes the selected layer(s), but not the objects in the layer.

Delete Unused Layers: Delete layers if they have no content.

Set All Layers\Set Selected Layer s\Set Only Selected Layers

You can set all layers or selected layer characteristics. When you set selected layer characteristics, you can specify whether unselected layers will be affected or not.

You can set the following characteristics:

- Visible/Invisible
- Normal/Template/Reference
- Full Detail/Bounding Box
- Shaded/Unshaded
- Textured/Untextured
- Playback On/Playback Off

The above layer settings menu items are also available when you right-click a Display layer.

Sort Layers Alphabetically: Sorts layers by name.

Sort Layers Chronologically: Sorts layers by time of creation.

2.24 Summary

In this chapter we complete the Navigation and Primitive , Transforming.

2.25 Self Assessment test

Broad Questions –

- 1 What are Transformation and explain it?
- 2 Explain Polygon primitive?

Short notes


1. Channel box
2. Pivot point
3. Layers


4. Nurbs primitive
5. Constructions history

2.26 Further Reading

1. Introducing Autodesk Maya 2013 **Dariusz Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training
...Autodesk Maya Press, **Marc-André Guindon**

UNIT 3 GROUPING, NURBS MODELING

 Learning Outcome	
<p>After going through this unit, you will learn:</p> <ul style="list-style-type: none">• Nurbs Modeling• Grouping & Parenting• Align and Snapping Object• Advantages of Digital Audio• Curve	

 Time Required to Complete the unit	
<p>The time required to study thus Unit is broken as follows</p> <ol style="list-style-type: none">1. 1st Reading: It will need 2 Hrs for reading a unit2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit3. Self Assessment: It will need 3 Hrs for reading and understanding a unit4. Revision and Further Reading: It is continuous process	

 Content Map	
<p>3.1. Parenting</p> <p>3.2. Grouping vs. Parenting</p> <p>3.3. Edit</p> <p>3.4. Aligning and snapping objects</p>	

3.5. Modify

3.6. Nurbs modeling

3.7. Creating NURBS Curves

Create

Edit Curves

3.8. Summary

3.9. Self Assessment test

3.10. Further Reading

3.1 PARENTING

Parenting is the term used when placing a node beneath another in a hierarchy so it becomes the child of the node above it (its parent) in the hierarchy.

3.2 Grouping vs. Parenting

When you need to move, scale or rotate multiple objects as one unit it is easier if they have been grouped together so that they transform as one unit.

Many primitive objects in Maya are grouped objects. For example, the NURBS cube primitive is comprised of 6 flat squares or *planes* that have been grouped together as one unit. When the plane objects are grouped together they create a *hierarchy*.

A hierarchy is a collection of nodes or objects that are connected together to form a unit for some purpose. Hierarchies are useful for describing how the objects within them share similar characteristics or *attributes*; move, scale, rotate for example.

By parenting the objects, you can move, rotate, or scale the cap and the body as a single entity by selecting only the body.

3.3 EDIT

Edit Commands

Click the Edit Commands tab to view and edit the MEL code associated with a tool or action.

3.4 Aligning and Snapping Objects

Align Objects: Align objects Aligns two or more object in 3D space. You can specify Align Mode, Align Ax is in the option window.

Align Tool: Align tool lets you align two or more object. The selected Objects align to the last selected object (Highlighted as green). To align the objects, Select Modify > Align Tool then select all the objects you want to align and in the end Shift-Select the object with respect to which you want to align other objects. Click on the icons provided by the Align Tool to align the objects.

Select Align tool and then select all the object and in the last select the object to which you want objects to align. Click the icon to align the objects. The icons show the bounding boxes of the objects will align.



Snap Together Tool: Snap together tool allows you to visually pick the points on two objects to snap together. Click a point on one object, then click a point on the second object. You can drag the selected points to edit them. Then press Enter to snap the points together.

3.5 MODIFY

Modify >

Snap Align Objects >

Point to Point: This tool allows you to align two objects at a point. The point can be a vertex, CV, Edit point etc. You have to select one point on each surface in order to use this command.

2 Points to 2 Points: This tool allows you to align two objects at two points. The point can be a vertex, CV, Edit point etc. You have to select two points on each surface in order to use this command.

3 Points to 3 Points : This tool allows you to align two objects at three points. You have to select three points on each surface in order to use this command.

3.6 Nurbs Modeling

The NURBS toolset is Maya's oldest and is an industry staple in building models for high-end film productions and industrial

design. While NURBS are very technical in nature, taking the time to understand how they work is worthwhile because you

can benefit by using them in certain modeling scenarios.

Non-Uniform Rational B-Splines is a mathematical term that sounds complicated. To understand NURBS, you should know

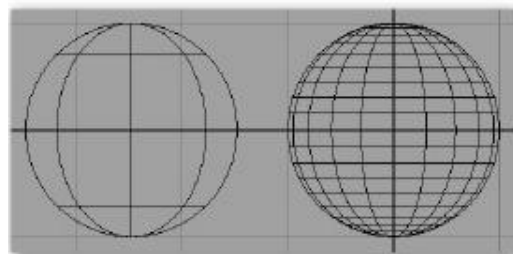
that a NURBS object is a mathematical description of a curve or surface. Any point on a NURBS curve or surface has an exact

coordinate value, in contrast to a polygonal surface, where only the locations of the vertices can be returned.

When comparing NURBS to polygons, a good analogy to consider is the difference between vector-based graphics used in Adobe Illustrator and Flash and pixel-based images used in Adobe Photoshop and many digital video and photography applications. Because vector lines are drawn on your screen based on a mathematical description, they always remain smooth, no matter how close you zoom in on them or how big the window is in which they are played back. Pixel based images, on the other hand, are made up of finite rectangles, and called pixels. While these may not be visible when you're viewing an image at its normal resolution, the image starts to break up as you zoom in and see that the image is made up of thousands, or even millions, of rectangular pixels.

Since a NURBS surface is mathematically described, it can be rendered to appear infinitely smooth, no matter how close up the camera gets. Figure given below shows a NURBS sphere (left) and a polygonal sphere (right). Look at the edges of the spheres and notice that the polygonal sphere is made up of segments and is not smooth like the NURBS sphere.

Fig: close up of NURBS sphere VS Polygonal sphere



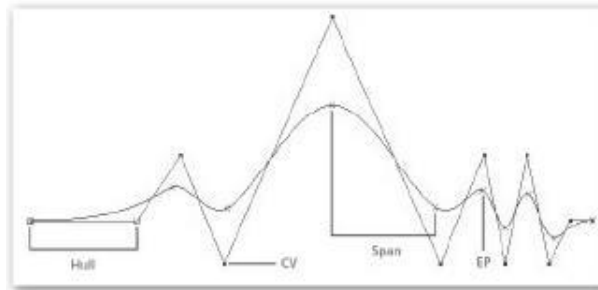
3.7 Creating Nurbs Curves

Anatomy of NURBS Curves and Surfaces Both NURBS curves and surfaces have similar components that control how they are edited. Understanding how these components relate to each other and how they are used to calculate curves and surfaces will provide you with a good foundation for transforming your simple surfaces into more complex shapes while maintaining a clean geometry that is easy to edit.

We'll first examine curves, since they have similar, but fewer, components than surfaces. You'll then learn how these components relate to surfaces and how some other components are unique to surfaces.

Components of a NURBS Curve

Figure shows a NURBS curve displaying its components, described next: Fig: Anatomy of NURBS Curve



Edit points (EPs) when a curve is drawn in Maya; the software joins together polynomial curve segments, called spans. The points where these segments join are called edit points (sometimes called knots). An edit point lies on a curve and is represented by a small × that you can select and move to edit the shape of the curve. Edit points can be added to a curve by using the Insert Knot command (Edit Curves

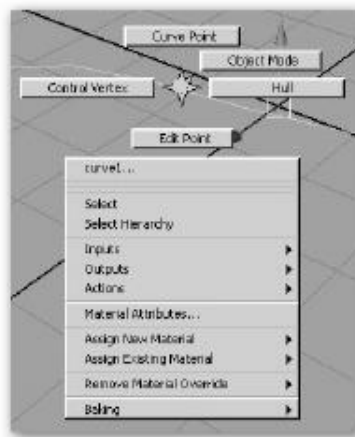
| Insert Knot).

Control vertices (CVs) CVs control how the curve is “pulled” or “weighted” between edit points. CVs basically define the shape of a curve or surface. The number of CVs between edit points depends on the degree of the curve. (See “Surface or Curve Degree” later in this chapter.) CVs often lie above or below a curve, in space, and are the components most commonly edited to control the shape of the curve. CVs cannot be inserted directly into the curve but rather are added when an edit point is inserted.

Curve points One of the many great aspects of NURBS technology is that, because curves are mathematically calculated, any curve point along a curve can be chosen and adjusted. Once a curve point is selected, knots can be inserted or the curve can be detached

(Edit Curves | Detach Curve).The shape of the curve can be edited from any curve point by using the Curve Editing Tool (Edit Curve | Curve Editing Tool).

Hulls Hulls are straight lines that connect the CVs together. Choosing a hull selects all of the CVs in a curve. You can display and edit curve components by using the right-click marking menu, shown in Figure as per below, which displays the available components for a NURBS curve.



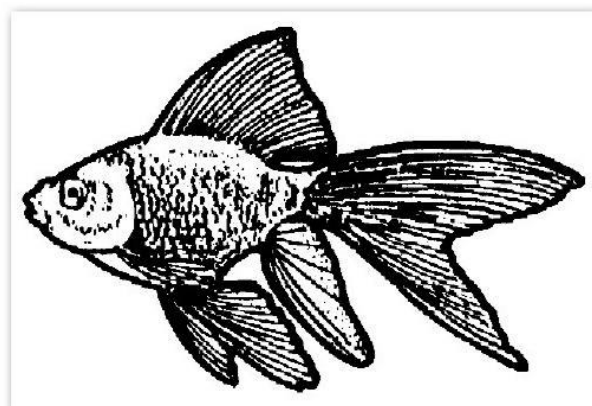
If you want to view a component but not select it, you can display it by choosing an option from the Display menu. For example, to see the hulls of your object, select the object and then choose Display | NURBS | Hulls. The hulls will be displayed for that object.

NURBS MODELING TECHNIQUE

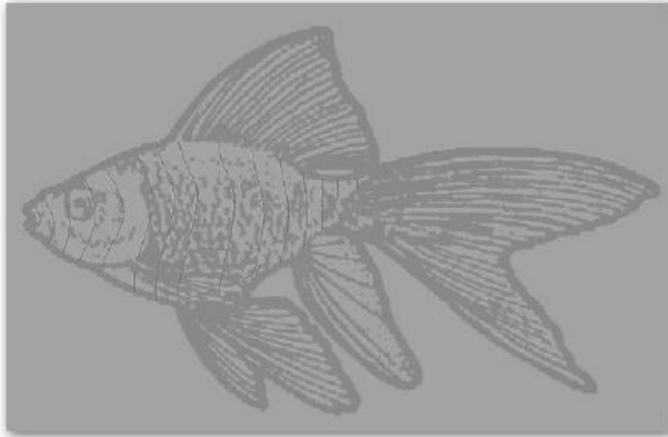
Nurbs Modeling Techniques

Fish Model

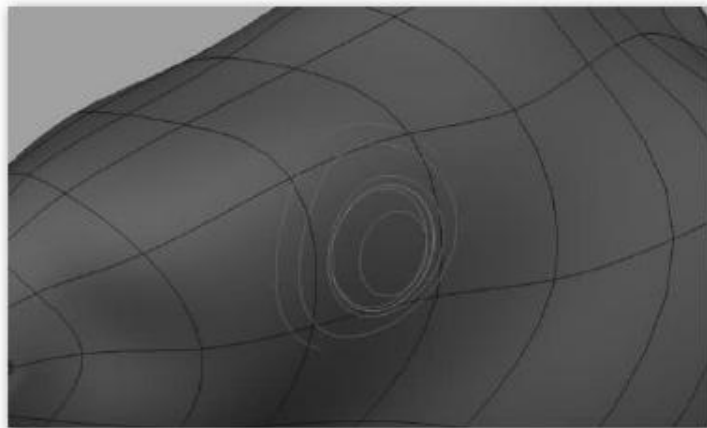
First of all you have to find some reference images through internet

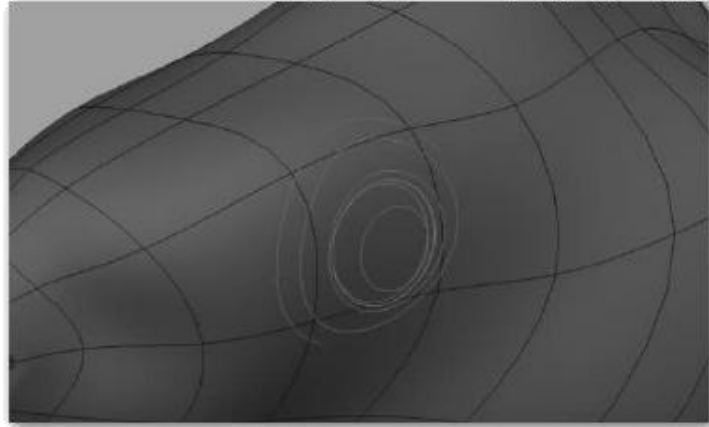


In Side-View create several Nurbs-Curves; get the shape as good as possible...just scale the curves .Then create the loft, now you have to tweak some CV's to create the belly, and some other details.

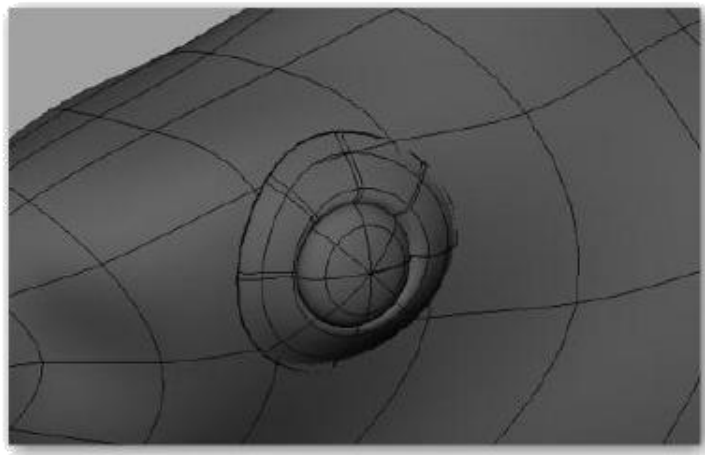


Now project a Nurbs-Circle onto the Main Body, duplicate it several times to get the rough shape of the eye

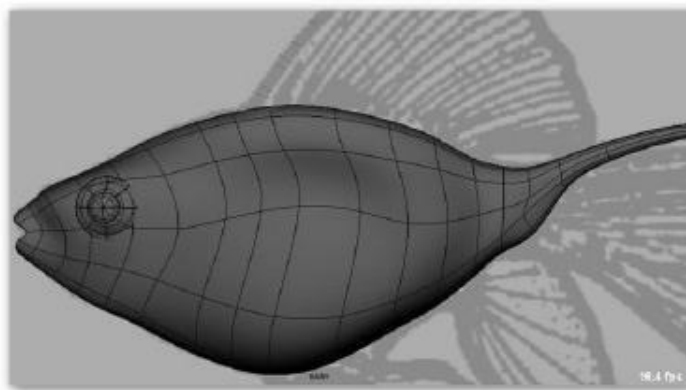




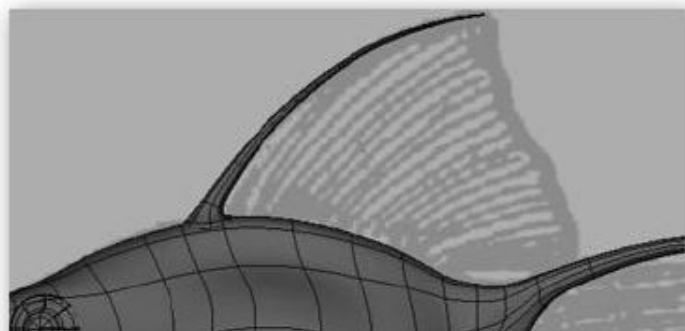
And loft again. We have also created a half-Sphere in the middle...that's the eyeball



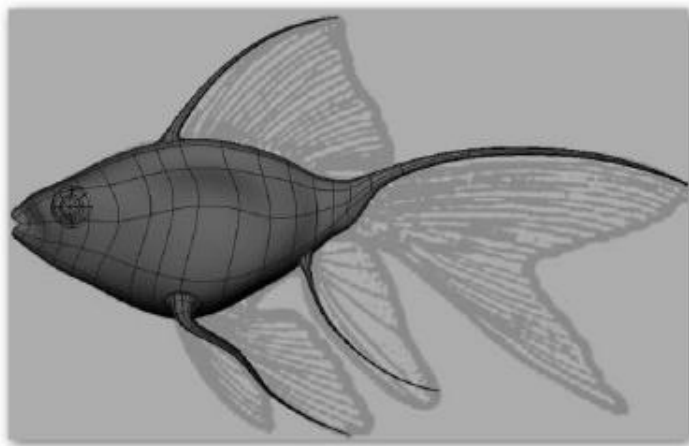
The same technique, we've used for the body, we'll now use for the back fins, just create a small Nurbs-Circle, duplicate it, copy, move...just take a look at the image, and see,



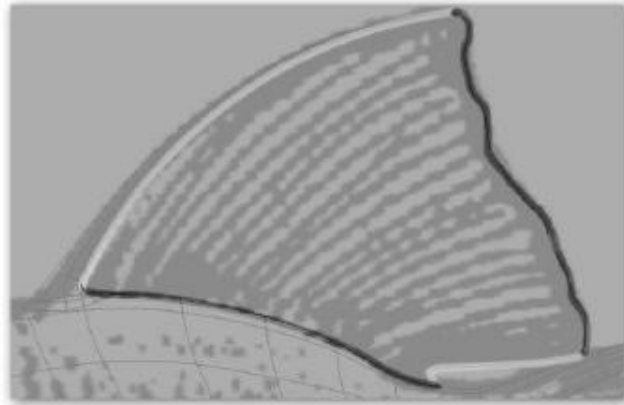
Loft again you need to tweak some of the circles, created before. But thanks to construction-History that should be no problem



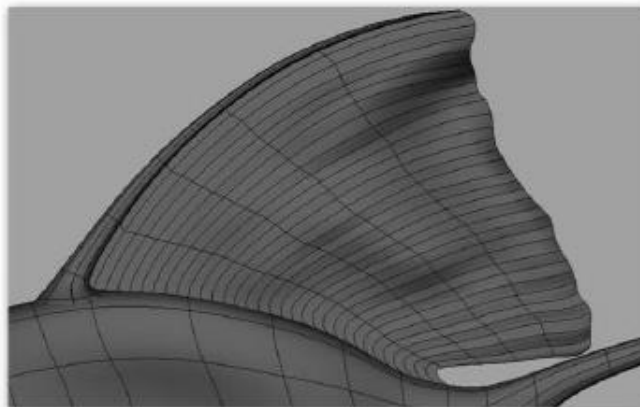
Perform this for the rest of the fins...all of them were attached to the main-body using fillets of all kinds



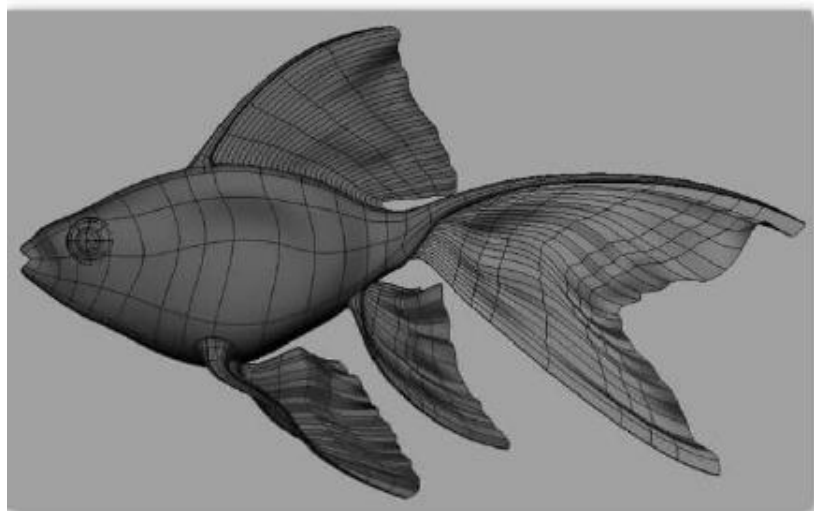
To create the things between, just duplicate some of the rear-fin curves, and in side-view draw the outline-curve. Take care, that all the curves touch each other. Use the snap to point Shortcut to do this. I've colored the curves you need to perform a Birail 2 surface



Use the Birail2-Tool to create the "skin". Afterwards tweak some CV's to get the "fluffy" shape...with every tool you like



Use these techniques to create the missing ones....and you're finished



3.8 Summary

In this chapter, you learned some of the basic principals behind NURBS modeling. We have covered curve creation and editing as well as some of the more common surface-generating commands available in Maya.

3.9 Self Assessment test

Broad Question

1. What NURBS CURVE?
2. What is Hull ?

Short Notes

- 1) Align
- 2) Grouping
- 3) Edit Curve
- 4) Snapping
- 5) Curve Point

3.10 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training
...Autodesk Maya Press, **Marc-André Guindon**

BCA (DES)304- 3rd YEAR

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**Dr. Babasaheb Ambedkar
Open University**

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The content is developed by taking reference of online and print

Publications that are mentioned in Bibliography. The content developed represents the breadth of research excellence in this multidisciplinary academic field. Some of the information, illustrations and examples are taken “as is” and as available in the references mentioned in Bibliography for academic purpose and better understanding by learner.’



ROLE OF SELF INSTRUCTIONAL MATERIAL IN DISTANCE LEARNING

The need to plan effective instruction is imperative for a

Successful distance teaching repertoire. This is due to the fact that the instructional designer, the tutor, the author (s) and the student are often separated by distance and may never meet in person. This is an increasingly common scenario in distance education instruction. As much as possible, teaching by distance should stimulate the student's intellectual

Involvement and contain all the necessary learning instructional activities that are capable of guiding the student through the course objectives. Therefore, the course / self-instructional material are completely equipped with everything that the syllabus prescribes.

To ensure effective instruction, a number of instructional design ideas are used and these help students to acquire knowledge, intellectual skills, motor skills and necessary attitudinal changes. In this respect,

Students' assessment and course evaluation are incorporated in the text.

The nature of instructional activities used in distance education self- instructional materials depends on the domain of learning that they reinforce in the text, that is, the cognitive, psychomotor and affective. These are further interpreted in the acquisition of knowledge, intellectual skills and motor skills. Students may be encouraged to gain, apply and communicate (orally or in writing) the knowledge acquired. Intellectual- skills objectives may be met by designing instructions that make

use of students' prior knowledge and experiences in the discourse as the foundation on which newly acquired knowledge is built.

