ARCHITECTURE DESIGN 2

BCADES-205

BLOCK 1:
REDERING TECHNIQUES

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> *Education is something which ought to be brought within the reach of every one.*

- Dr. B. R. Ambedkar

Dr. BabasahebAmbedkar
Open University

BCA(DES)-205
ARCHITECTURE DESIGN 2

Block

1

REDERING TECHNIQUES

UNIT 1 LIGHTS

UNIT 2EFFECTS

UNIT 3 CAMERA AND RENDERING TECHNIQUES

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 cues, 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)

Unit 1   Lights

Learning Outcome

After going through this unit, you will be able to:

Defineconcept of light

Discuss various types of light

Explainenvironment

Interpretexposure controls

Comparedifferent exposure controls

Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 3 Hrs for reading

2nd Reading with understanding: It will need 4 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 2 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

Content Map

1.1   Introduction to Light

1.2   Concept of Light

1.3   Sub objects of Light

1.4   Concept of Photons, Fake Radiosity and Caustics

1.5   Environment

1.1   Introduction to Light

Lights play an important part in the visual process. Have you ever looked at a blank page and been told it was a picture of a polar beer in a blizzard or looked at a completely black image and been told it was a rendering of a black spider crawling down a chimney covered in soot? The point of these two examples is that with too much or too little light, you really can't see anything

Light in the 3D world figures into every rendering calculation and 3D artists often struggle with the same problem of too much or too little light. This chapter covers creating and controlling lights in your scene.

1.2   Concepts of Light

As we already know, to see anything, light is must. When the light rays hit an object, they are reflected off the surface of the object and enter into our eyes. This will let us view different objects. Lot of factors determines the behaviour of light. This includes the surface property of the object, the environment, the angle from which we look upon the object etc.

If the surface of the object is opaque, the light ray will be reflected completely. If the surface is transparent, the light rays will pass through and let us view the objects behind.

However, as the light rays will enter into a different medium, it will cause them to bend and slow down. This effect is knows as Refraction. The amount of refraction is determined by the thickness of the transparent object.

If the surface of an object is metallic, it will allow the surrounding to be reflected on its surface. This is known as Reflection.If the light colour is white, it will allow us to see the objects with their own surface colour. However, if a light is of any other colour, it will mix with the colour of the object's surface and the resulting colour will be seen.

The colour of the surface of an object is controlled by a material component "Diffuse". As lot of light rays hit the surface of an object, there will be few rays which enter into our eyes at exactly 90 degree.

Such rays will form a highlight on the object's surface. This is known as Specular.

When there is no light, the software will use default lights to shade and render the scene.As soon as you put any light, the default lights are off. When you delete all the lights in the scene, the default lights are put on again.

In the dialogue box, un der Views menu > viewport configuration go to lights and shadows. Here you will get opt on named – illuminate scene with > scene lights or default lights. In the default lights, you will get options for 1 light or 2 lights. Put on D efault Lighting and click 2 Lights radio button. These two lights are known as
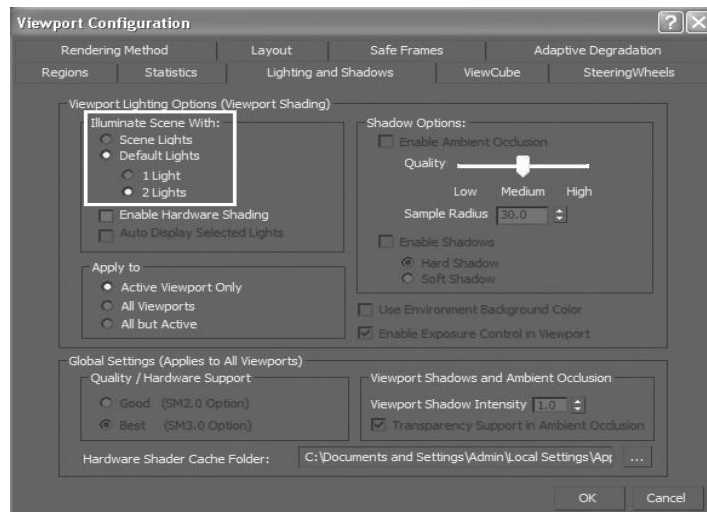
Fill Light

Key Light

Fig. 1.1: Default Lights

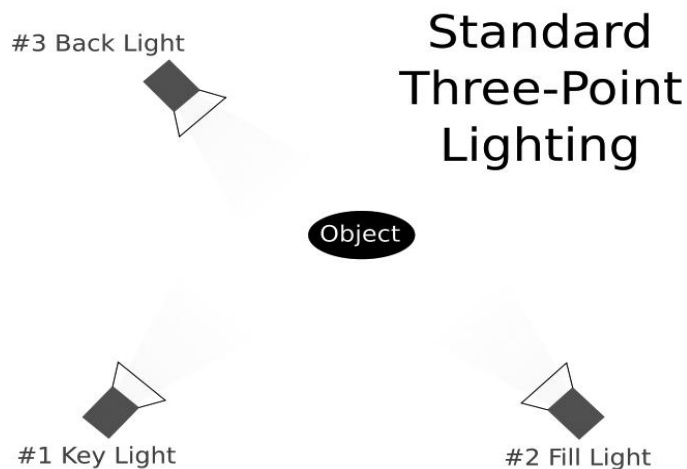Let us see how this 3 point lights work for a good scene lighting. You ca n understand the same from the following figu re.

Fig. 1.2: Three Point Lighting

3DS MAX gives a light support similar to this as a default light in the viewport. Once you put any light from the create panel, these default lights get off and you get lighting in the scene as per the lights you have kept in the scene.

🔔 Study Notes

👁 Assessment
Define and explain the concept and uses of light in animation.
Explain 3 point lighting.

🗣 Discussion
Discuss various types of lights and their uses.

1.3 Sub Objects of Light

As we all know, light is made of Photons.There are many other objects also who play a major role in light casting and the results of light falling or absorbed by objects in the environment.

Light contains many supporting elements shown in the following list:

Intensity:This specifies how much amount of light you want to keep. In the following figure, you can see two rendered images with less and more intensity of lights.
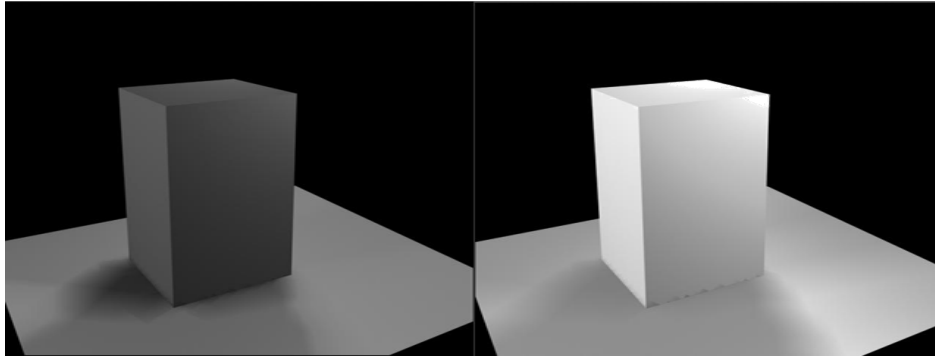
Fig. 1