The provision of exercises in the form of assignments, projects and tutorial feedback is necessary. Instructional activities that teach motor skills need to be graphically demonstrated and the correct practices provided during tutorials. Instructional activities for inculcating change in attitude and behavior should create interest and demonstrate need and benefits gained by adopting the required change. Information on the adoption and procedures for practice of new attitudes may then be introduced.

Teaching and learning at a distance eliminates interactive

Communication clues, such as pauses, intonation and gestures, associated with the face-to-face method of teaching. This is particularly so with the exclusive use of print media. Instructional activities built into the instructional repertoire provide this missing interaction between the student and the teacher. Therefore, the use of instructional activities to affect better distance teaching is not optional, but mandatory.

Our team of successful writers and authors has tried to reduce This. Divide and to bring this Self Instructional Material as the best teaching and communication tool. Instructional activities are varied in order to assess the different facets of the domains of learning.

Distance education teaching repertoire involves extensive use of self- instructional materials, be they print or otherwise. These materials are designed to achieve certain pre-determined learning outcomes, namely goals and objectives that are contained in an instructional plan. Since the teaching process is affected over a distance, there is need to ensure that students actively participate in their learning by performing specific tasks that help them to understand the relevant concepts.

Therefore, a set of exercises is built into the teaching repertoire in order to link what students and tutors do in the framework of the course outline.

These could be in the form of students' assignments, a research project or a science practical exercise. Examples of instructional activities in distance education are too numerous to list. Instructional activities, when used in this context, help to motivate students, guide and measure students' performance (continuous assessment)



PREFACE

We have put in lots of hard work to make this book as user-friendly as possible, but we have not sacrificed quality. Experts were involved in preparing the materials. However, concepts are explained in easy language for you. We have included many tables and examples for easy understanding.

We sincerely hope this book will help you in every way you
Expect.

All the best for your studies from our team!

All the best for your studies from our team!

UNIT 4 NURBS SURFACES, POLYGON MODELING



Learning Outcome

After going through this unit, you will learn:

- Nurbs Surface
- Polygon Modeling



Time Required to Complete the unit

The time required to study this Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

4.1 Surfaces

4.2 TEXT

4.3 Edit NURBS

4.4 Polygon modeling

4.5 Explain Polygons and its Components.

Modeling Polygons

Edit Mesh

Mesh

4.6 Proxy

4.7 Summary

4.8 Assessment

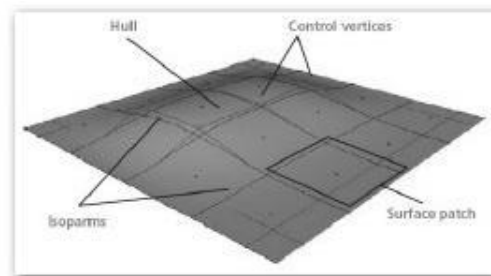
4.9 Further Reading

4.1 Surface

NURBS Surface

NURBS surfaces contain some of the same components as NURBS curves. Both CVs and hulls perform the same functions that they do for curves and can be chosen and edited in the same way. However, surfaces also have some unique components, as shown in Figure below. These unique components are discussed next.

Fig: Components of NURBS Surface



1. Isoparms Isoparms lie on the NURBS surface and extend across the entire surface at a constant parametric value. Just as edit points represent the ends of curve spans, isoparms represent the boundaries between surface patches—the regions on a surface enclosed by isoparms. Isoparms can be selected and added to a surface, but unlike their curve counterparts, they cannot be edited directly.

2. Surface point A surface point is any point or parameter on a surface. This is similar to a curve point.

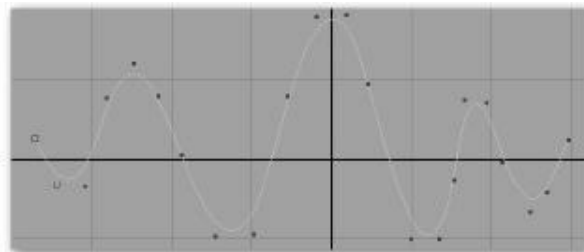
3. Surface patch A surface patch is the region between the enclosed isoparms.

Surface or Curve Degree

The degree of a surface or a curve refers to the exponent used in the underlying polynomial equation that defines the geometry. What this means to the Maya user is that degree equates to the number of control vertices that are needed to define one span of a NURBS curve or surface. The number of control vertices needed to define one span will always equal the degree of the curve + 1. Therefore, a one-degree (linear) curve has two control vertices—one at the beginning and one at the end. A one-degree curve is always a straight line. Maya allows NURBS objects to have one, two, three, five, or seven degrees of curvature. In Maya, a degree of three is the default and is most often used.

Curve Direction

The direction of a curve is initially determined by the order in which you draw it, which is called the curve's U direction—the first point at which you draw is considered the beginning of the curve and the last point is the end point. If you don't know which direction an existing curve is going, you can select it and display the components by pressing F8 (or you can enable the Select by Component Type button on the status line) and making sure the Points Selection Mask is activated on the status line. Or you can right-click the object and choose Control Vertex. The beginning of the curve will be marked with a small box, and the second CV will be marked with a U to communicate that the curve is moving in the U direction. This is illustrated in Figure as per below.



Parameterization of Curves and Surfaces

Parameterization describes how the numeric values are assigned to each point on a NURBS surface or curve. Each of these points has a numerical value known as a parameter that describes the point's location. On a curve, this parameter gives a point's location in the curve's U direction. A surface has two parameters, one in U and the other in V. Any point on a surface can be queried or described using this coordinate system.

Methods of Parameterization

The parameterization, or how a parameter value is calculated across the curve, is determined by one of two methods: the uniform method or the chord-length method, both shown in Figure as per below.

When drawing a curve, the method of parameterization can be set in Knot Spacing attributes of the CV (or EP) Curve tool's settings window (choose Create | CV Curve Tool).

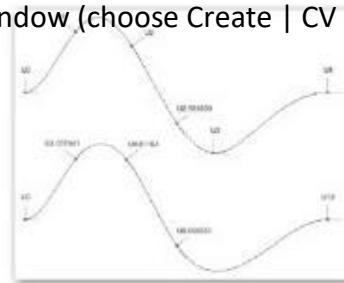
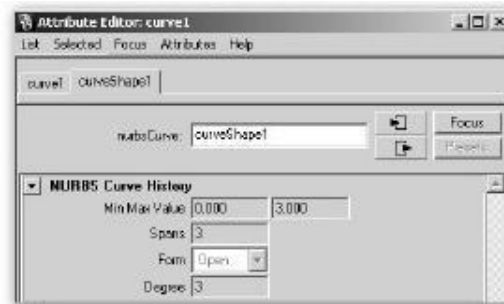


Fig: Two and Four Span Curve uses Uniform parameterization and Bottom curve is uses Chord length parameterization

With uniform parameterization, integral parameter values are assigned at each edit point. To demonstrate, let's consider a curve with four spans, in which the edit points are not evenly spaced. In the uniform parameterized curve. Using uniform parameterization, you can match parameterization between two curves just by figuring the total number of spans. However, determining parameters based on the length of the curves is not so straightforward Using chord-length parameterization, the parameter values are assigned to the edit points based on the distance of a straight line, expressed in Maya units, extended between the edit points. While this method gives the curves irregular parameter values at their edit points, the values do reflect information that is relative to a point's position along the curve.

Parameter Range

A uniformly parameterized curve of surface always has a value of 0 at the first edit point. Exactly how the rest of the parameters are divided up over the length of the surface depends on the Parameter Range. Draw a three-span curve. In the Attribute Editor, look at the Min Max Value attributes. You should see that the Min value is set to 0 and the Max value is set to 3, as shown fig below. When the values are assigned this way, you can deduce that the parameter range is set from 0 to the number of spans.



You can choose to set the parameter range to 0 to 1 as well. This has no effect on any modeling operations. This is available for many reasons. One reason is that texture coordinates are laid out on a grid that has a range from 0 to 1. Some workflows or rendering engines may only be able to properly apply textures to a surface that has a parameter range from 0 to 1. Another use for setting the parameter range from 0 to 1 is for use with particle effects. Many times a NURBS surface is used to guide particles. When the effects artist wants to run particles along a surface, from one end to the other, they would probably rather not deal with keeping track of how many spans the surfaces has. Instead, the surface's parameter range can be reset to 0 to 1 using the Rebuild Surface command (Edit NURBS | Rebuild Surface).

Maintaining Parameterization While Modeling

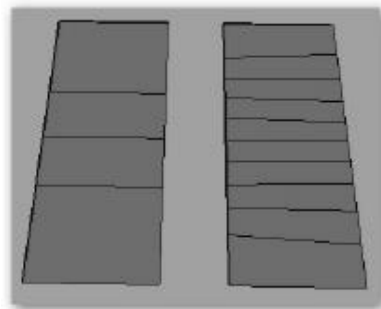
Much of the NURBS modeling process involves the constant rebuilding of curves and surfaces so that they maintain normal parameterization and have a matching number of spans for creating clean, orderly surfaces. To generate the cleanest surface, the parameters of the source curves must match.

Figure below, shows two surfaces that were generated by lofting two curves together. The curves used to generate the surface on the left were created with the same number of spans (four) and, as a result, they had matching parameterization. The structure of the lofted surface is clean and predictable. You can tell this by looking at the even flow of isoparms that were created by connecting the edit points

on the original curves. As a modeler, you can predict exactly where these isoparms are going to intersect each curve. Just because two pieces of geometry have the same number of spans does not

necessarily guarantee that they have matching parameterization. This mainly becomes an issue when an operation is applied to a surface. Whenever a surface is attached or detached or an isoparms is inserted, the parameterization of the geometry is affected. When this occurs, the surfaces must be rebuilt immediately in order to reparameterize that value across the geometry.

Fig: The surface on the left was generated from two curves that had the same number of spans. The surface on the right was generated by two curves that had a different number of spans.



Advantages and Disadvantages of NURBS Modeling

NURBS modeling works well for building any smooth, curving surface—such as the body of a car or a human body. Because of its ability to represent complex shapes, NURBS is the preferred toolset used among most industrial designers. In fact, chances are that the chassis of your computer and monitor were designed using NURBS modeling. However, the biggest drawback to using NURBS has to do with the fact that to build a complex object, you must

create and link together multiple individual surfaces. Working with multiple surfaces can mean more time spent having to texture each surface individually and manage the seams between surfaces so that they match at render time.

Advantages of NURBS

Following is a discussion of some of the benefits of NURBS modeling.

Few Control Points Using NURBS, you can create and edit smooth curving objects with few control points. This results in less data needed to calculate these surfaces, which translates into smaller file sizes and more efficient use of your computer's RAM. In a network environment, smaller files transfer faster and do not clog the pipeline. This was a big factor back in the early years of 3D animation pipelines, when cost of RAM was at a premium. Nowadays, this aspect of NURBS is taken for granted, but is still important to consider.

Resolution Independence

The mathematical nature of NURBS surfaces enables smooth surfaces to remain smooth no matter how close the camera zooms in. However, when a NURBS surface is rendered, it is tessellated, which means that it is converted into polygonal faces, based on the user-defined tessellation attributes of the NURBS object. This means that while the object is being cut up into triangles, the user still has the power to assign how smooth or coarse the object will render. Having this kind of control can really help optimize a scene's rendering time. If the object is far away from the camera, it can be rendered with a low tessellation setting. The same piece of geometry can also be used in a close-up shot by increasing the tessellation setting. With a polygonal object, however, two separate models would have to be built to optimize the overall polygon count of the scene: one low-resolution model for when the object is in the background, and a high-resolution model that will work for close-up shots.

Definition: tessellation the process of creating a faceted surface. When a NURBS surface is tessellated, it is converted into polygonal faces that define the original shape.

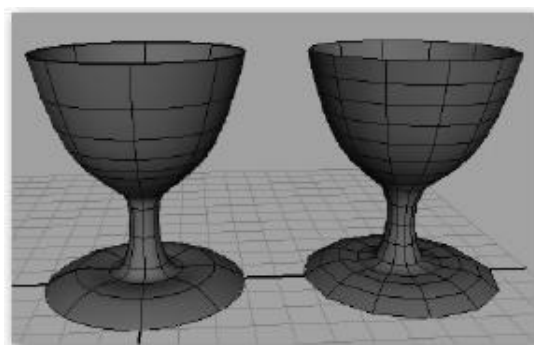
Texture Coordinates By its rectangular nature, any point on a NURBS surface can be defined by a coordinate in the U and V directions. Texture maps, such as bitmapped files that you might create in an image editing application like Photoshop, are also rectangular in nature, and their pixels are defined by coordinates in the X and Y directions. Because of this congruent relationship,

is able to fit a texture map to a surface by matching these corresponding coordinate systems, allowing the texture to fit exactly on a surface and match its curvature, no matter how many twists or turns the surface makes. With a polygon model, an entire process of laying out the UVs is necessary before any texturing can be done on an object.

Conversion-Ability Maya allows you to convert any geometry type to another by using the Convert command. Converting a NURBS model to polygons can produce the cleanest geometry, and it requires the least amount of cleanup due to the inherent orderliness and square-patch nature of NURBS. A conversion from NURBS to a polygon is illustrated in Figure as per below. Notice that each square surface patch on the NURBS object is converted to a square polygonal face on the polygonal object. It is even possible to specify how many polygonal faces should be created for every one surface patch on the NURBS surface so that the resulting polygonal object will appear smooth. Many modelers prefer to build the initial surfaces with NURBS and then convert them to polygons or subdivision surfaces to

add more rigid detail.

Fig: A NURBS surface converted to Polygonal



Disadvantages of NURBS

While you can easily model just about anything using NURBS, most of the disadvantages with NURBS stem from the fact that more complex NURBS models are often made from multiple individual surfaces. As a result, you have to deal with the problems described next.

Seams Probably the biggest problem with models built from NURBS has to do with the seams that can show between surfaces. When using trimmed surfaces. The solution is to try to match the tessellation between adjacent surfaces manually. However, this usually results in heavy tessellation, which means a lot of polygons and hence longer render times.

Branching In modeling, branching refers to the parts of models that extend, or branch off, from the main surface or a group of surfaces. In these cases, the grid like structure of the topology is broken and the five-point junctions that we saw in Chapter 4 are introduced. Since a NURBS surface can only contain a quad layout, the NURBS surface must be broken up into individual pieces and arranged to handle the change in the structure.

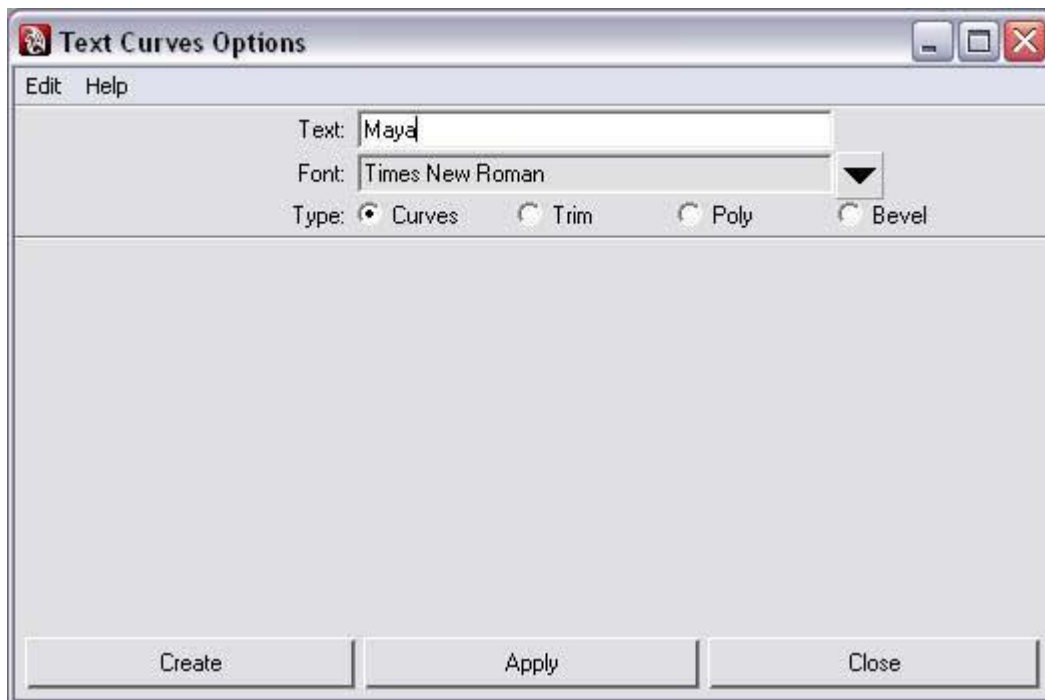
Texture Mapping Across Multiple Surfaces When you're creating very detailed models using NURBS, you will often end up with multiple surfaces. While this is not necessarily a bad thing, it can make managing the scene a lot more difficult, especially when it comes to having to apply texture maps across these mismatched surfaces. And, while we mentioned having texture coordinates inherent to the model as an advantage of NURBS, it also has limitations, because the UVs cannot be edited separately from the mesh.

4.2 TEXT

Set the menu set to polygons.



Step one - To create the text, go to create>text... Click on the box to open the options.



Step two - First enter the text in the text field.

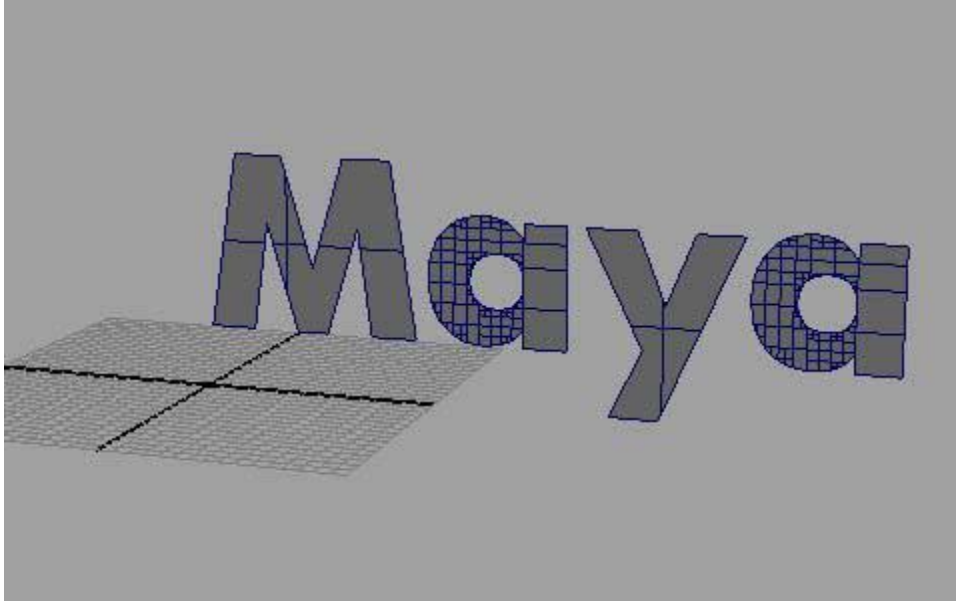
Step three - To change the font, click on the arrow next to font and click "select...".

Step four - Type: this is the type of geometry you'll be outputting. Trim will output a NURB surface, Poly will output polygons, and Curves output NURBS curves.

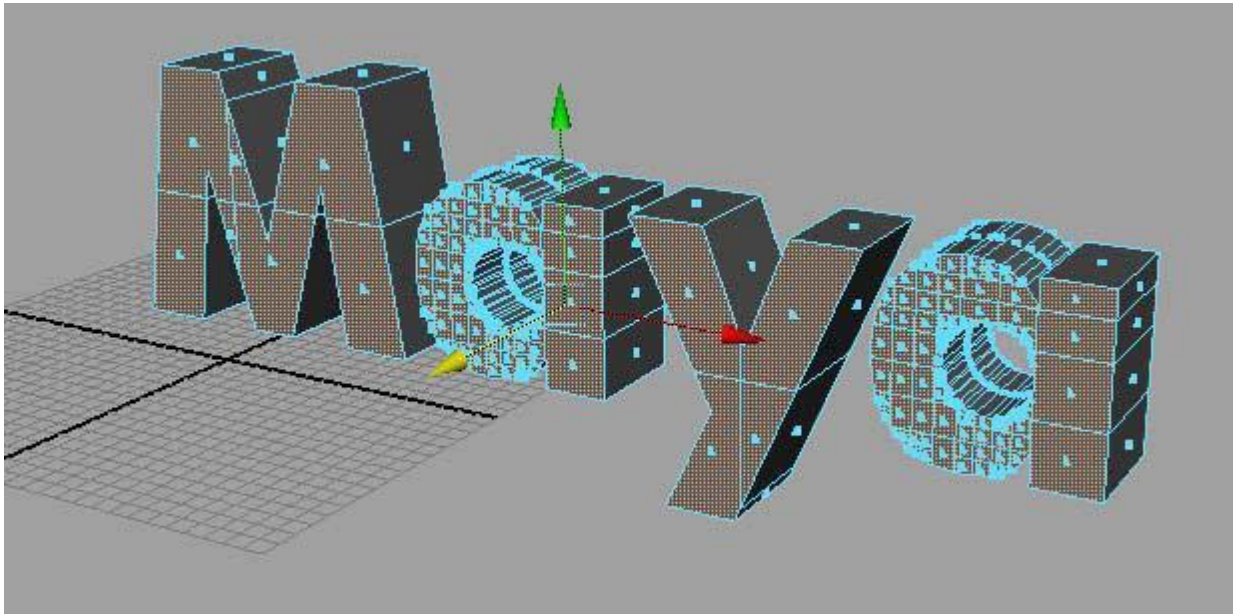
If you select Poly, it's best to output the type to quads and the tessellation method to general or count.



Step five - Click create to create your text.



Step six - To give your text a 3D look, select all the polygonal geometry and go to edit mesh>extrude. Don't de-select anything; go to the move tool and move the text forwards.



Now you are ready to use the text for your project.



4.3 EDIT NURBS

Curves

The NURBS modeling process usually begins with the creation of curves that match a profile or cross section of the object that you are modeling. Once you establish the curves, you execute commands that use the curves as inputs to generate surfaces. In this section, we will explore many of the curve editing tools and commands and then learn to generate surfaces from them using some of Maya's surface commands.

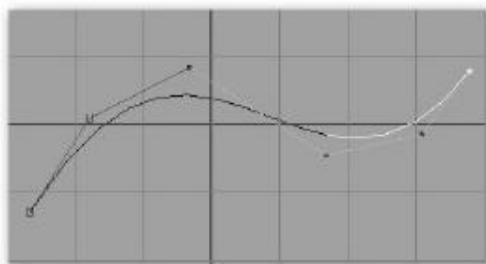
Curves are often the starting points for models. While they are never rendered, you will probably need to work with them to some degree while building most of your objects. You might use them to trace a bitmap that you use for reference or as the input to some other operation that generates surfaces. Or you might derive a curve from a surface to duplicate and manipulate it to generate a second surface. When you work with curves, most of the operations that you use involve attaching and detaching curves. A good working knowledge of curves will help you to build them efficiently, which will lead to organized surfaces that you generate from them.

Creating Curves with the Curve Tools

While we've already been using curves in the last few exercises, we examine curves a bit closer here. Maya has two different methods for creating curves—one that creates them with CVs and another that creates them with edit points (EPs). Regardless of what tool you use, keep in mind that you want to describe your curve by using the least number of points possible. This makes it easy to edit the curves later and build efficient surfaces.

CV Curve Tool

Choose Create | CV Curve from the main menu in the menu bar or from the Hotbox. You can also select this tool from the shelf under the Curves tab. The default settings are set to draw a third-degree curve with uniform parameterization. click at least four times to place four CVs in the view window. On the fourth click, you will notice that a smooth curve segment is generated. You can continue to click and place as many CVs as you want. When you are ready to complete the curve, press ENTER.



EP Curve Tool

Choose Create | EP Curve _. In the settings window that appears, click the Reset Tool button to set the tool to its default settings. Click once in the view window to set the first point. Click again in another place to set the second point. A curve will appear. Because the EP curve is completing an entire span every time a point is placed, you need to set only two points to complete the curve. Press ENTER (RETURN) to finish the curve.

Curves on Surfaces

In addition to drawing curves on the planes in the view window, you can also draw them directly on a surface, extract them from existing curves or isoparms, create them by

projecting another curve in the scene, or create them from the line of intersection between two intersecting surfaces.

Drawing on a Live Surface

Make Live

A curve can be drawn on any NURBS surface by first making the surface live. To do this, first select the surface on which you want to draw. Choose **Modify | Make Live**, or click the **Make Live** button on the status line. Once the surface is live, you can use any of the curve tools to draw on it.

Duplicating Surface Curves

Duplicate Surface Curves

Any curve on a surface or surface isoparm can be duplicated and then edited on its own. To duplicate curve on a surface or isoparm, first select it and then choose **Edit Curves | Duplicate Surface curves**. While the curve is still connected to the surface through history, it becomes a separate object and can be edited accordingly.

Projecting a Curve

Project Curve on Surface

Any curve in a scene can be projected onto a surface and a new curve created. To project a curve, select a curve and a surface and choose

Edit NURBS | Project Curve on Surface. In this tool's options window, you can specify whether the curve should be projected from the active view or along the normal of the surface.

Creating Curves Along Intersecting Surfaces

Intersect Surfaces

A curve on a surface is created along the line of intersection between any two intersecting surfaces by selecting the surfaces and choosing Edit NURBS | Intersect Surfaces.

Creating Curves on Surfaces Using Other Tool's Options

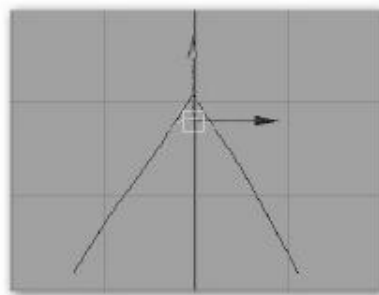
Tools such as the Circular Fillet tool have an option that allows you to create a curve on a surface when the fillet operation is performed.

Attaching and Detaching Curves

Attaching and detaching are probably the most common operations you'll use when working with curves. To attach curves, you connect or blend any two curves into a single curve. The Attach Curves command attaches two curves together. You can use two methods of attaching: connecting and blending. With the Connect option set, the end of one curve is moved to match the end of the other curve and the curves are attached.

Attach Curves

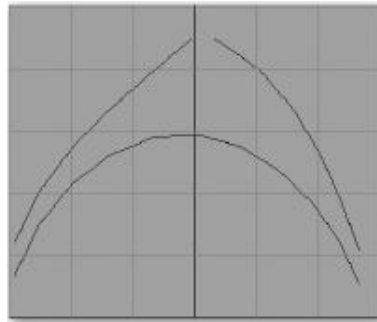
Draw two curves with either the CV Curve tool or the EP Curve tool. Choose Edit Curves | Attach Curves to bring up the Attach Curves Options window. Choose Edit | Reset Settings to restore the tool to its default settings. Then uncheck Keep Originals. Click Apply to attach the curves. The two curves will be attached at the two closest end points and will be blended with a bias of .5, so that each curve is moving the same amount to attach.



Detach Curves

Detaching a curve involves choosing a point on a curve that marks the spot where the curve will be detached into two separate pieces. The only option available in the Detach Curves Options window is one to keep the original curve. To detach the curve, select it, RMB-click it, and choose Curve Point. Choose Edit Curves | Detach Curves. The curve detaches at the selected curve's point. The result is two separate curves. While this

process is basic, selecting points (or isoparms), attaching, and detaching are integral parts of NURBS modeling.

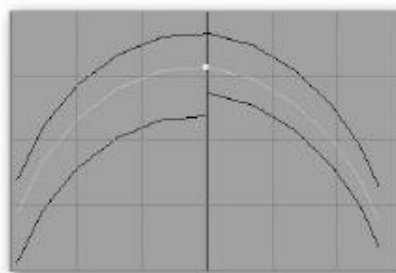


Cutting and Filleting Curves

When a high degree of precision is needed in creating curves, the attach and detach method may not give you the control you need for creating rounded blends between curves. In these situations, a fillet can provide the precision you need.

Curve Fillet

To use the Fillet Curve command (Edit Curves | Fillet Curve), you first select two intersecting curves. Two different construction methods can be used, Circular and Freeform; The Circular option builds a circular- shaped fillet according to the size indicated via the Radius setting. When the Freeform option is selected, the point at which the fillet begins on each curve can be set by editing the Curve Parameter attributes on the fillet Curve node once the fillet has been created.

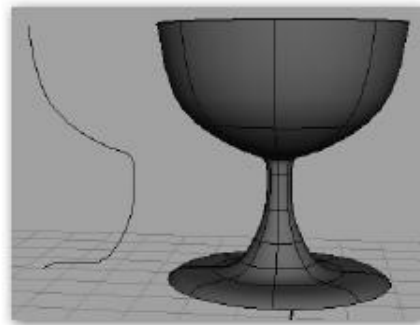


Surfaces

While curves play an important role in the modeling process, the surfaces generated from the curves are rendered to create the actual object. Surface generation in Maya begins with one or a series of source curves. These curves are used as the input objects for one of the surface generating tools. These surface-generating tools, or modeling operations, then use their specific algorithms to generate a surface based on the attribute settings of the tool.

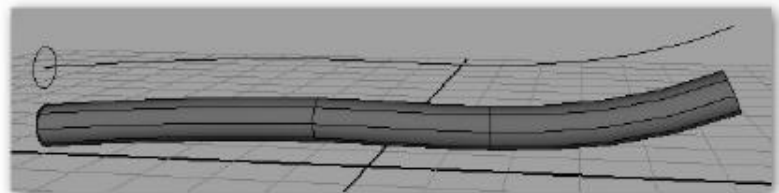
Revolve

The Revolve command is perhaps one of the simplest of the surface commands in Maya because it needs only one curve to be able to calculate the surface. Any round, symmetrical surface is a perfect candidate for the Revolve command.



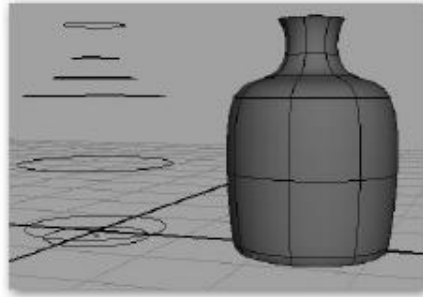
Extrude

Another quick way to generate a surface with few input curves is to use the Extrude command. This is a different operation than the Edit Mesh | Extrude command. With this command, a profile curve can be extruded by any amount along its normal, or it can be extruded along a given path.



Loft

If a 3D modeler had to choose one surface-generating tool that he or she could not live without, it would be the Loft command. You select any number of curves to be used as cross sections and then use the Loft command to create a surface between them. The resulting surface will pass through each of the curves in the order they were chosen.



Birail

Birailing works by blending one or more “profile” curves along two “rail” curves. Because birailing allows you to define all four sides of a surface, as well as any shape along that surface, it is capable of generating the most complex shapes with the fewest number of input curves. Maya has three different birail tools available in the Surfaces | Birail menu: Birail 1 Tool, Birail 2 Tool, and Birail 3+ Tool. While all of these operations require exactly two rail curves, the difference between them is the number of curves that are used as profiles. Its simplest implementation, the Birail 1 tool, works by sweeping just one profile curve along two rail curves. The following tutorial demonstrates a great workflow for using the birail tools to create very complex surfaces.

Fig: Birail 1 tool operation

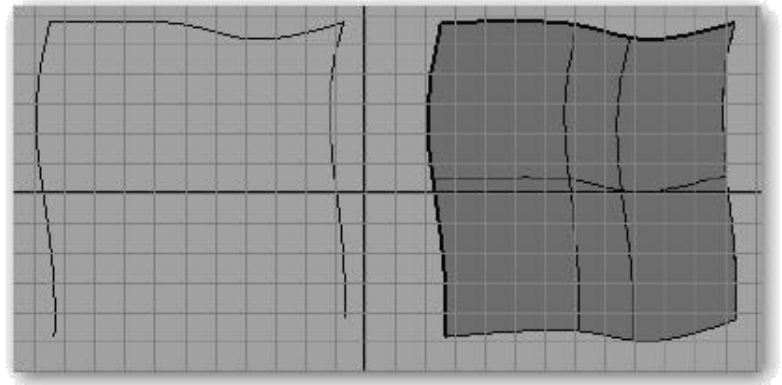


Fig: Birail 2 tool operation

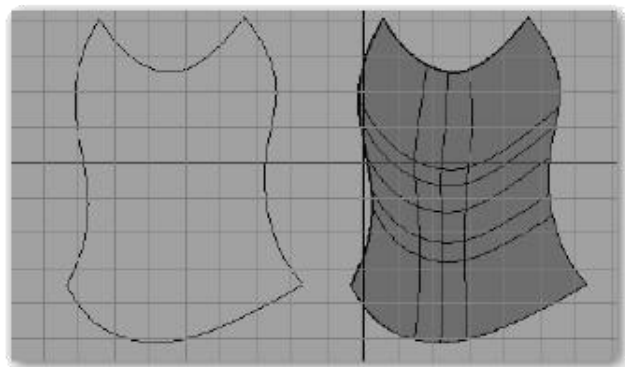
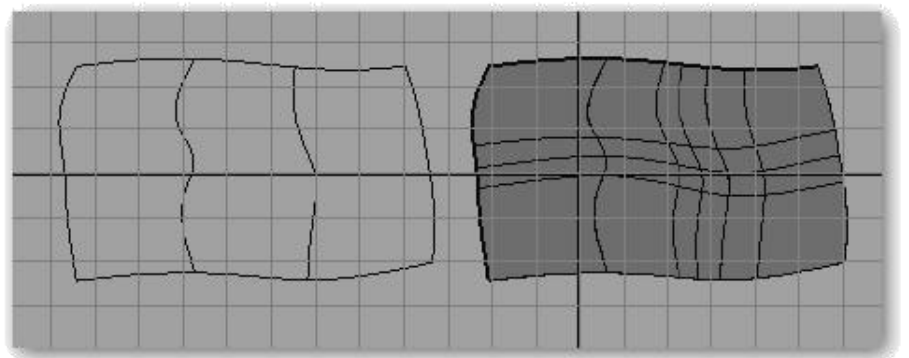


Fig: Birail 3+ tool Operation



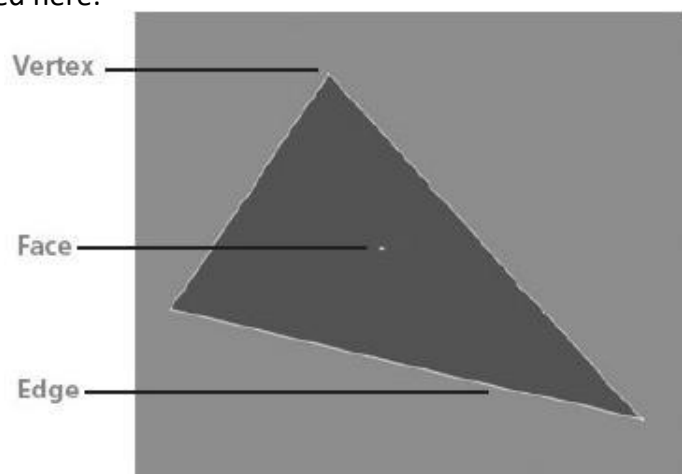
4.4 POLY MODELING

Polygons are the building blocks of 3D modeling. Polygons are the smallest renderable units that make up a 3D model. a single polygon can be broken down into smaller components. At its most basic level, a polygon is a triangular-shaped face defined by three vertices that are connected by three edges. Any 3D model that you render inside of Maya is made up of polygons. Polygon Anatomy

There are three different types of components in a polygonal object: a vertex, an edge, and a face. Figure as per below, shows the

components of a polygon, which are listed here:

Fig: components of a polygon



Vertex: A point in space. The vertex is the most basic component of a polygonal model. When Maya stores polygonal data it assigns each vertex in a model a unique identification number and gives that point's location in 3D space. This information allows the software to reconstruct the model when a file is opened by connecting each vertex to another one with an edge. By editing the position of a vertex, you are changing the shape of the face that it creates.

Edge: The polygonal components that connect two vertices. The area between at least three connected vertices creates a face. **Face:** A minimum of three vertices enclosed by three edges. Although you can create a face with any number of vertices, the faces will be broken up into triangles at render time. A triangular face is called a tri, a four-sided face is called a quad, and a face with more than four sides is called an n-gon. The collection of connected faces in a model is called a polygonal surface or a polygonal mesh. **UVs:** Every vertex in a 3D model can be assigned a coordinate in 2D space. Once the UVs are assigned, they can be edited in the UV Texture Editor to control the placement of a texture map on the 3D model.

Normal Every polygonal face has a front and a back side. A surface normal indicates the direction of the front of the face. You can display the normal of a polygonal object by selecting the mesh and choosing Display | Polygon | Face Normals. The direction of the normal can be changed by selecting a mesh and choosing Normals | Reverse.

4.5 Explain Polygons and its Components.

As with many things in Maya, there are always different ways to perform one task. By default, there are two different ways to access the components of a piece of geometry. One way is through the Selection Mask located on the status line and the other is through a marking menu. This process of switching into component mode and making selections is crucial to navigating your way through the Maya UI and is used in just about any workflow along the production pipeline, not just modeling.

Using the Selection Masks to Select Components

Anything we select in object mode will allow us to make edits to the object transform nodes. We can exclude any types of objects from a selection by clicking on one of the object

type buttons. For example, if we wanted to select only curves, we could disable all of the buttons except for the curve type. This is helpful for excluding unwanted types of objects in your selection. An object that is selected while in object mode is indicated by a green highlight in the view windows. Fig: selection mask is set to object mode



To change into component mode, click the button to the right of the object mode button. The buttons in this section of the status line will change to look as they do here:

Fig: selection mask is set to component mode



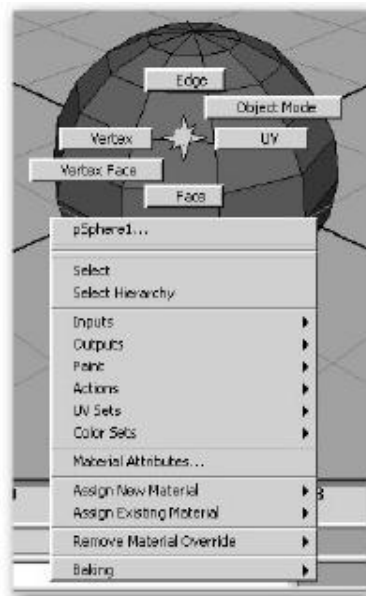
You can toggle between object and component mode by pressing the F8 key on your keyboard.

Using the Marking Menu to Select Components

Undoubtedly one of the most powerful aspects of Maya is its well designed user interface. Navigating through such a large program would take time if you were left to using only the dropdown menus from the menu bar. To give the user a better experience while working, the Maya engineers implemented marking menus. A marking menu is one that appears at your mouse cursor by pressing a certain key or mouse button in the workspace. The advantage of this type of interface is that you don't have to go looking elsewhere in the interface to switch to other tools or selection modes. This way your eyes and attention will remain focused on your task. The fastest method for selecting an object's components is to use a marking menu. In the view window, position your mouse cursor over the cube and RMB- click and hold. A marking menu containing all of the polygonal components will appear right at the spot where you are clicking. Figure below shows the marking menu displaying the polygonal components. You can choose one of the component modes by continuing to hold down the mouse and dragging over the desired

component type, Vertex, Face, Edge, or UV. When you have completed your edits to components, you can select object mode from the Component Editor. The display of your components will disappear and your object will return to its green highlighted color indicating that you are in object mode. While using the marking menu to select the components may seem basic, it is essential that you become comfortable with the process before moving on. Really, no matter what kind of task you are doing, be it animating, rigging, or working with particles, the process of activating the marking menu with an RMB-click will provide you with tools, commands, or modes that will make you more productive.

Fig: By right mouse button clicking and holding over a polygon object, a marking menu appears that contains the different component selection available.



Advantages of Polygon Modeling

Polygon modeling has several advantages over NURBS modeling.

Modeling Detailed or Branched Models Is Easy Because polygon models are based on the connection of independent faces, it is possible to have polygons with any number of sides and meeting any number of adjacent faces at the corners (vertices). While abusing this advantage can lead to a very sloppy model, being able to break a grid like structure to create branching structures, which occur in areas such as fingers emerging from a hand, can be accomplished quickly and easily while maintaining a single surface. In comparison, it is impossible to create branching structures using a single NURBS surface. Instead, you are

forced to use a multi patch (multiple individual NURBS surfaces) modeling technique, and then

you must manage the continuity between each patch to make the structures appear to be a single surface. This is a time-consuming effort that is of no issue when modeling with polygons.

UV Texture Coordinates Are Editable In a polygonal model; the artist has full control over where each vertex will be located in the UV (texture space). Maya contains an entire interface for this type of editing in the UV Texture Editor, which is discussed in Chapter 18. By having this kind of control, the artist can optimize texture maps and fix stretching or distortions. It is not possible to edit the UV of a NURBS surface without changing the layout of the surface itself in 3D space.

Hard Edges and Corners Are Easily Accommodated Due to the nature of polygons being made up of finite straight segments; it is very easy to create sharp edges and other rigid details. This makes polygonal modeling extremely useful for modeling architectural elements such as buildings and environments.

Simple Toolsets Are Available While you might use several dozen commands and tools when modeling with NURBS, you can create detailed polygonal models using very few tools. This makes it much easier for someone new to 3D modeling to become productive in a short amount of time. It's also helpful to even the most experienced modeler since fewer processes need to happen to complete a task.

Models Are Transferable Between Different Software Polygonal models are recognized by almost any 3D animation program or rendering engine, so, unlike NURBS models, you can transfer models between programs easily.

Disadvantages of Polygon Modeling

The following are some disadvantages of polygonal modeling. Data Size of a Smooth Polygon Object Is Comparably Large To represent a smooth, curvy object, without noticing any faceting in the silhouette of the model, it could take many faces. This will result in slower interaction compared to that of NURBS models. The tail of a dinosaur may need several hundred or thousands of faces to define its

shape and render smoothly. A similar structure in NURBS may only require a small fraction of that data. Because of the number of vertices needed to create a smooth detailed object, the data size can be significantly larger than that of a similar NURBS model. Your computer may run into problems loading or rendering a scene if sufficient memory is not available.

Also, sending large files over a computer network can clog a pipeline.

Adding Detail to Smooth Objects Can Be Difficult A common polygonal modeling workflow has the modeler work on a low-resolution version of the model and then smooth, or subdivide, that model to view the final result. When the model is smoothed, the position of the vertices is interpolated to result in a much smoother form. The problem is that whenever detail is added to the model, the smoothed version will appear flat in that area, so the modeler must shuffle the position of the vertices around to obtain the smooth shape they once had. This makes it difficult to model high-precision.

Tips for Polygon Modeling

To avoid any problems with your model, keep in mind the following tips as you work.

Keep Polygon Faces As Quads (Four Sided) First of all, it's much easier to view your models with one less edge through each face. If your aim is to create an organic, smooth surface later by using the Smooth command or by converting the surface into a subdivision surface, it's a good idea to use quad faces as much as possible from the beginning. Quad faces smooth and convert to subdivision surfaces without problems. Figure shown below shows both quad and tri faces being converted to subdivision surfaces. You should be aware that a polygonal model

with non manifold geometry won't convert to a subdivision surface model. This may also be of concern if you plan to render subdivision surfaces in Mental Ray.

Heads Up Display

The HUD for poly count, shown next, displays the number of polygonal vertices, edges, faces, and UVs for the entire scene (second

column), a selected object (third column), and selected components (fourth column). The HUD appears as an overlay in your view

windows. The HUD is helpful in managing your polygonal models as you work. To turn it on, choose Display | Heads Up Display |

Poly Count. It is always helpful to know how many polygons are amounting in your scene. Many productions specify a limit on the

number of faces that can be used for each model. Also, being able to account for the number of components selected is a real help

when components overlap. Without being able to look up this information in the HUD, you may think you only have one vertex

selected when you very well may have two or three.

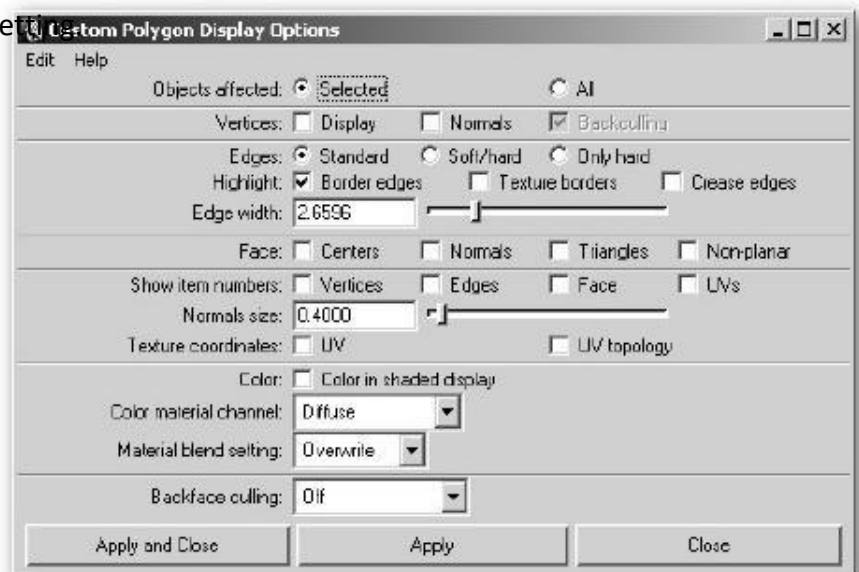
Fig: poly count

View	Shading	Lighting	Show	Render
Verts:	296	296	0	0
Edges:	600	600	0	0
Faces:	312	312	0	0
Tris:	576	576	0	0
UVs:	404	404	0	0

Custom Polygon Display

Choose Display | Polygons | Custom Polygon Display from the main menu bar to open the Custom Polygon Display Options window, shown in Figure 3-8. This window lets you set how a selected polygonal object will be displayed in the view windows. While you can turn on the display of the normals and vertices just as you can by choosing Display | Polygon Components, this window gives you access to a whole lot more.

Some of the most useful options here control how various edges are displayed. When you are dealing with multiple polygonal surfaces, it can sometimes be difficult to determine where one surface ends and the other begins. Turning on the Highlight Border Edges option will thicken the edges along the borders of polygonal surfaces. How thick they appear is controlled via the Edge Width set



4.5 Explain Polygons and its Components.

Tool sets of Polygonal Modeling

Here we will see the tools of basic Polygon Modeling. First we will cover the Edit Mesh Menu set. Edit Mesh Menu as shows in fig.

below.

Edit Mesh Menu



Extrude

The Extrude command will create new polygonal components based on an existing selection. It is one of the most used commands in polygonal modeling.

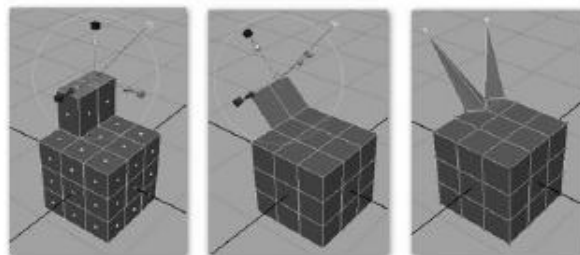
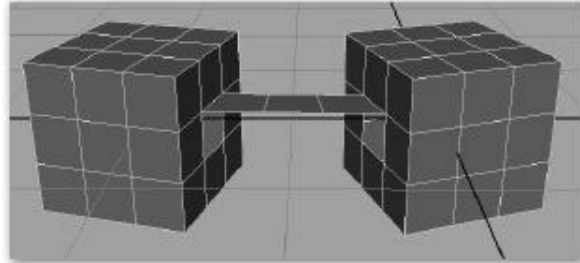


Fig: Extrude after selecting Poly Face, Edge and Vertex

Bridge

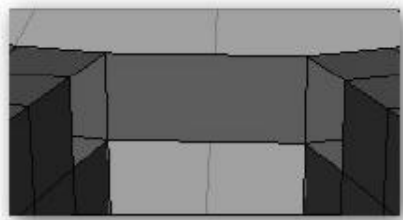
Bridge is useful when you need to connect two sets of edges together with a piece of mesh. After applying bridge command, you can edit the attributes for the bridging mesh by selecting the mesh and editing the polyBridgeEdge node in the Attribute Editor.



Append to Polygon Tool

When this tool is selected, then the border edges highlighted and appear thicker. You have to select at least two border edges.

Selection orders will affect on you generated polygon.



Cut faces Tool

The tool can split polygons across multiple polygon meshes in one operation. Drag a line in a view window to define the cutting plane.

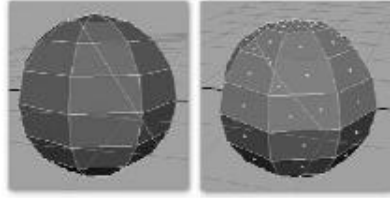
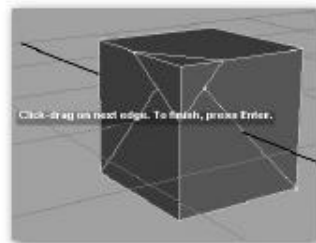


Fig: cut face tool applied on when selected whole object and on selected faces

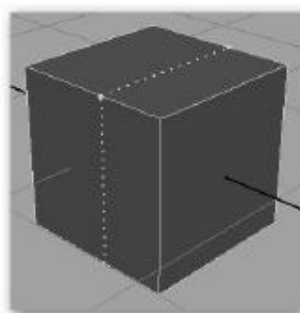
Split Polygon Tool

You can split the mesh using this tool. You can add division as per you want and your need. You can correct the n-sided polygon or tries to Quad topology using this tool.



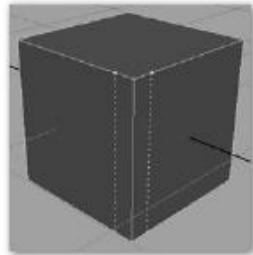
Insert Edge Loop Tool

This is the tool from which you can insert an edge loop across a full edge ring on a polygonal mesh and to insert a partial edge loop across a polygonal mesh and also to insert a multidirectional edge loop.



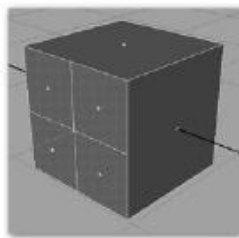
Offset Edge Loop Tool

Using this tool, you can create edge loops that are offset from an original edge. Depending on the orientation of the edge loop on the mesh, drag your mouse in either a side to side, or back and forth motion to position the preview locators. Release the mouse button when you have positioned the edge loop preview locators in the desired location.



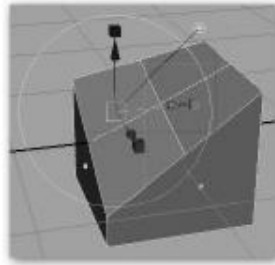
Add Divisions

Splits selected polygon components (edges or faces) into smaller components. Add Divisions is useful when you need to add detail to an existing polygon mesh in either a global or localized manner.



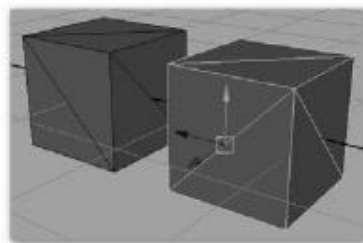
Transform Component

Using this command, you can move, rotate or scale your polygonal component. Maya creates a transformation node (polyMoveComponentType) and automatically switches to the Show Manipulator tool, allowing you to edit the node.



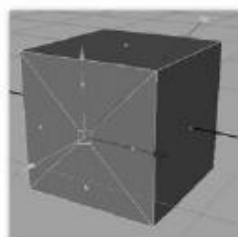
Flip Triangle Edge

Using this command, you can flip the triangle edges it means orientation of the edges will be change. This can often make a significant difference in the shape of low-polygon count models. You cannot flip edges that are texture borders in UV space. You cannot flip border edges, including hole borders. You cannot flip edges with zero length.



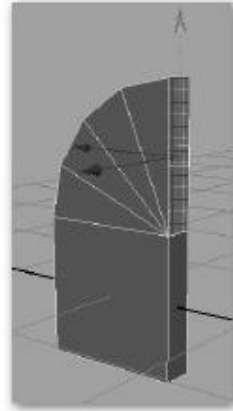
Poke Face

The Poke Face feature subdivides a polygon face in such a fashion that a new vertex is added to the center of the selected face. Poke Face is useful when you need to add details such as bumps or indentations to a polygon face.



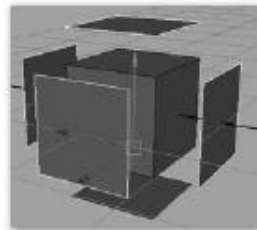
Wedge Face

With this command, you can pull out an arc of new polygons from existing faces with adding subdivisions.



Duplicate Face

Using this command you can create a new separate copy of any selected faces. The duplicated faces become parts of the original mesh which otherwise remains unaffected.



Detach component

Detach Component separates any selected vertex that is shared by multiple faces into multiple vertices depending on the number of faces the vertex shares.

Merge

The Merge command welds together any selected components within a distance determined by the Tolerance attribute. This command is especially useful for cleaning up geometry once two polygonal surfaces are combined with the Combine command.

Merge to Center

Merge to Center merges any selected vertices so they become shared and positions the resulting shared vertex at the center of the original selection.

Merge Edge Tool

You can merge edges to create a shared edge between them by selecting the two border edges.

Delete edge/vertex

To delete polygonal components efficiently, it is recommended that you use the Delete Edge/ Vertex command. For example, if a series of edges is selected and then deleted using the BACKSPACE (DELETE) key, the edges are removed but the vertices that once connected them remain. Using the Delete Edge/Vertex command removes the “stray” vertices and ensures a cleaner mesh.

Chamfer Vertex

Using this command, you can create a planar polygon with the place of selected vertex.

Bevel

This is the command; you can create beveled polygons along the currently selected edges.

The Combine command (Mesh | Combine) combines multiple shapes into one. Be aware that combining does not merge any components together. Combine is often used with the Merge command.

Separate

Using this command, you can disconnect or separate your previously combined objects if history is not deleted.

Extract

Using this command, you can detach the selected faces from the poly mesh. The extracted faces become a separate component within the existing mesh.

Booleans

Booleans let you combine polygon meshes to create a new shape.

Union: Combines the volume of the meshes.

Difference: Subtracts the first mesh from the second.

Intersection: Leaves only the shared volume of the meshes.

Smooth

It will smooth selected faces or selected poly mesh that means it will add subdivisions to the faces or poly mesh and make them smooth.

Fill Hole

The Fill Hole feature lets you fill in a region of a polygon mesh where polygons do not exist provided the region is bounded by three or more polygon edges. Fill Hole creates a polygon with three or more sides to fill in the selected region.

Create Polygon Tool

With this tool, you can create a polygon with placing vertices directly on the scene window. To create a polygon you have click at least three times in a scene. To return a value, means for completing tool you have to press Enter.

Sculpt Geometry Tool

Lets you specify the settings for the Sculpt Geometry Tool in the Tool Settings editor. There are attributes unique to the Sculpt Geometry Tool in the Sculpt Parameters sections. The Attribute editor shows the properties of the sculpt geometry tool where you have decide which operation do you want to do with the geometry. In the Attribute window, you can change the brush size, brush type, brush opacity in brush tab. You can also get sculpt parameters like operations: push, pull, smooth and erase. You can get max displacement value to displace the geometry.

Mirror Geometry

Using this command, you can create symmetrical polygon meshes. Just you have to define in which direction you want to do the operation.

4.6 Polygon Proxy

Subdiv Proxy smooths the selected polygon mesh by adding polygons and keeps the original non-smoothed mesh as a proxy. A node connection is made between the proxy and smoothed version of the mesh so that changes to the proxy's shape or topology update the smoothed version of the mesh.

Removes the smooth mesh created by Proxy > Subdiv Proxy (with Mirror Behavior set to Full) and combines the two halves of the proxy mesh (the original mesh and the mirrored mesh) into a single mesh (similar to using Mesh > Mirror Geometry on the original mesh).

The Proxy > Crease Tool is the same feature as Edit Mesh > Crease Tool. They exist in two locations to more easily facilitate user workflows. For more information see Edit Mesh > Crease Tool.

Toggles the display of the subdiv proxy object between normal polygon display and the smooth subdiv proxy version.

Switching between the subdiv proxy and the normal polygon display modes is useful when you're modeling polygon surfaces and want to quickly switch between either mode to preview your work.

Displays both the proxy mesh and subdiv mesh simultaneously. You can also control this display mode using the ~ hotkey

4.7 Summary

In this Chapter we covered about Nurbs Surface and Proxy

4.8 self Assessment test

Broad questions

1. What is NURBS surface?
2. Explain PolyProxy?

Short notes

1. Extrude
2. revolve
3. Polygon Anatomy
4. Normal

4.9 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training
...Autodesk Maya Press, **Marc-André Guindon**

UNIT 5 HUMAN AND ANIMAL ANATOMY, SUBDIV MODELING



Learning Outcome

After going through this unit, you will learn:

- Anatomy
- Subdiv modeling



Time Required to Complete the unit

The time required to study this Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

5.1 Anatomy

5.2 Basic Sub Division Modeling Workflow

5.3 Subdiv surface components

1.1 Creasing Subdiv Surfaces

1.2 Soft Modification Tool

1.3 Sculpting Subdivs

1.4 Summary

1.5 Assessment

1.6 Further Reading

5.1 Anatomy

HUMAN ANATOMY

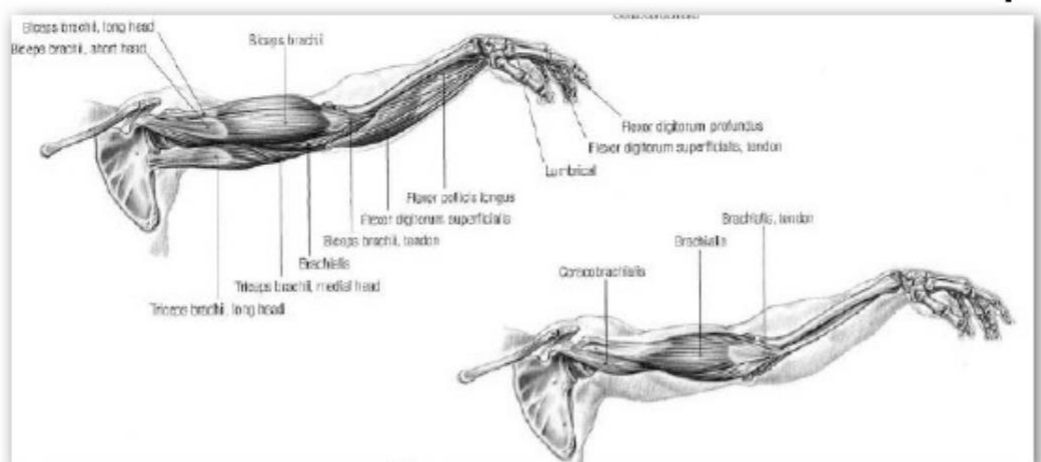
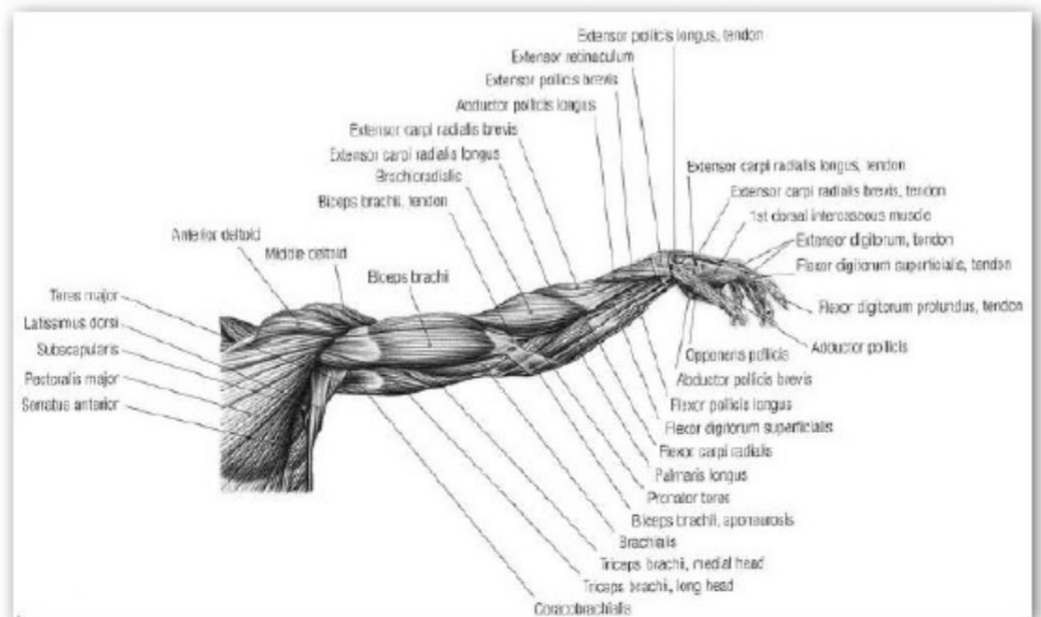
In this chapter we will study the whole Human Anatomy structure. We will the Muscles structure of the Arms, Shoulders, Chest, Back, Legs, Buttocks and Abdomens.

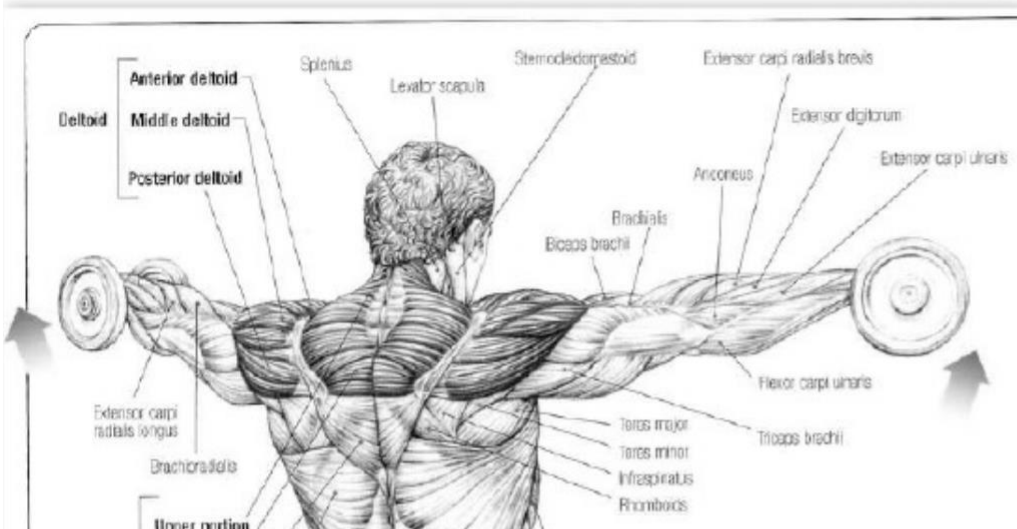
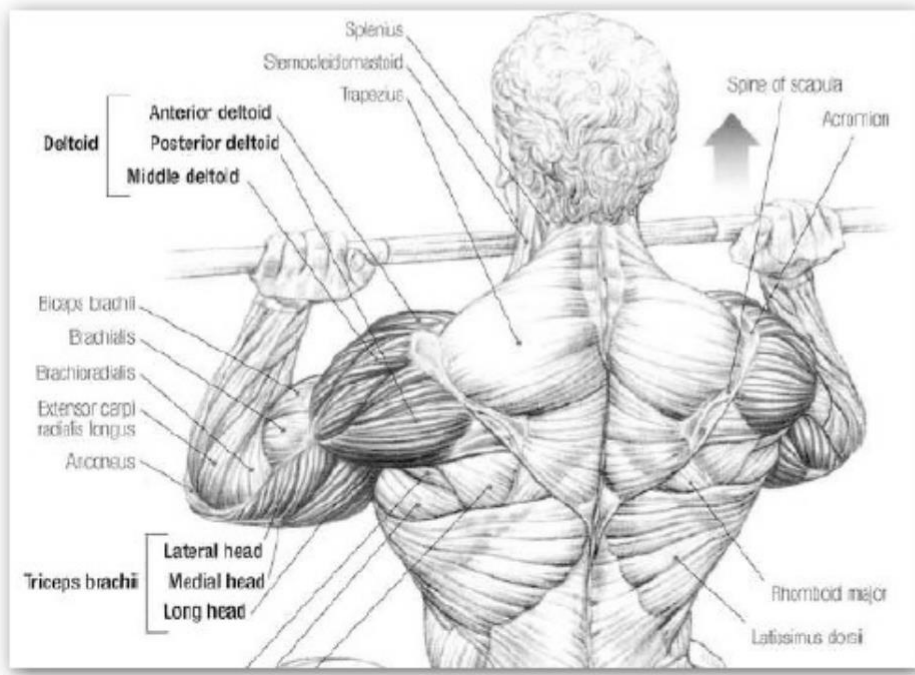
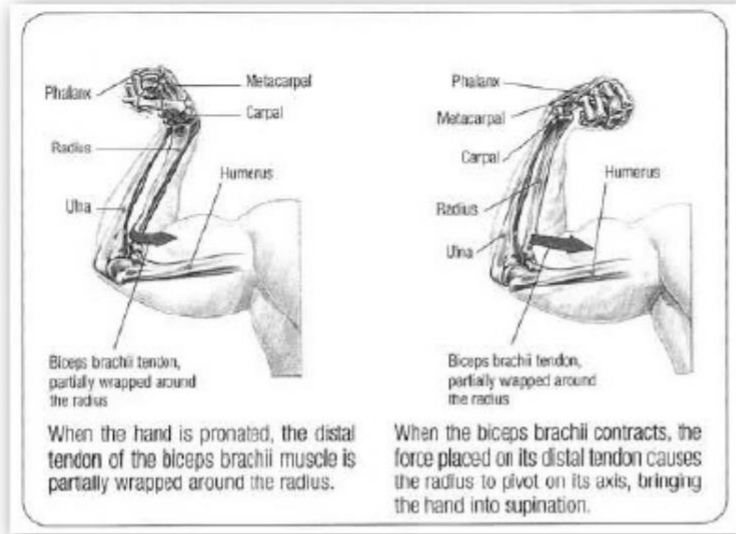
Here gives all illustrated images of muscles structure.

Arms

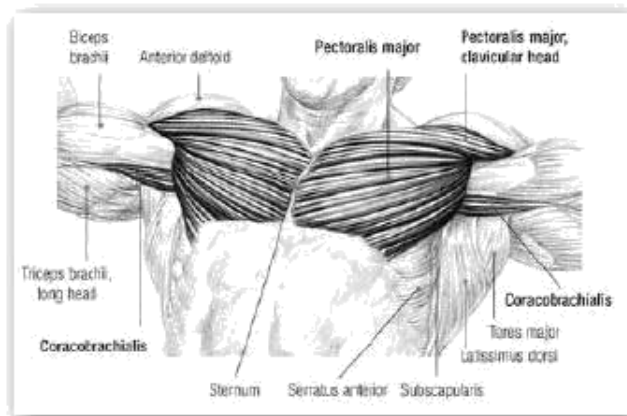
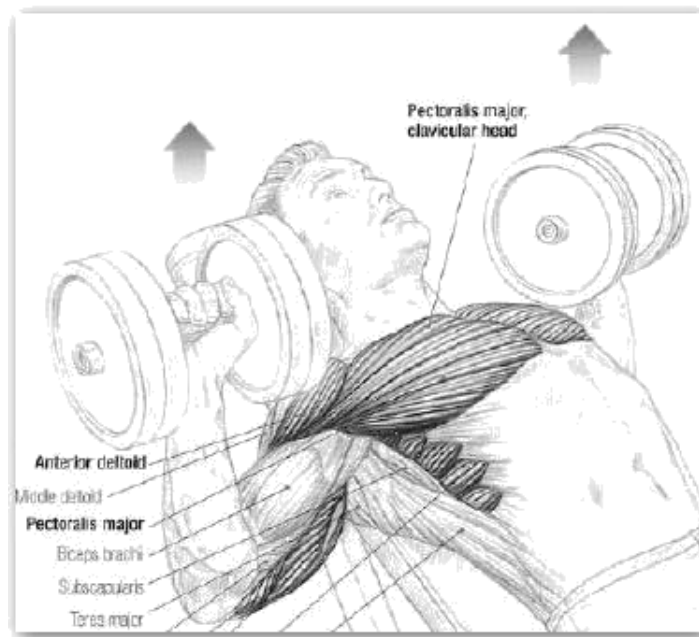
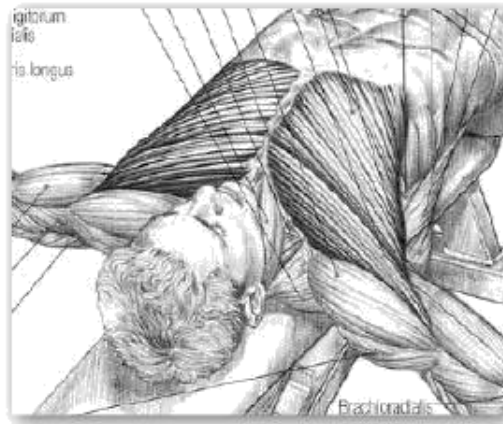
Fig: whole arm muscles structure

Shoulder

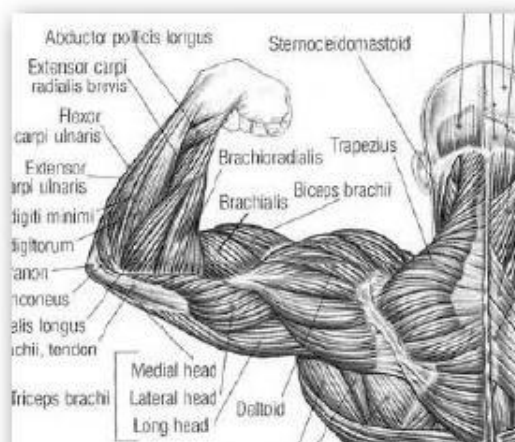




CHEST



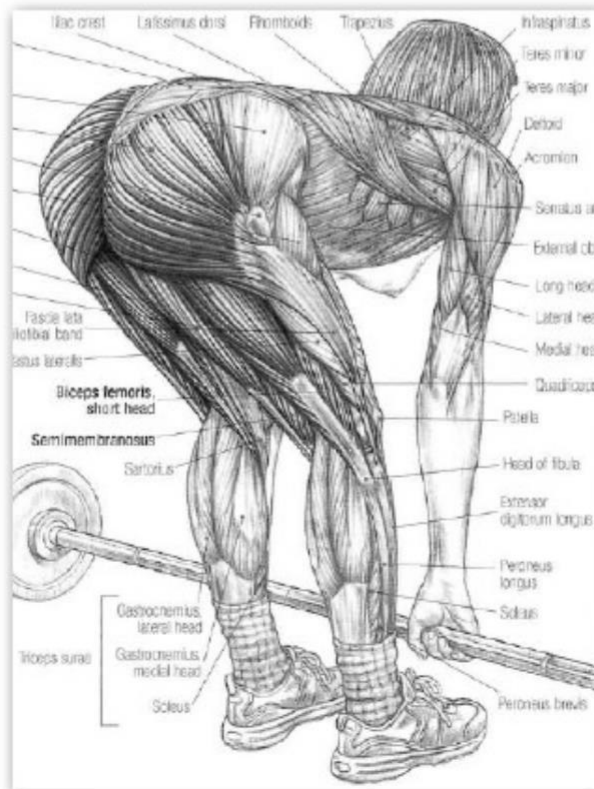
BACK



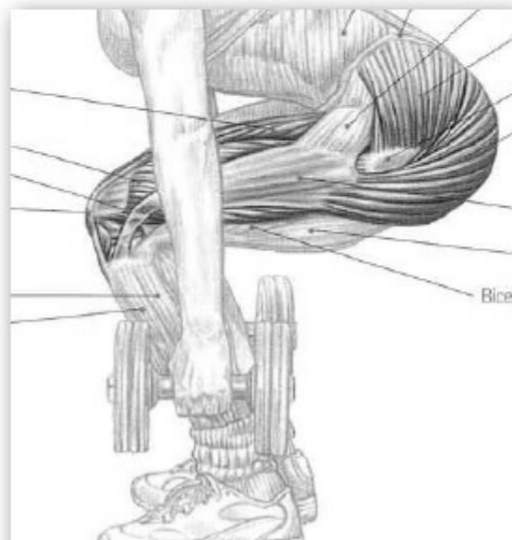
BRINGING THE BAR TO THE NECK WITH ARMS ALONGSIDE THE BODY



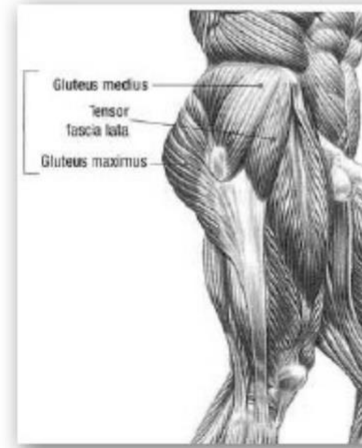
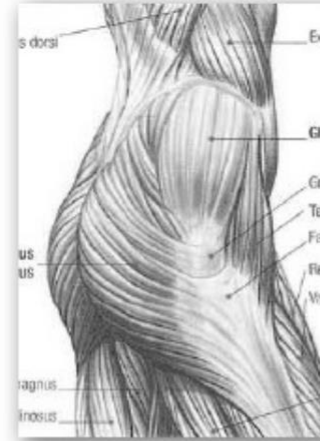
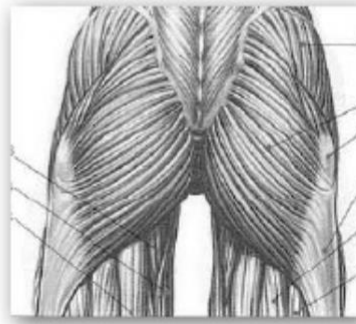
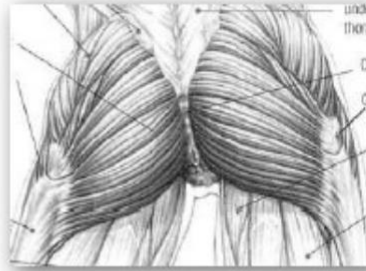
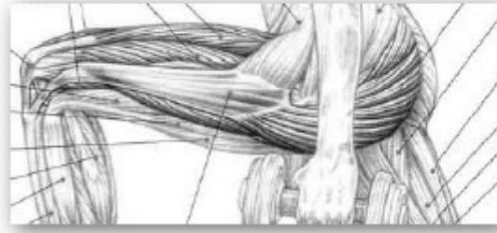
BRINGING THE BAR TO THE CHEST WITH ELBOWS BEHIND



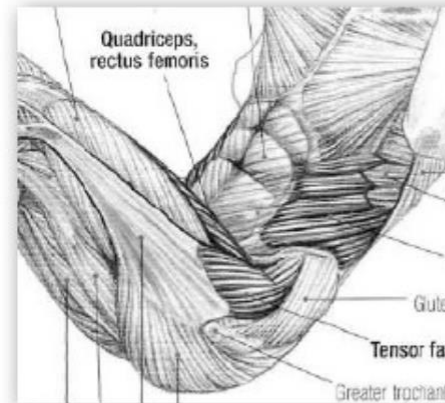
LEGS



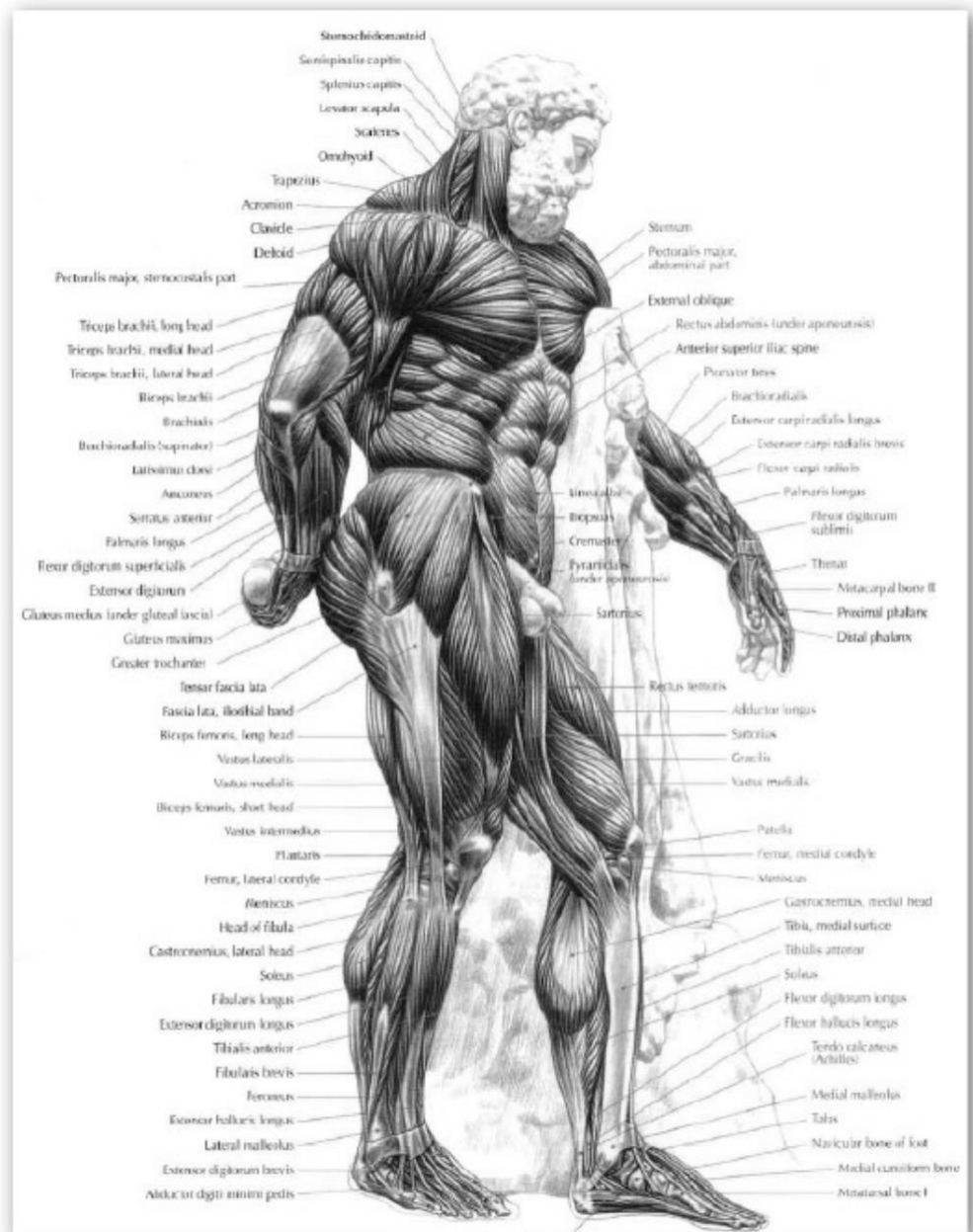
BUTTOCKS



ABDOMNS



FULLBODY



5.2 Basic Sub Division Modeling Workflow

Polygon offers a sculptural modeling technique, but they require a significant addition of detail to create smooth, organic models. NURBS offer smooth surfaces, but they require the adoption of an alien modeling paradigm that involves concepts such as stitching, parameterizing, and trimming. Subdivision surfaces offer a compromise between the smoothness of NURBS and the sculptural quality of polygons by providing a paradigm that combines some of the best features of both modeling types. Subdivision surfaces are typically used toward the end of the modeling production process in order to add smoothness and detail to models that would otherwise be too computationally expensive to deal with earlier in the production pipeline. This chapter will follow that workflow, modeling Machismo's head in polygons before converting it to subdivision surfaces for smoothing and detail work.

5.3 Subdiv surface components

A subdivision surfaces (subD) is a hybrid surface combining many of the advantages of both NURBS and polygons. Like NURBS, subDs represent a large number of polygons that can be increased or decreased depending on the needs of the artist. A relatively small number of knots (control points) control a surface, which is tessellated into levels of smoothness that are appropriate for anything from interactive display on the computer monitor to high-resolution models for rendering to High Definition Video (HD) or film. Unlike NURBS, which are limited to manipulating four-sided patches into models, subDs also support polygonal topologies and modeling methods. Indeed, as you will see, it is most advantageous to begin modeling in polygons and switch to subDs for detailing. In fact, at the most basic editing level of a subD object (level 0), polygon vertices share the placement of the subD surface.

The greatest advantage of subDs is their hierarchical nature. Subdivision surfaces can create increasing levels of detail and you can switch between the display of higher and lower levels of detail while modeling. Also, changes made to the model at a lower level of detail propagate up to the higher detail levels. Furthermore, this varying level of detail can be localized so that surface detail and complexity can be added only where needed. With

NURBS, modeling detail requires that the number of U and V spans be increased across the entire patch or object. This approach increases the computational weight of the model and is largely undesirable. Even polygons require a high degree of modeling to add localized detail without increasing the entire object's resolution. Figure given below shows the relative surface resolution needed for each modeling paradigm. Notice how the subD surface in the middle has detail added only where needed.

Artists typically approach a model first by creating a low-resolution polygon version and then converting it over to subDs. After the conversion, the mesh becomes quite smooth; creasing is often used to retain intended harder edges.

Subdivision surfaces can be deceptive, however, in that they can promote bad modeling practices. You know that a primarily quad-based modeling effort is the best practice when modeling with polys. Triangles work, but n-sided polys should be avoided because they smooth strangely. Subdivision surfaces smooth n-sided polys fine, but the n-sided polygons are not supported by mental ray for Maya; those objects containing polygons other than four sides will not render and may crash the renderer.

Subdivision surfaces can be edited in two modes: standard mode and polygon proxy mode. Standard mode allows you to edit the subdivision components of the model and view it as a true subdivision surface. In this mode, you can use the standard subdivision modeling tools and refine components into levels. At any point, you can switch the model into polygon proxy mode, which allows you to edit the general hull of the object as if it were a low-resolution polygon model. Also in this proxy mode, you can use any of the polygon modeling tools.

5.4 Creasing Subdiv Surfaces

Full Crease Edge/Vertex modifies the appearance of a subdivision surface by applying an edge shaped feature along the selected region of the mesh.

Applying a crease is useful when you want a sharp edge or transition on a surface. You can also apply a partial crease, or uncrease previously creased regions of the surface. The

feature produced by a full crease appears more pronounced on the surface than a partial crease

A full crease is a hard or sharp edge created at the selected edges, or a sharp point created at the selected vertex. The surface moves very close or exactly to the edge or vertex to form the crease.

A partial crease moves the surface closer to the selected edges or vertices without ever reaching them. Partial creasing is useful when you want a softer edge effect, such as at the edge of a character's lips.

5.5 The Soft Modification Tool is a deformer with adjustable falloff attributes that lets you manipulate 3D geometry much like an artist would push or pull on a piece of modeling clay to change its form. This enables you to smoothly deform high density surface meshes without having to adjust each vertex manually. Color feedback lets you visualize the area of influence around the deformer and across the surface mesh.

By default, the amount of deformation is greatest at the center of the manipulator, and gradually falls off further away from the center. However, you can control the falloff of the deformation to create various types of effects.

The Soft Modification Tool is located in the Tool Box. You can also access the tool within the Animation menu set by selecting Create Deformers > Soft Modification.

You can use the Soft Modification Tool on NURBS surfaces, polygonal surfaces, subdivision surfaces, curves, particles or any object with components.

5.6 Sculpt Subdivision

The Sculpt Geometry Tool lets you manually sculpt NURBS, polygons, or subdivision surfaces quickly with the stroke of a brush. You simply paint the surface mesh using the Sculpt Geometry Tool to push or pull CVs (NURBS) or vertices (polygons and subdivision surfaces) to achieve the shape you want

5.7 Summary

In this Chapter covered Subdivision and anatomy .

5.12 Self Assessment Test

1. Explain Anatomy
2. Explain Subdivision Modeling

Short notes

1. Sculpt Subdivision
2. Crease
3. Soft Modify tool
4. Subdivision
5. Partitial Crease

5.13 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training ...Autodesk Maya Press, **Marc-André Guindon**

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**Dr. Babasaheb Ambedkar
Open University**

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Publications that are mentioned in Bibliography. The content developed represents the breadth of research excellence in this multidisciplinary academic field. Some of the information, illustrations and examples are taken “as is” and as available in the references mentioned in Bibliography for academic purpose and better understanding by learner.’



ROLE OF SELF INSTRUCTIONAL MATERIAL IN DISTANCE LEARNING

The need to plan effective instruction is imperative for a

Successful distance teaching repertoire. This is due to the fact that the instructional designer, the tutor, the author (s) and the student are often separated by distance and may never meet in person. This is an increasingly common scenario in distance education instruction. As much as possible, teaching by distance should stimulate the student's intellectual

Involvement and contain all the necessary learning instructional activities that are capable of guiding the student through the course objectives. Therefore, the course / self-instructional material are completely equipped with everything that the syllabus prescribes.

To ensure effective instruction, a number of instructional design ideas are used and these help students to acquire knowledge, intellectual skills, motor skills and necessary attitudinal changes. In this respect,

Students' assessment and course evaluation are incorporated in the text.

The nature of instructional activities used in distance education self- instructional materials depends on the domain of learning that they reinforce in the text, that is, the cognitive, psychomotor and affective. These are further interpreted in the acquisition of knowledge, intellectual skills and motor skills. Students may be encouraged to gain, apply and communicate (orally or in writing) the knowledge acquired. Intellectual- skills objectives may be met by designing instructions that make

use of students' prior knowledge and experiences in the discourse as the foundation on which newly acquired knowledge is built.

The provision of exercises in the form of assignments, projects and tutorial feedback is necessary. Instructional activities that teach motor skills need to be graphically demonstrated and the correct practices provided during tutorials. Instructional activities for inculcating change in attitude and behavior should create interest and demonstrate need and benefits gained by adopting the required change. Information on the adoption and procedures for practice of new attitudes may then be introduced.

Teaching and learning at a distance eliminates interactive

Communication clues, such as pauses, intonation and gestures, associated with the face-to-face method of teaching. This is particularly so with the exclusive use of print media. Instructional activities built into the instructional repertoire provide this missing interaction between the student and the teacher. Therefore, the use of instructional activities to affect better distance teaching is not optional, but mandatory.

Our team of successful writers and authors has tried to r e d u c e

This. Divide and to bring this Self Instructional Material as the b e s t teaching and communication tool. Instructional activities are varied in order to assess the different facets of the domains of learning.

Distance education teaching repertoire involves extensive use of self- instructional materials, be they print or otherwise. These materials are designed to achieve certain pre-determined learning outcomes, namely goals and objectives that are contained in an instructional plan. Since the teaching process is affected over a distance, there is need to ensure that students actively participate in their learning by performing specific tasks that help them to understand the relevant concepts.

Therefore, a set of exercises is built into the teaching repertoire in order to link what students and tutors do in the framework of the course outline.

These could be in the form of students 'assignments, a research project

or a science practical exercise. Examples of instructional activities in distance education are too numerous to list. Instructional activities, when used in this context, help to motivate students, guide and measure students' performance (continuous assessment)



PREFACE


We have put in lots of hard work to make this book as user-friendly as possible, but we have not sacrificed quality. Experts were involved in preparing the materials. However, concepts are explained in easy language for you. We have included many tables and examples for easy understanding.


We sincerely hope this book will help you in every way you
Expect.


All the best for your studies from our team!

All the best for your studies from our team!

Unit 6 TEXTURING

 Learning Outcome	
<p>After going through this unit, you will learn:</p> <ul style="list-style-type: none">• Hypershade• Ray tracing• IPR rendering	

 Time Required to Complete the unit	
<p>The time required to study this Unit is broken as follows</p> <ol style="list-style-type: none">1. 1st Reading: It will need 2 Hrs for reading a unit2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit3. Self Assessment: It will need 3 Hrs for reading and understanding a unit4. Revision and Further Reading: It is continuous process	

 Content Map	
<p>6.1 Shaders, materials, and mapping</p> <p>6.2 Hypershade</p> <p>Understanding the network graph of a material</p> <p>6.3 Raytracing</p> <p>6.4 Hypershade nodes</p>	

6.5Ipr renders

6.6Materials

6.7Summary

6.8Assessment

6.9Further Reading

6.1 Shaders,Material and Mapping

A material is a collection of attributes that define color, shininess, and other surface characteristics.

The basic workflow of building a material is to start with a rendering node, such as a basic material, and edit its attributes. Other nodes, such as textures, can be connected to these attributes by dragging and dropping them onto a material and choosing the desired connection. Placement nodes are then edited to direct how a texture is positioned on a surface. For more advanced materials, additional utility nodes are connected to tweak the attributes of the other nodes in the network. As you'll see, even a relatively simple exercise in the Material Editor can lead to a few dozen separate nodes and connections. The network of connected nodes that feeds into a material is called a shading network. Therefore, a completed material is often called a **shader**.

To assign a material to an object

1 Before you create a new material, right-click the sphere and select Material Attributes.

The default material attributes appear in the Attribute Editor. The default material assigned to the sphere (and all other surfaces) is a type f material called Lambert. The material displays the surface with gray shading. You should not edit the default shading material.

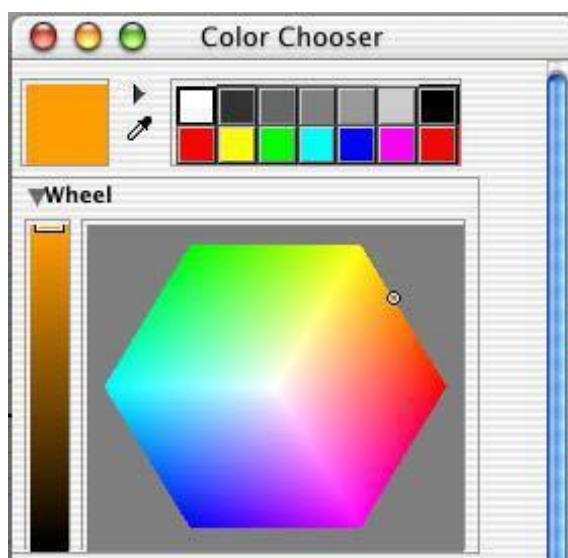
2 Right-click the sphere and select Assign New Material > Blinn to create a new material for the sphere. The new material's attributes appear in the Attribute Editor.

A Blinn material gives a surface a shinier look than a Lambert material. Blinn is a good choice for creating a variety of surface appearances. Knowing which material type to use for a particular surface comes with practice. Fortunately, you can change the material type later on, so you do not need to make a decision now. You will learn more about material types later in the lesson. Getting Started with Maya 463 9 | Rendering Lesson 2 > Assigning a shading material



3 In the Attribute Editor, click the gray box to the right of Color to open the Color Chooser.

4 In the Color Chooser, click inside the color wheel (hexagon) and drag the pointer to an orange-colored area, as illustrated. The sphere becomes the same color you select in the Color Chooser. Also drag up the slider to the left of the hexagon to get a brighter shade.



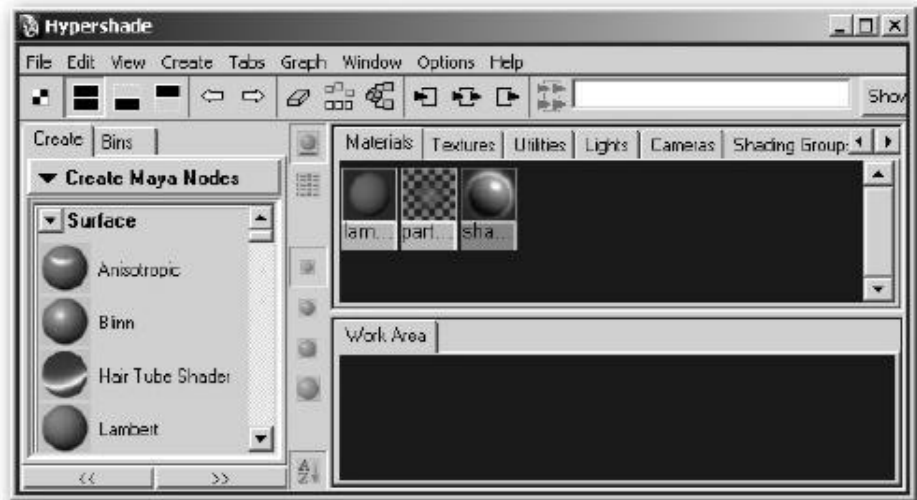
5 Click Accept to close the Color Chooser. If you compare the color in the Color attribute box with the sphere's color in the scene view, you'll notice a difference. The color you assigned is only one aspect of surface appearance. The appearance also depends on how the surface reacts with light. The main attributes that control the reaction to light are under the Common Material Attributes heading. As an example of these attributes, you will change the Diffuse setting.

6 In the Attribute Editor, drag the Diffuse slider to its right to increase the color brightness as viewed in the scene view. This will help create the illusion of a bright orange.

6.2 Hypershade

The Hypershade window (Window | Rendering Editors | Hypershade) is shown in Figure given below. This is where you build and edit materials for all the objects in your scene. Like the Hypergraph, the Hypershade displays a dependency graph of the different materials in your scene. In fact, these materials display the exact same nodes, and you could do all the same editing and connecting by using the Hypergraph and other menu commands. The main difference between the two is that, when dealing with material-related nodes (also known as rendering nodes), the Hypershade displays its node icons, known as swatches in Maya, in more detail. This means that a file texture node's icon displays a thumbnail version of the actual texture. A material node's swatch will display

everything from the falloff of the specularity to the peaks and troughs of its bumps.



Hypershade Sections

The Hypershade is divided into three main sections: the Create Bar, the top tabs section, and the bottom tabs section. In the Create Bar, you can create any of the rendering nodes by clicking them. Click and hold the Choose Node Type arrow to view the different types of rendering nodes. You may choose the Create Maya Node (the default), Create Mental Ray Nodes, or Create All Nodes. Once a selection is made, the relevant nodes will appear in the Create Bar. Items in the Create Bar are also available by right-clicking in the other sections of the Hypershade window, so to create more space to work, you may want to hide the Create Bar. To do so, click the Create Bar On/Off button in the toolbar, shown in Figure above. The top tabs section contains all of the rendering nodes in the current scene; they are organized by category: Materials, Textures, Utilities, Lights, Cameras, Bake Sets, and Projects. Here's how this works. If, for example, you click a Blinn material in the Create Bar, a new Blinn material icon will appear in the Materials tab. Likewise, any texture that is created will be displayed in the Textures tab. This feature organizes the different kinds of nodes in your scene. The third section of the Hypershade, the bottom tabs section, is where you can view, select, and edit the connections of the rendering nodes. To view a node in the work area, you can MMB drag the node's icon from one of the top tabs down into the work area. To view its connections, you can use one of the three materials connection buttons in the Hypershade toolbar. This will expand that node to show its input connections, output connections, or both, in the work area. To clear this space, use the Clear Work Area button in the toolbar. Selecting one of the rendering nodes from the scene library tabs and clicking one of the

display connections buttons will automatically clear the work area and display the connections for the selected node. These two sections of the Hypershade can be hidden by using the three buttons in the upper left corner of the Hypershade toolbar. Clicking the first button hides the lower tabs and expands the space for the upper tabs. Clicking the second button hides the upper tabs and shows only the lower section, and clicking the third (the default view) displays both tab sections. To move around in the Hypershade window, you use the same pan and zoom controls used in most of the other windows in Maya.

6.3 RAYTRACING

Within Maya there are multiple ways to add shadows to lights. Raytrace shadows can take longer to render, but the results are incredible. Raytrace shadows take into account the distance from the light and the size of the light. As a large light moves closer to an object, the shadow projected becomes softer.

Raytracing is a rendering technique used to create photorealistic reflections and refractions on reflective surfaces, and to produce shadows. Raytracing is a high-quality alternative to reflection mapping, although it requires more computation time. Raytracing accurately renders the properties like:

1. Direct Illumination
2. Shadows
3. Specular Reflections
4. Transparency Effects

The raytracing algorithm calculates the color for each pixel by emitting rays from the camera into the scene. When a ray hits an object, its color is evaluated and then a secondary ray is projected (bounced) if the object is reflective or refractive. Maya calculates raytracing only when it is turned on in the raytracing quality section in render options.

6.4 Working with the Hypershade NODE

Let's practice working with the Hypershade by creating a Blinn material and connecting a texture to the Color attribute:

The Create Bar should be turned on and displaying its Create Maya Nodes option; click the Choose Node Type arrow and select Create Maya Nodes from the resulting menu, if necessary.

Click the sphere icon labeled Blinn. A Blinn material will be added to your scene and will appear in both the Materials tab and in the Work Area tab. If this is the first Blinn material you have created in the scene, it will be named blinn1. The next time

you create a Blinn material, it will be named blinn2. Scroll down in the Create Bar and find the Textures section. Unfold this section

to see the texture nodes. Click the Grid icon (see Figure below). A Grid texture node is added to the scene and appears on the

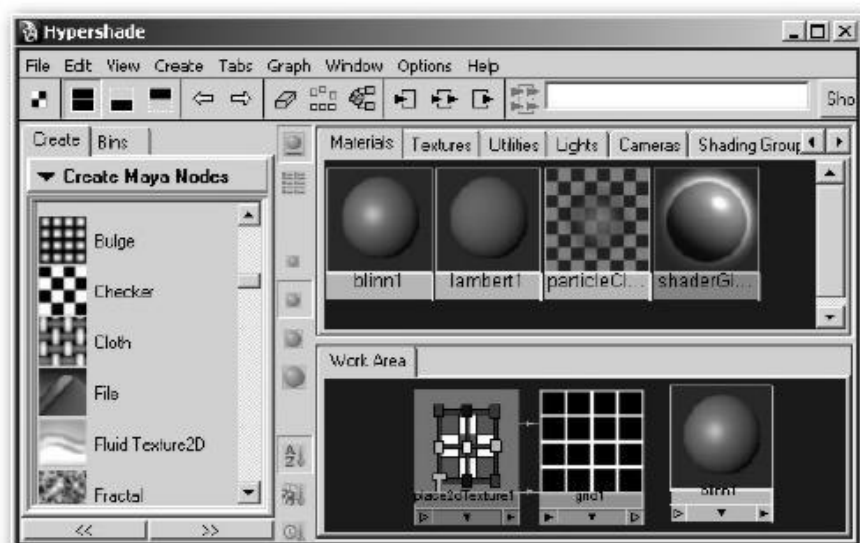
Textures tab and the Work Area tab. Depending on where your Blinn material was positioned in the Workspace, your

Grid texture node might overlap it. If this is the case, simply select one of the nodes in the work area and drag it out of the way so

that all the nodes are visible. The work area should look like that shown in Figure below. In addition, notice that a 2D placement

node has also been created and connected to the Grid texture node. This controls how that texture fits into the texture space.

Fig: 2d Placement node, Grid texture node and Blinn node into work area

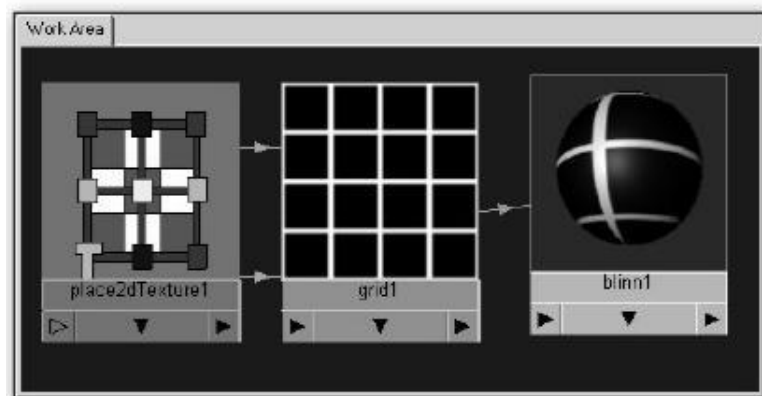


We want to have this Grid texture control the Color attribute of the Blinn material. We can make this connection directly in the Hypershade by dragging and dropping the Grid node's icon onto the material node's icon. In the work area, select the Grid

texture node and MMB-drag it onto the Blinn material node. When you release the mouse button, a marking menu appears with a list of attributes that the Grid texture can be mapped to by default. Since we want to map this to the Color attribute,

choose Color from the list. A connection is made, and the material node icon is updated to display the Grid texture on the material.

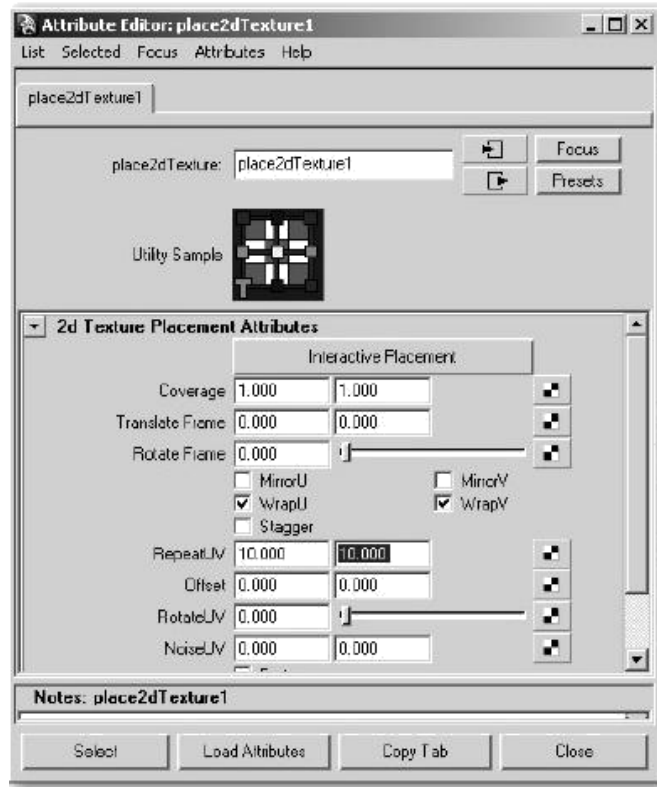
Your work area should look like the fig given below.



Lastly, we assign the material to an object in the scene. Create a NURBS sphere(Create | NURBS Primitives | Sphere). You can assign the material to the object simply by MMB dragging the material swatch onto the object in the view window or the Outliner. Another way would be to select the object, right-click a material in the Hypergraph, and choose Assign Material to Selection from the marking menu. To view the texture on the object in a view window, make sure you turn on hardware texturing by pressing the 6 key.

Using the Attribute Editor for Editing Materials

The Attribute Editor (shown in Figure given below) also plays an important role when you are working with materials. While connections can easily be made in the Hypershade window alone, the actual editing of attribute values is done in the Attribute Editor. Connections to other textures can also be made in the Attribute Editor. In fact, this tool offers access to more of the possible connections than the marking menu that is displayed when a node is dragged onto a material in the Hypershade.



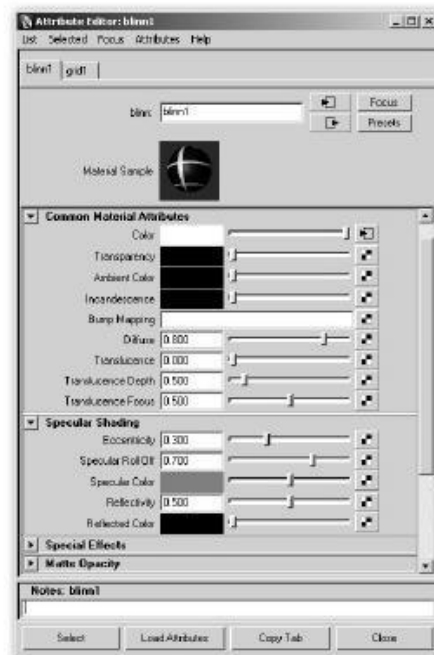
To get the most out of material editing, it is best to use the Hypershade and Attribute Editor together. Generally, you use the Hypershade to view connections and select particular nodes. Once selected, that node's attributes are displayed in the Attribute Editor, where they can be edited. Connections to textures are probably best made through the Attribute Editor, and then additional utilities and optimizations can be made back in the Hypershade.

Let's try using the Attribute Editor to make connections to textures. We are going to continue working with the material we created earlier. If you no longer have that scene available, follow below Steps in the preceding section to create a Blinn material with a Grid texture connected to the Color attribute. Open the Attribute Editor, either by pressing CTRL-A, clicking the Show Attribute Editor button in the status line, or double-clicking a material node in the Hypershade.

Click the different nodes in the Workspace and notice how the Attribute Editor loads the specific attributes for the selected node. The Blinn material node attributes describe the basic surface characteristics, the checker texture attributes contain values that edit the colors in that Grid pattern, and the placement node attributes have values for translations, rotation, and other spatial attributes. Let's change the color of the Grid pattern. Select the Grid texture node in the Hypershade. In the Attribute Editor, click the color swatch in the Line Color attribute. The Color Chooser, shown here, will open. Use the Color Chooser to change the white to red. Click the Accept button to close the Color Chooser.

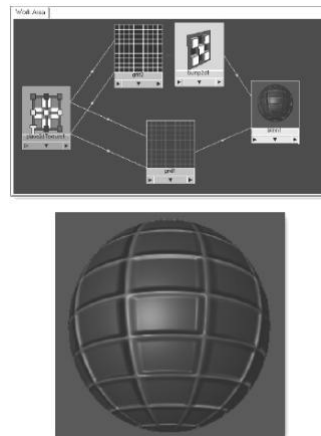
In the Attribute Editor, you can use the slider to the right of the color swatch to change the brightness value of the red. Change the Filler Color attribute to blue.

Now we'll change the tiling of the Grid pattern. Select the 2D placement node (named place2dTexture1) in the Hypershade to view its attributes in the Attribute Editor. Change the value of Repeat UV to 10 for both U and V, as shown in Figure below. The Grid pattern on the Grid node icon in the Hypershade window will change to show more tiles. Moving downstream, the Blinn material node also updates to show the new Grid pattern mapped to it.



Next, we'll edit the Bump attribute of the Blinn material node by connecting a texture to it. Select the blinn1 material in the Hypershade window to display its attributes in the Attribute Editor, Find Bump Mapping in the Attribute Editor (under Common Material Attributes). Click the checker button at the right to add a connection to this attribute. This will bring up the Create Render Node window.

The Create Render Node window, shown next, is really the same as the Create Render Node menu in the Hypershade window. Make sure that 2D Texture creation setting is set to Normal at the top of this window. Then select the Grid texture. You'll notice that in the Hypershade, a new Grid texture node is connected to a bump2d node, which is in turn connected to the Bump attribute of the Blinn material node. A bump map creates raised and indented areas in a surface when it is rendered. Lighter grayscale values raise the surface, while darker values create indentations.



Rendering Nodes and Their Attributes

In the last section, you saw some of the basic rendering nodes. Rendering nodes can be divided into five basic categories: materials,

textures, utilities, lights, and cameras. The Blinn and Lambert materials are examples of material nodes, the checker node is an

example of a texture node, and the placement node is a type of utility node. While we have already used these nodes, connected

them, and edited ,their attributes, we have only touched the surface. In the next few sections we will dig deeper and examine some

of the individual attributes of the material, texture, and utility nodes.

Material Nodes

Material nodes are responsible for controlling the characteristics of a surface. The main material nodes in Maya are Anisotropic,

Blinn, Lambert, Phong, Phong E, and Ramp Shader. While the texture nodes might display a pattern hinting at the material that a

surface could be made of, the material node is primarily responsible for communicating this effect. Even without a texture

containing pictorial details, the type of material node and the settings of its attributes will largely tell you the material is made of

plastic, metal, glass, rock, or other material. The way material interacts with its environment the objects, colors, and lights that

surround it provides most of the visual clues about its substance.

Take a moment to analyze the surface characteristics of a mirror. What color is a mirror? It is actually black, but it does not give off

any of its own color. Instead, its surface is almost completely reflective, so it just reflects what is around it. To create a material

attribute for a mirror surface, you would turn down the diffuse value all the way, so that the color of the object is not reflected back

into the camera.

All the materials in Maya share the same set of attributes. These are known as the common material attributes. Where these

materials differ is in the way they calculate their specular and reflection attributes, if they have any. The Lambert material does not

have any specular attributes. It is best used for matte surfaces, such as chalk or certain types of paper or fabric.

Common Material Attributes

The common material attributes for all of Maya's materials are as follows:

Color The color of the material. Assigning an RGB or HSV (Hue, Saturation, Value) value using the Color Chooser sets this attribute.

Its brightness value can be controlled with the slider.

Transparency Controls the transparency/opacity of the surface. A value of 0 (black) renders the image 100 percent opaque. A value of 1 (white) renders the object totally transparent. A color value can also be used; it will act as a color filter

over objects behind it.

Ambient Color Sets the color of the darkened or black areas. Think of it as bringing up the black contrast levels of an image in

Photoshop. When used together with ambient lights, the color and brightness of the lights control the amount of ambient color specified in this attribute, which will contribute to the final render.

Incandescence Controls the self-illumination, or luminance, of the object. This attribute creates the illusion that the object is emitting light. The material will illuminate the color set using the Color Chooser with the brightness amount set with the slider. Note, however, that this will not cause the object to illuminate any objects around it.

Bump Mapping Alters the surface normals to create the illusion of raised areas and indentations on a surface. This attribute uses an 8-bit grayscale image to assign transparency values: 0 (black) is the lowest or deepest, while 1 (white) appears to be raised or highest.

Diffuse Sometimes called falloff, this attribute controls the amount of light reflected back from the surface. At a value of 1, the surface will reflect back 100 percent of the color specified in the color channel. The default value is 0.8.

Translucence Controls the amount of light that can pass through an object. Think of the way light travels through wax, leaves, and certain plastics and rubbers. At a setting of 0.0 (the default), no light shows through. At 1.0, all light shows through.

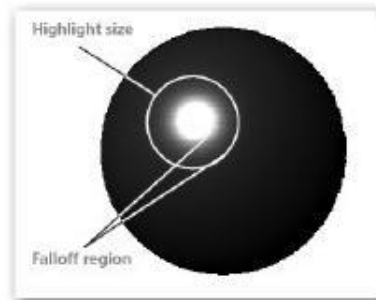
Translucence Depth Controls the amount of decay that will occur as the light moves through the object. When the value is set to 0, no decay occurs and the light emitted through the other side will be just as bright. In most cases, the light will lose some of its brightness and decay before it reaches the other side of the object.

Translucence Focus Sets the amount of blurring on the surface of backlit objects. The light scattering on a thin surface, such as a leaf or skin, will cause this effect. At 0.0, light is scattered in all directions.

Specular Shading Attributes

As mentioned, specularity controls the reflectivity of a surface. Even a surface that doesn't necessarily reflect objects around it will reflect the light sources that illuminate it. This is known as the specular reflection. The specular attributes differ slightly depending on the material you are using. Usually some type of control can be used for the size of the highlight

and another control for how it falls off; this is illustrated in Figure given below. Some materials, such as the Phong material, use composite algorithms to calculate the specular shading; others, such as Phong E, Blinn, and Anisotropic, break up the specular attributes into several attributes for finer control. The Anisotropic material even lets you control the shape of the specular reflections.



The reflectivity of an object determines how much of the environment or other objects will be reflected from the surface. The color of the reflection is determined by the reflected Color attribute. For a surface to reflect objects around it, raytracing

must be turned on in the Render Settings window. Because raytracing is very processor-intensive, it can take a long time to render.

Consequently, reflections sometimes faked by applying an environmental reflection map to the reflected Color attribute.

Texture Nodes

Texture nodes contain the picture or pattern that will be mapped onto a material. In Maya, you can use a procedural texture or a file texture.

Procedural Textures

Procedural textures are completely computer generated from mathematical equations. Checker, bulge, fractal noise, and cloth are all examples of procedural textures. Each has its own specific parameters to achieve its unique results. One of the biggest advantages of using procedural texture maps is that they are resolution-independent. Whereas bitmapped file textures start to soften and break apart as you zoom closer, procedural textures remain infinitely sharp no matter how close you get.

A subset of procedural textures is called 3D textures. Because a procedural texture is not limited to 2D pixel information, the

computer is able to calculate the depth of a texture. Marble or any kind of rock is a good example from the real world. The

patterns in marble are continuous through its mineral layers, changing slightly from slice to slice. A 3D texture in Maya behaves the same way. This texture is especially useful if the surface is semitransparent.

File Textures

File texture nodes contain a bitmapped image that is imported into the scene. This image can be loaded through the Image Name attribute in the file texture node's Attribute Editor. Further adjustments can be made to this image in the Color Balance section of the file texture's Attribute Editor. Color Gain and Color Offset control the brightness and contrast of the texture's RGB channels, and Alpha Gain and Offset control the levels of the file texture's alpha channel.

Placement Nodes

A placement node is a type of utility node. These nodes are automatically created with and connected to a texture node. They can also be created through the Create utility menu. Placement nodes control how a texture is mapped to a surface. Two basic kinds of placement nodes can be used: 2D and 3D. To understand the difference between these nodes and how to use them, we first need to talk about how a texture is mapped to a surface.

2D Placement Node

Whenever you are dealing with a 2D texture—whether it's a procedural or a bitmap image you will use at least the 2D placement node. This node controls how the texture map is placed within the UV space from 0 to 1. Let's take a look at some of the attributes of the 2D placement node and the ways they affect how the texture is mapped. The first three attributes listed in the Attribute Editor deal with how the texture frame is laid out. The rest of the attributes deal with how the texture behaves within that frame.

Coverage Controls the amount of surface the texture covers. A value of 0.5 for the U value covers 50 percent of the surface in the U direction. This value can be interactively changed

in the view window by clicking the Interactive Placement button in the 2D placement node's Attribute Editor and MMB-dragging the edge of the 2D placement frame on the surface in the view window.

Translate Frame Sets the position of the covered area. This value can be interactively edited in the view window using the placement tool: MMB-drag in the middle of the frame and position the texture in the desired position.

Rotate Frame Orients the covered area. To rotate the frame interactively with the placement tool, MMB-drag one of the corners of the frame. **Mirror U and V** Mirrors the tiles next to one another to hide possible tiling artifacts, such as seams. This attribute requires that the Repeat values be set to more than 1.

Wrap U and V Sets whether a map is repeated in U and V over the entire surface.

RepeatUV Specifies how many copies of the texture map are mapped within the coverage area along either the U or V direction.

This is sometimes called tiling.

Offset Offsets the pattern of the texture map.

RotateUV Rotates the texture itself. Realize that this differs from Rotate Frame in that the actual transforms of the frame remain. It is just the texture map within that frame that rotates. **Noise UV** Randomly displaces the colors of the texture. This can be helpful in breaking up recognizable repetitions or patterns.

3D Textures and 3D Placement Nodes:

As mentioned, the 3D placement node is used mainly to position a texture or projection node in 3D space. While you have already seen how it is used to position a projection node that is projecting a 2D texture, you've not yet seen it used for a 3D texture. A 3D texture is a special kind of procedural texture map. Instead of being a flat surface, the 3D texture has depth to it. This means that you could map a 3D texture to a sphere and not worry about it stretching anywhere. All points in the surface in 3D space are evenly mapped. The `place3dTexture` node positions the 3D texture. This illustration shows a 3D marble texture applied to a head. The box around the head is the placement node used to position the texture. The 3D placement node is really not much more than a basic transform node. In this situation, the placement node is positioned in world space. The transform tools are used to

move, rotate, and scale the texture. Since the placement of a 3D texture is based on the
place3dTexture node's world space coordinates, realize

that any object with a projection or texture that is mapped with a 3D placement node will “move through” the 3D texture space when the object is transformed in any way.

One way to avoid this would be to group the place3dTexture node to the object to which it is being mapped. However, while this will work fine for rigid objects such as spaceships or cars, you’ll have problems if the mapped geometry deforms. Therefore, when using 3D textures that need to stay put, it is a good idea to “bake” them onto a material. This can be done by selecting the material node and the surface it is mapped onto and choosing Edit | Convert to File Texture in the Hypershade. This will save a texture map corresponding to how the material is mapped to the surface and will create a duplicate of the material with the texture nodes mapped as normal textures.

6.5 IPR RENDER

There are a few limitations to using IPR for fast visual feedback as you adjust shading and lighting. Besides being unable to provide production-quality anti-aliasing, IPR cannot display several other advanced display characteristics, for example, true surface reflections (raytracing) and 3D motion blur. If an advanced display characteristic seems to be missing from an IPR-rendered frame, try rendering the frame with the software renderer.

If you change the camera view, turn Depth Map Shadows on or off, or reposition shadows, IPR does not update the rendered image automatically. You must refresh the image. From the Render View window, select IPR > Refresh IPR Image.

6.6 Material

A material type (also referred to as a shading model) defines how a particular shading material on a surface simulates a natural reaction to light. Blinn, Phong, and Lambert are a few examples of material types available in Maya. Each of these material types provide distinct shading characteristics based on the mathematical algorithms that define them.

From the settings you’ve made so far, you may decide you want to give the orange a different look than possible with the Blinn material. You will now change to a different

material for comparison. Getting Started with Maya 466 9 | Rendering Lesson 2 > Assigning textures

To set the material type

1 Next to the Type attribute near the top of the Attribute Editor, pull down the menu and select Phong E.

Phong and Phong E are variations of the Lambert material type, with specular highlights added. The main difference between materials is the way each handles specularity. By switching between the material types, you can compare which material gives you the specularity you need.

Your settings for the Color and Diffuse attributes are maintained because they are common to all material types. The Specular Shading and all other attribute settings do not convert when you change the material, so it's best to choose your material before you make many changes.

2 In the Specular Shading section, you can leave Roughness and Highlight Size at the default settings. The default highlight settings give the orange a waxy look.

These attributes are similar to the Blinn attributes, Eccentricity and Specular Roll Off. Unlike the Blinn counterparts, these highlights do not appear in the scene view. You can see the highlights only in a rendered image and in the Material Sample.

3 The Phong E material type has a Whiteness attribute not available with Blinn. Change Whiteness to a light gray to accentuate the highlights.

This change is subtle, so drag the slider back and forth while watching the effect in the Material Sample or in an IPR region.

Look for the entire highlighted area to become whiter. Again, a strong highlight will create a waxy look.

6.7 Summary

By now, you should have a pretty good idea of how to create and edit materials and be somewhat comfortable with using the Hypershade to make connections between nodes.

6.9 Assessment

1. Explain Hypershade
2. Explain IPR render

Short notes

1. Raytracing
2. Lambert
3. Material
4. Shading
5. 2d texture and 3d texture

6.10 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training .Autodesk Maya Press, **Marc-André Guindon**

Unit 7 EDITING UVS



Learning Outcome

After going through this unit, you will learn:

- UV
- UV Texture Editor
- Create UVs



Time Required to Complete the unit

The time required to study this Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

- 7.1 UVs
- 7.2 Mapping
- 7.3 UV Texture Editor
- 7.4 Create UVs

7.5 Summary

7.6 Self Assessment Test

7.7 Further Reading

7.1 UVs

UV texture space is another coordinate system in 3D and it is used for mapping textures on surfaces and UVs are points that provide the information needed to apply textures to the surface. Subdivision surfaces and polygons require specific arrangement of the UVs so that textures look correct when applied to the surface material. Typically, you arrange UVs after you have completed your modeling and before you assign textures to the model. UVs act as marker points that control which points (pixels) on the texture map correspond to which points (vertices) on the mesh. You can see the texture space coordinates in UV Texture Editor.

7.2 Mapping

UV mapping is a process whereby you create, edit, and otherwise arrange the UVs that appear as a flattened, two-dimensional representation of the surface mesh, over top of the two-dimensional image to be used as a texture as it appears in the UV Texture Editor. UV mapping is a critical skill to master for accurate and realistic textures on polygonal surfaces. In Maya, UV texture coordinates (UVs) can be created for polygon

surface meshes using the following UV mapping techniques:

1. Automatic UV mapping
2. Planar UV mapping
3. Cylindrical UV mapping
4. Spherical UV mapping
5. User-defined UV mapping

6. Camera UV mapping

Automatic UV mapping

Automatic mapping creates several UV map pieces or shells in texture space by attempting to find the best UV placement by simultaneously projecting from multiple planes.

Planar UV mapping

Planar mapping projects UVs onto a mesh through a plane. This type of mapping is best suited for planar objects.

Cylindrical UV mapping

Cylindrical mapping creates UVs for an object based on a cylindrical projection shape that gets wrapped around the mesh. This type of mapping is best suited for cylindrical objects.

Spherical UV mapping

Spherical mapping creates UVs using a projection that is based on a spherical shape wrapped around the mesh. This type of mapping is best suited for spherical objects.

User-defined UV mapping

User-defined UV mapping is the same as automatic mapping. The only difference is that in user-defined you can map UV texture coordinates by specifying user-defined planes for UV projection using the Load Projection option.

Camera UV mapping

The camera UV mapping creates a Planar UV mapping. The current camera view plane is used as the plane for the planar projection.

7.3 UV Texture Editor

The UV Texture Editor lets you interactively edit UV texture coordinates for polygons and subdivision surfaces. You can select, move, scale, and generally modify the UV topology for a surface. You can also view the image associated with the assigned texture map as a

backdrop within the UV Texture Editor and modify the UV layout to match as required.

UV Toolbar

UV Lattice Tool This tool is used to manipulate the lay out of UVs as a group by letting you create a lattice around the UVs for deformation purposes.

Move UV Shell Tool

Move UV Shell tool lets you select and reposition a UV shell by selecting a single UV on the shell.

UV Smudge Tool

UV Smudge Tool moves the position of selected UVs and their neighboring UVs. **Select Shortest Edge Path Tool** The Select Shortest Edge Path Tool determines the most direct path between any two selection points and selects the polygon edges in between.

Flip U

It flips the positions of the selected UVs in the U direction.

Flip V

It flips the positions of the selected UVs in the V direction.

Rotate UVs counterclockwise

It rotates the positions of the selected UVs by 45 degrees in a counterclockwise direction.

Rotate UVs clockwise

It rotates the positions of the selected UVs by 45 degrees in a clockwise direction.

Cut UVs along selection

This tool separates UVs along the selected edges, creating borders.

Split UVs

This tool separates UVs from each other along the edges connected to the selected UV points, creating borders.

Sew UVs

Attaches UVs along the selected borders, but does not move them together in the texture editor view.

Move and Sew UVs

Attaches UVs along the selected borders, and moves them together in the texture editor view.

Layout

This tool attempts to arrange the UVs into a cleaner layout.

Grid UVs This tool moves every selected UV to its nearest grid intersection in editor window.

Unfold

Unfold unwraps the selected UV mesh while attempting to ensure that the UVs do not overlap.

Relax

Relax spreads out the selected UV mesh to make it easier to work with.

Align Min U

This tool aligns the positions of the selected UVs to the minimum U value.

Align Max U

This tool aligns the positions of the selected UVs to the maximum U value.

Align Min V

This tool aligns the positions of the selected UVs to the minimum V value.

Align Max V

This tool aligns the positions of the selected UVs to the maximum V value.

Toggle Isolate Select Mode

This tool switches between showing all UVs and only the isolated UVs.

Add selected to isolation

This tool adds the selected UVs to the set of isolated UVs.

Remove selected from isolation

This tool removes the selected UVs from the set of isolated UVs.

Remove all

This tool clears the isolated subset.

Display Image

Display Image tool shows or hides the texture image in the editor window.

Toggle Filtered Image

This tool switches the background image between hardware texture filtering and sharply defined pixels.

Dim Image

This tool reduces the brightness of the currently displayed background image.

View Grid

View Grid option displays or removes the grid.

Pixel Snap

If this is on, UVs automatically snap to pixel boundaries.

Shade UVs

This tool shades selected UV shells in a semi-transparent fashion so you can determine areas where UVs overlap.

Toggle Texture Borders

This option toggles the display of texture borders on UV shells.

Display RGB Channels

This option displays the RGB channels of the selected texture.

Display Alpha Channel

This option displays the Alpha channel of the selected texture.

UV Texture Editor Baking

This option bakes the texture and stores it in memory.

Update PSD Networks

This option updates or refreshes the PSD textures currently in use for the scene.

Force editor texture rebake

This option rebakes the texture after you make changes to the textures. Use Image Ratio

If this is on, the texture will be shown in its aspect ratio.

7.4 Create UVs

Creates UV texture coordinates for the selected object based on the current camera view as a planar projection. That is, the camera view becomes the plane of projection.

Best Plane Texturing Tool

Assigns UVs to the faces you select based on a plane computed from vertices you specify.

Assign Shader to each Projection

When Assign Shader to each Projection is turned on, a shader with a checkerboard texture is assigned to the selected mesh as you project UV texture coordinates. This aids in determining the alignment of the UVs by providing a known visual reference. The default setting is off.

Create Empty UV set

Creates a new, empty UV set on the current object. You can then create the UVs in the set using one of the mapping/projection methods. This feature is also available for use from the Polygons menu in the UV Texture Editor.

Copy UVs to UV set

Creates a new UV set based on an existing UV layout or transfers a UV layout from one set to another. This feature is also available for use from the Polygons menu in the UV Texture Editor.

Set Current UV set

Lets you specify which UV set you want to use for a particular polygon mesh. You specify which set you want by typing t he name of the UV set in the text field that appears. This feature is also available for use from the Polygons menu in the UV Texture Editor.

Rename Current UV set

Lets you rename the currently selected UV set. This feature is also available for use from the Polygons menu in the UV Texture Editor.

Delete Current UV set

Deletes the currently selected UV set. This feature is also available for use fromthe Polygons menu in the UV Texture Editor.

7.5 Summary

In chapter we covered UVs and UV textrure editor.

7.13 Self Assessment Test

1. What is Mapping ?
2. What is uv texture editor?

Short notes

1. Automatic Mapping
2. Camera UV Mapping
3. unfold
4. relax
5. Update PSd network

7.14 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training .Autodesk Maya Press, **Marc-André Guindon**

Unit 8 LIGHTING



Learning Outcome

After going through this unit, you will learn:

- Light
- Light linking
- Maya software Rendering



Time Required to Complete the unit

The time required to study this Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

8.1 Creating lights

8.2 Lighting Types

Create > Lights

Setting up for lighting

8.3 Concept of three point lights

8.4 Light Linking

8.5	Light Baking
8.6	Indirect Illumination
8.7	Shadows
8.8	Maya Software Rendering
8.9	Maya Hardware Rendering
8.10	Summary
8.11	Assessment
8.12	Further Reading

8.1 Creating Lights

Maya's light nodes are designed to work just like lighting in the real world. This allows a traditional lighting designer to begin using Maya quickly, because the tools have familiar names and behaviors. Traditionally, lights serve two main purposes in film and still photography. The first is, obviously, to illuminate the scene being photographed.

Without light there would be no color—the printed film would be nothing but black. The other purpose for lighting is to add a dramatic effect or mood to a scene. In fact, lighting may be one of the first visual effects ever used. Heroic characters are traditionally well lit, even shining, whereas villains lurk in shadows or are backlit. Just as it is important to do research and collect references on your models and textures, it is important to take notice of lighting, both in the natural world and in the movies.

8.2 Lighting Types

Maya's light nodes are designed to work just like lighting in the real world. This allows a traditional lighting designer to begin using Maya quickly, because the tools have familiar names and behaviors. Traditionally, lights serve two main purposes in film and still photography. The first is, obviously, to illuminate the scene being photographed.

Types of Lights

Maya has six different types of lights: ambient, area, directional, point, spot, and volume.

All these lights can be created from the main Create | Lights menu or in the Create Lights menu in the Hypershade. The different types of lights (shown in fig below)

create the following effects:

- Ambient light simulates diffused lighting in all directions. Use this light as a fill light to brighten the dark areas of the scene or to even out the lighting entirely.

Directional

Point

Spot

Volume

- An area light is a 2D rectangular light source. The size of the light, which can be determined using the standard scale tools, has a direct effect on the distribution of the light in the scene. Sunlight coming through a window is a common example: the light can be caled to fit the window shape while the reflection of the light on, say, the floor is brightest closest to the window and falls off farther away from the window.
- Directional light shines evenly in one direction only, such that the rays are emitted parallel to each other from an infinitely large plane. Use this light to simulate a light source such as the sun. Maya uses a directional light as the default light in the scene.
- A point light shines evenly in all directions from the location of the light. Use a point light to simulate an incandescent light bulb.
- A spot light shines evenly within a narrow range of directions (defined by a cone) from the location of the light.

Use a spot light to create a beam of light that gradually becomes wider—for example, a flashlight or car headlight.

- A volume light illuminates objects within a finite region defined by a primitive shape: sphere, box, cylinder, or cone. The direction of the light can be set to outward, inward, or down, making a volume light capable of simulating many of the other light types in Maya.

Another advantage of using a volume light is that its total decay distance is indicated by its icon in the view window, so precise placement is easily achieved without having to do numerous test renders. The color range is also controllable through a ramp interface. This allows you to control the color of the light at any point along its volume decay. It can also be used to control the falloff.

8.3 Concept of three point lights

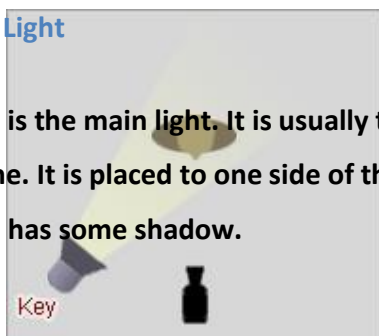
The *Three Point Lighting Technique* is a standard method used in visual media such as video, film, still photography and computer-generated imagery. It is a simple but versatile system which forms the basis of most lighting. Once you understand three point lighting you are well on the way to understanding all lighting.

The technique uses three lights called the key light, fill light and back light. Naturally you will need three lights to utilise the technique fully, but the principles are still important even if you only use one or two lights. As a rule:

- If you only have one light, it becomes the key.
- If you have 2 lights, one is the key and the other is either the fill or the backlight.

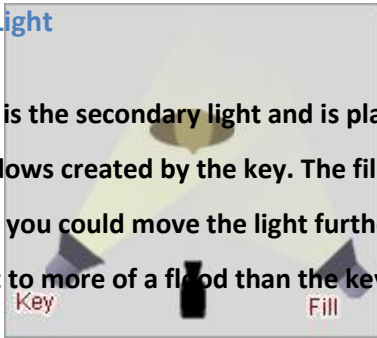
Key Light

This is the main light. It is usually the strongest and has the most influence on the look of the scene. It is placed to one side of the camera/subject so that this side is well lit and the other side has some shadow.



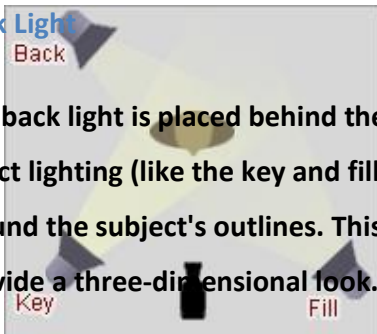
Fill Light

This is the secondary light and is placed on the opposite side of the key light. It is used to fill the shadows created by the key. The fill will usually be softer and less bright than the key. To achieve this, you could move the light further away or use some spun. You might also want to set the fill light to more of a flood than the key.



Back Light

The back light is placed behind the subject and lights it from the rear. Rather than providing direct lighting (like the key and fill), its purpose is to provide definition and subtle highlights around the subject's outlines. This helps separate the subject from the background and provide a three-dimensional look.



If you have a fourth light, you could use it to light the background of the entire scene.

8.4 Light Linking

With the help of light linking you can link lights with the nodes in the scene. When you link the light to a specific node, the light will affect that node only. Light linking is done using Relations hip editor. Two type of light linking are available:

light centric in which you c onnect light to the illuminated objects and other one is object centric in which a specific obj ect (node) is connected to the lights.



8.5 light Baking

This process is also called Light Mapping.

Light Baking is a method of sampling an object before rendering, and storing the results for later on uses.

It is the most common application that samples illumination for each point of a texture image wrapped around to the object and stores that illumination in the texture. Here the Illumination is effectively frozen into the texture and later it can be mapped onto an object in the conventional way.

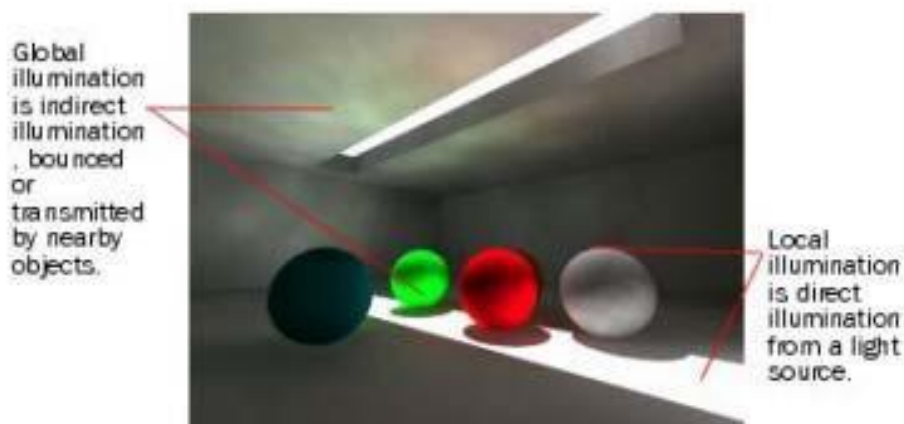
Light Baking was introduced with mental ray 3.0. It is very flexible and user friendly to use as it is given in mental ray. Here Lightmap Shaders are very supportable with this option here. When you attach Lightmap Shader to the material then the Light Baking gets on for the object on which you have applied the same material.

The advantage of Light Baking is that rendering can obtain illumination quickly from the frozen illumination, instead of computing it at rendering time which takes a long time as per the file size and the calculation of the bounced lights. It is especially valuable for indirect illumination which takes more time to compute than direct illumination. So, it is very useful in gaming.

8.6 Indirect Illumination

Indirect Illumination is also called Global Illumination.

Indirect Illumination is the technique used to capture indirect illumination, the natural phenomenon where light gets bounced off anything in its path until it is completely absorbed in the environment. Illumination is the calculation of the bounced light. Direct Illumination is the light which falls on the object directly and gets bounced from the object and the object is visible. Indirect Illumination is the light which is already bounced by the object and is spread in the environment.



Here the objects in the place where the light is not falling they are also becoming visible to our eyes. For example – If the light enters in a dark closed room from a small window then also all the area and objects are becoming visible to our eyes. They are not very bright to see but you can see each of them at least. This happens due to the light which gets bounced by the object on which it falls. Here the intensity and material of the object which bounces the light is also very important.

8.7 Shadows

Shadows are the darkened areas which appear on a surface as an object gets in the path of a light source. Shadows fall onto the area of a surface that doesn't directly receive light and

which is opposite to the light. Shadows ground the objects in your scene and help in defining their three-dimensional appearance. Shadows make your scene real looking.



8.8 Maya Software Rendering

Software Rendering

Software rendering produces images of the highest quality, letting you achieve the most sophisticated results. Maya has the following software renderers:

1. The Maya software renderer: Maya's software renderer is an advanced, multi-threaded renderer. It is a hybrid renderer, offering true raytracing plus the speed advantages of a scan-line renderer. The Maya software renderer supports all of the various entity types found within Maya including particles, various geometry and paint effects and fluid effects.

The Maya software renderer features IPR, a tool designed to allow you to make interactive adjustments to the final rendered image, and which greatly enhances rendering productivity. Most importantly, the nature of Maya's integrated architecture allows complex interconnections, like procedural textures and ramps that govern particle emission and other unpredictable relationships that are capable of producing stunning visual effects.

2. mental images mental ray for Maya : mental ray for Maya offers all the features traditionally expected of photorealistic rendering and includes functionality not found in most rendering software. mental ray for Maya allows interactive and batch mental ray rendering from within the Maya user interface.

8.9 Maya Hardware Rendering

Hardware rendering uses the computer's video card and drivers installed on the machine to render images to disk. Hardware rendering is generally faster than software rendering, but typically produces images of lower quality compared to software rendering. Hardware rendering cannot produce some of the most sophisticated effects, such as some advanced shadows, reflections, and post-process effects. To produce these kind of effects, you must use software rendering.

8.9 Summary

In this chapter, you learned about the different types of lights and their properties. The techniques shown in the tutorials outlined some very useful procedures you can use to create some very realistic lighting effects without using any physically accurate rendering schemes. As you will see in the next chapter, while these new rendering schemes produce very realistic lighting conditions, they come at a cost of rendering time.

8.10 Self Assessment test

1. What is light?
2. Explain Types of lighting

Short Notes

1. Volume light
2. Maya Hardware Render
3. Maya Software Render
4. Shadow
5. Light Baking

8.11 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**

2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training .Autodesk
Maya Press, **Marc-André Guindon**

Unit 9 RENDERING AND CAMERA



Learning Outcome

After going through this unit, you will learn:

- Cameras
- DOF
- Motion blur



Time Required to Complete the unit

The time required to study thus Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

9.1 CAMERAS

9.2 Explain Camera and its uses.

9.3 Creating And Animating Cameras

9.4 To Create a new camera

9.5 Create >

9.5 Camera Attributes and Effects

9.6 Batch Rendering

9.7	Depth Of Field
9.8	Motion Blur
9.9	Summary
9.10	Assessment
9.11	Further Reading

9.1 Cameras

In Maya, two types of cameras are available: Perspective and Orthographic. By default, you have three orthographic cameras, Top, Front and Side and one perspective camera Perspective (preps). For rendering, you must use custom (user) cameras

9.2 Explaing Cameras and it uses

The . You can place custom cameras anywhere in the scene; even inside a very small thing as well as you can animate custom cameras. You have three types of custom cameras:

- a) **Camera:** You can use camera for static scenes or simple animation.
- b) **Camera and Aim:** You can use camera and aim to create little complex animations where camera should focus on something like a randomly flying insect
- c) **Camera, Aim and Up:** You can use camera, aim and up in such animation where you want to control the up axis of the camera too.

9.3 Creating And Animating Cameras

When you first begin animating the camera, it helps to follow the rules of videography, such as avoiding jarring camera motions—rapid pans, zooms, or rotations of the camera. In addition, you should usually give the camera the impression of having mass. The virtual

camera, by default, starts and stops moving instantly, which looks unrealistic and abrupt to viewers. To avoid this problem, adjust the tangents for the camera position's start and stop keys in the Graph Editor so that motion begins and ends gradually . Do the same for the camera's aim point keys and any other animated camera attributes

9.4 To Create a new camera

Create > Cameras > Camera

There are three types of perspective cameras in Maya. As with Maya's lights, you can change a camera to any other camera type in the Attribute Editor.

Camera

With this camera type, you see only the camera icon. In general, because this camera freely rotates and loses track of its "up" vector, you should use it only when you're linking the camera to another object for movement and animation, or when you're placing a camera in one fixed spot.

Camera and Aim

This camera includes a camera target and an aim handle for adjusting the camera target. In addition, this camera automatically stays level in relation to the horizon, so it's the one you'll use most often. You can make this camera roll if you want, but by default, it stays level except at extreme straight-up or straight-down orientations.

Camera, Aim and Up

This camera type includes two handles: the aim handle, described for Camera and Aim, and an up handle for banking (leveling) the camera. This camera type is useful when you want to bank the camera during your animation.

9.5 Camera Attributes and Effects

A camera's exposure settings determine depth of field (the region of sharp focus), and whether or not subject matter is crisp or blurred by motion. In real-world photography, together the fStop and shutter speed determine how much light is exposed to film. However, fStop and shutter speed also determine what is in focus. The length of time light is allowed to pass through the camera lens to the film is determined by the shutter speed. The higher the speed, the shorter the exposure time, the less light exposed to the film. The amount of light that is allowed to pass through the camera lens to the film is determined by the camera's aperture setting (also known as the fStop). The wider the aperture, the

more light exposed to the film.

Major Attributes of the camera are:

Angle of view/Focal Length

The focal length of a lens is the distance from the center of the lens to the film plane. The shorter the focal length, the closer the focal plane is to the back of the lens. Increasing the Focal Length zooms the camera in and increases the size of objects in the camera's view. Decreasing the Focal Length zooms the camera out and decreases the size of objects in the camera's view. Lenses are identified by their focal length. Focal length is expressed in millimeters.

Camera scale

Scales the size of the camera relative to the scene. If camera Scale is 0.5, the camera's view covers an area half as large, but objects in the camera's view are twice as large.

Auto Render Clip Plane

If this is on, the near and far clipping planes are automatically set so they enclose all objects within the camera's view. This option works only with Maya software renderer. If off, the near and far clipping planes are set to the Near Clip Plane and Far Clip Plane attribute values.

Film Back

The Film Back attributes control the basic properties of a camera.

1. Film Gate: Film Gate lets you select a preset camera type.

2. Camera Aperture: The height and width of the camera's Film Gate setting, measured in inches.
3. Film Aspect Ratio: The ratio of the camera aperture's width to its height.
4. Lens Squeeze Ratio : The amount the camera's lens compresses the image horizontally. Some cameras, anamorphic cameras, compress the image horizontally to record a large aspect ratio image onto a square area on film.
5. Fit Resolution Gate: Fit resolution gate controls the size of the resolution gate relative to the film gate.
6. Film Fit Offset : Film fit offset offsets the resolution gate relative to the film gate either vertically or horizontally.
7. Film Offset: Film offset offsets vertically and horizontally the resolution gate and the film gate relative to the scene.
8. Pre Scale: This value indicates the artificial 2D camera zoom.
9. Film Translate: The Film Translate value indicates the artificial 2D

camera pan.

10. Film Roll Pivot: The Film pivot point is used to rotate from the center of the film back.
11. Film Roll Value: This specifies the amount of rotation around the film back.
12. Film Roll Order : Film Roll order specifies how the roll is applied with respect to the pivot value.

Output Settings

Output settings controls whether the camera generates an image during rendering, and what types of images the camera renders.

1. Renderable: If on, the camera can create an image file, mask file, and, or depth file during rendering.
2. Image : If on, the camera creates an image file during rendering.
3. Mask: If on, the camera creates a mask during rendering.

4. Depth : If on, the camera creates a depth file during rendering. A depth file is a type of data file that represents the distance of objects from the camera.
5. Depth Type: This option determines how to compute the depth of each pixel.

Environment

Environment control the appearance of the scene's background as seen from the camera.

1. Background Color : This is the color of the scene's background when it is rendered.
2. Image Plane : You can not apply texture to background color. For textures, you can create an Image plane and then apply texture on the plane.

Shutter Angle \

The Shutter Angle influences the blurriness of objects of motion blurred objects.

The larger the Shutter angle setting, the more blurry objects. Shutter Angle is measured in degrees.

9.6 Batch Rendering

Generally Maya renders only the current frame. If you want to render number of frames (animation), you have to use batch render. You can give the batch render command from the Maya and you can also batch render from the command prompt. Before giving the command, make the following changes in the render options:

1. Set the filename.
2. Set the Frame/Animation extension for the file.
3. Set the Image format, for example single file like avi or you can generate sequence of images.
4. Set the video compression.
5. Set the starting and ending frames.
6. Set the camera through which you want to render.
7. Set the Image size in which you want to render.

8. In Maya Software tab set Anti-aliasing quality to Production quality.
9. If Reflection and Refraction is used then Activate Raytracing.
10. Then go to Rendering menu set, Render Menu and choose batch render. In the batch render option box you can specify whether to use all the available processors or you can enter number of processes. These work only on multi-processor machines. You can continue using the Maya or you can close Maya and start working on different application while batch rendering is going.

9.7 Depth of Field

Depth of field is the region of sharp focus in a photograph. Depth of field is determined by the camera's aperture setting. At wide aperture settings, the depth of field is shallow. At narrow aperture settings, the depth of field is deep, and more of the foreground and background is in focus.

9.8 Motion Blur

Motion blur gives the feeling of motion. Motion blur is determined by the shutter speed. Fast motion appears motion blurred at slower shutter speeds. Motion blur can be turned on and off on a per-object basis.

9.9 Summary

In this chapter, you learn how to Render a preview quality for test renders and how to render final output, Film Quality with the software renderer. You also learn how to apply Motion blur and environment fog to the scene. In the next chapter you will learn Mental ray rendering.

9.10 Self Assessment Test

1. Explain Types of Camera.
2. Explain Depth of Field.

Short notes

1. Shutter angle
2. Film Gate
3. Angle of view/Focal Length
4. Motion Blur
5. Camera and aim

9.11 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training .Autodesk
Maya Press, **Marc-André Guindon**

Unit 10 MENTAL RAY RENDERER



Learning Outcome

After going through this unit, you will learn:

- Mental Ray
- HDRI
- Caustic
- GI



Time Required to Complete the unit

The time required to study this Unit is broken as follows

1. 1st Reading: It will need 2 Hrs for reading a unit
2. 2nd Reading with understanding: It will need 3 Hrs for reading and understanding a unit
3. Self Assessment: It will need 3 Hrs for reading and understanding a unit
4. Revision and Further Reading: It is continuous process



Content Map

10.1 Final Gather

10.2 Global Illumination with Photons

10.3 HDRI

10.4 Caustics

10.5 Summary

10.6 Self Assessment Test

10.7 Further Reading

10.1 FINAL GATHER

Final gather is a method of global illumination to create very diffuse scenes where the indirect illumination changes slowly. Final gathering is a technique for estimating global illumination for a given point by either sampling a number of directions in the hemisphere over that point, or by averaging a number of final gather points nearby since final gather points are too expensive to compute for every illuminated point. Without final gathering, the global illumination on a diffuse surface is computed by estimating the photon density near that point.

With final gathering, many new rays are sent out to sample the hemisphere above the point to determine the incident illumination. Final gathering is useful in scenes where the indirect illumination varies slowly, such as purely diffuse scenes. For such scenes, final gathering eliminates photon map artifacts such as low frequency noise and dark corners.

If you want to use Final Gather, you have to enable the Final Gather from the render setting for mental ray for Maya renderer. The options available are:

1. **Final Gather** : Use this setting to turn Final gathering for global illumination on or off.
2. **Precompute Photon Lookup**: This option causes photon tracing to compute and store an estimate of the local irradiance at every photon location. This means that far fewer final gathering points are required because the photon map carries a good approximation of the irradiance in the scene—mental ray for Maya can estimate irradiance with a single lookup, instead of many photons. In this case, photon tracing takes longer than before and requires slightly more memory, but rendering is faster.

3. **Final Gather Rays:** This setting controls how many rays are shot in each final gathering step to compute the indirect illumination.
4. **Min Radius, Max Radius:** Max Radius and Min Radius control the size of the sampling region within which Final Gather rays search for irradiance information from other surfaces.
5. **View (Radii in Pixel Size):** This option causes the Min Radius and Max Radius of final gather rays to be calculated in pixel size , rather than in object space. This allows you to set the visual quality in pixel size, without knowing the object or scene bounds.
6. **Final Gather Scale:** The Scale value allows you to easily control the intensity and color of the final gather contribution on a global scene level.

10.2 Global Illumination with Photons

Global Illumination works by shooting photons from lights and creates a photon map according to their distribution in the scene. The way that these photons are distributed is based on the absorption, reflectivity, and refractivity of an object. The effects of this type of rendering are most noticeable in the color bleeding between objects and soft diffusion of light across scene. Render the image with the Maya software renderer. The result is shown in Figure as per given below. You can save this image and use it for comparison with the Global Illumination rendering we are about to perform.



Now to enable Mental Ray. In the Render Settings window, choose Mental Ray from the

Render Using pull-down menu. Select the Mental Ray tab. You should now be able to view the settings for Mental Ray, shown next.

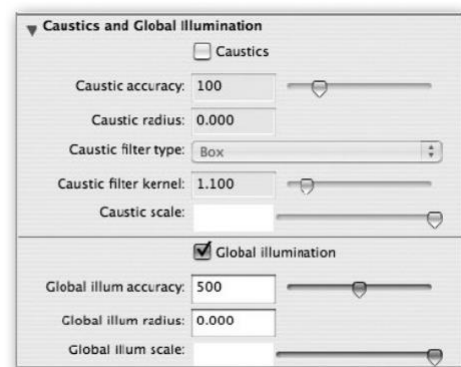
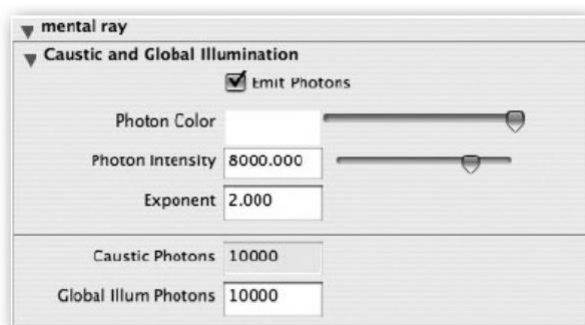
Choose Preview Global Illum for the Quality Presets setting. This turns on Global Illumination and sets the Sampling Quality attributes to a medium setting for faster renders. You can verify that Global Illumination is turned on by scrolling down to the Caustics and Global Illumination folder in the Render Settings window and making sure the box next to Global Illumination is checked.

If you were to render the scene right now, it would not look different from the last image we rendered with the Maya software renderer. This is because the lights in the scene have to be set up to emit photons in order for the Global Illumination to be calculated.

Select the point light in the scene (this is the only light used). In the Attribute Editor, scroll down and find the section named Mental Ray. In this section, click the box next to Emit Photons, as shown here.

The Photon Intensity attribute here controls the brightness of the emitted photons. If you click the Render button and don't see any Global Illumination effect, try increasing the Photon Intensity attribute value.

The Global Illum Photons attribute sets the number of photons that will be emitted from the light so that Mental Ray can render the Global Illumination effect. Because the number of emitted photons has an impact on render times, it is best to keep this as low as possible. Remember that the number of photons needed to create a quality render depends on the scale, in Maya units, of the scene being rendered. If the scene is small, it may not take too many photons to fill the area being rendered. Therefore, the correct number of photons will vary greatly from scene to scene.



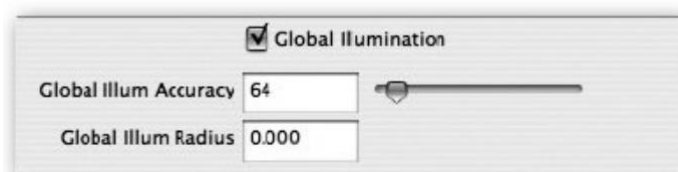
Set the Global Illum Photons attribute to 1000. This will be enough to cover the scene with photons, but they will not be so finely distributed that they can't be recognized. At this point, you have enabled enough controls for the renderer to make a Global Illumination calculation. Do a test render and view the results.

Figure given below shows the teapot rendered with these settings. Notice the big, circular-shaped spots of color all over the scene. By setting the Global Illum Photons value low, the photons are easy to see and should give you some idea of what they are doing to bleed the color throughout the scene.

To blend these photons in the rendered image, we will go back to the Render Settings window and adjust some more settings. The two attributes we will concentrate on in this step are Global Illum Accuracy and Global Illum Radius, shown and described here:

Global Illum Accuracy

Represents the number of photons that Mental Ray looks for within the area represented by the Global Illum Radius setting. It then composites what it finds, and the result is the Global Illumination effect. Low Global Illum Accuracy values yield grainy images, and high values give you smoother, more precise results but take more time to render. If you set the Accuracy value higher than the number of photons emitted by all the lights in the scene, your image will never render because the photon calculation won't finish.



Global Illum Radius

The size (in Maya units) of the effect that the photon produces when it hits an object. Larger numbers produce bigger effects but usually less accurate results. High Radius values combined with low Accuracy values can give you a good approximation of what your scene will look like and are great for test renders. Low Radius values combined with high Accuracy values provide the most accurate representation of the final image but take much longer to render. A value of 0 for either of these attributes tells the renderer to make its best guess. In the Render Settings window, begin adjusting the Global Illum Accuracy attribute. Set it to 1 and notice the effect. The photons are not sharing any space at all. You want to increase this value until it has little or no effect—this means that no more photons fall within that radius. For the accuracy to have any more effect, the number of photons emitted from the light must be increased. A value of around 60 works well for Global Illum Accuracy in this scene. Adjust the Global Illum Radius attribute. Increase it until the photons are big enough to cover the areas evenly but are not so spotty. A value of 4.5 is good. Return to the light's Attribute Editor and adjust the values for the Photon Intensity, Exponent, and the number of emitted photons. Increase the number of photons until they blend enough so that you can no longer make them out. Increase the Global Illum Photons attribute to 4500.

To determine how bright the overall effect will be, use the Photon Intensity attribute. A value of 7000 gives the walls a nice bleed from the green teapot. The scene was set up to use regular depth map shadows, but we need to turn shadows on in the Mental Ray Render Settings windows for them to render. Set the Shadow Maps to On. Figure given below shows the final rendered image for this scene.



10.3 HDRI

HDR Images with Final Gather

The term “image-based rendering” has become popular recently. It describes a type of rendering that uses images from the real world to calculate lighting.

When we start thinking about these concepts in terms of Final Gather, image-based rendering can mean that we use photographs from the real world to control the Incandescence attribute of our dome or irradiating surface’s material for the Final Gather render. The problem is, however, that a regular photograph does not have all of the information we need. We would need a file format that does not just record colors that are dark and bright, but one that understands overexposure as well.

Thanks to the work and research of Paul Debevec, we have an image format that encompasses all of this information into a single file. This file format is called the HDRI file format.

Paul Debevec’s website, at www.debevec.org/, offers a program called HDR Shop that allows you to create images in this file format. Images are also available on the site for download that can be used in Final Gather. This is what we will be working with in this section.

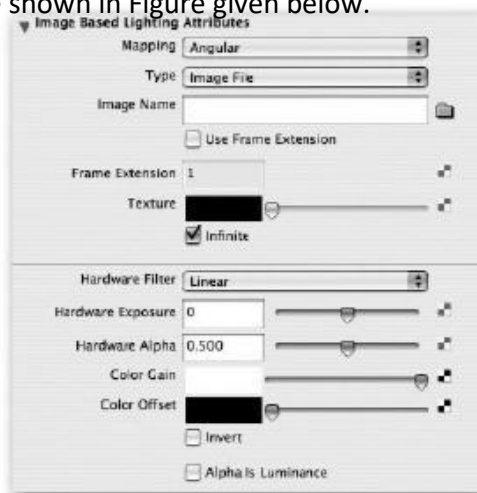
HDRI stands for high dynamic range imagery: a normal 24-bit image can represent brightness as only one of 256 levels—this means that a pixel with a brightness value of 256 (that is, white) is exactly twice as bright as mid-gray (brightness of 128). While color space represents a printed image fine, it bears no relation to reality, where the bright sky outside your window is, in fact, many thousands of times brighter than the mid-gray page in front of you, and the spot where the sun shines is probably millions of times brighter. By using a 32-bit floating point number (floating point numbers are capable of representing enormous ranges by moving their decimal points around) to represent each pixel brightness for R, G, and B instead of a limited 8-bit integer (a whole number limited to a range from 1 to 256), HDR images can truly represent the range of brightness found in real

life.

This is important if you want to re-create realistic lighting accurately using a rendering technique such as Final Gather.

In the Render Settings window, choose Render Using Mental Ray. You should now see the Mental Ray Render Settings tab. Set the Quality Presets attribute to PreviewFinalGather. Scroll down the list of attributes and turn off Global Illumination. Then, in the Final Gather section, check to make sure that Final Gather is enabled.

Select the light in the scene and turn its Intensity attribute all of the way down to 0. With Final Gather, we do not need to use any lights. Turning this down will keep Mental Ray from using the default lighting in the absence of any other lights. We could create a sphere, as we did in the previous tutorial, and then map the HDRI image to it, but instead we will use an image-based lighting node. This will create a spherical environment similar to an environment sphere that we have used in past tutorials, except the image based lighting node has specific attributes that let you control the lighting in the scene when using Final Gather. To create the image-based lighting node, find the Image Based Lighting section and click the Create button. The image-based lighting attributes are shown in Figure given below.



Open the Attribute Editor to view the attributes for the image-based lighting node. You'll see an attribute called Image Name. Click the File Browser button to browse and open any .hdr image: In the Render Settings window, find the Final Gather Rays attribute in the Final Gather section and set this to 200. This should provide you with a low-quality render that is

reasonably fast. You can adjust the brightness levels of the HDR image in the Attribute Editor by editing the Color Gain and Color Offset attributes. You can make any adjustments to the object's materials to control how they interact with the Final Gather rendering by going into each material's attributes and adjusting the Irradiance Color in the Mental Ray section..

10.4 Caustics

Mental ray can render with Caustics, the light effects that caused by specular reflected or refracted light. Examples of caustics are:

- The light patterns created on the bottom of a swimming pool as light is refracted by the water surface and reflected by the diffuse pool bottom.
- Light being focused by a glass of water onto a diffuse table cloth. Caustics cannot be simulated efficiently using standard ray marching since predicting the potential specular paths to a light source from any given surface is a difficult task. To overcome this problem mental ray uses a photon map. The photon map is generated in a preprocessing step in which photons are emitted from the light sources and traced through the scene using photon tracing. A photon leaving the light source can be reflected or transmitted specularly by objects. The photon is traced through the scene until it either hits a diffuse surface or until it has been reflected or transmitted a maximum number of times as indicated by the photon trace depth. When a caustic photon hits a diffuse object it is stored in a caustic photon map and not traced any further.

If you want to use Caustics, you have to enable the Caustics from the render setting for mental ray for Maya renderer. The options available are:

1. Caustics: This setting turns caustics on or off. Caustics are produced only by light sources for which photon emission is enabled. The material shader, which must have a non-zero diffuse component, which receives the caustics, must be set to receive caustics.
2. Caustic Accuracy: This setting controls the number of photons used to estimate the

caustic brightness.

3. Caustic Radius: This setting controls the maximum distance at which mental ray for Maya considers photons for caustics.

4. Caustic Filter Type: This setting controls the sharpness of the caustics. Filtering increases the weight of photons that are close to the point of interest, and reduces the amount of blur at the edges of a caustic.

a. Box : Box filter setting generally makes caustics look sharper. It is faster, but less precise.

b. Cone: Cone filter setting generally makes caustics look smoother. It is more precise, but slower.

5. Caustic Filter Kernel : The bigger the kernel, the softer the caustic.

6. Caustic Scale : Use this setting to control the influence of indirect illumination effects for caustics.



10.5 Summary

This chapter provided an overview of the major rendering features and workflows available to you in Maya. Raytracing, Global Illumination, and Final Gather can help you produce realistic imagery when needed. As you've seen here, most of these options can be enabled and controlled in the Render Settings window.

10.12 Self Assessment Test

1. Explain HDRI
2. Explain Caustic

Short notes

1. Global Illumination
2. Final Gather
3. Caustic Radius
4. GI. Photons
5. Mental Ray

10.13 Further Reading

1. Introducing Autodesk Maya 2013 **Dariush Derakhshani**
2. Learning Autodesk Maya 2009 Foundation: Official Autodesk Training .Autodesk Maya Press, **Marc-André Guindon**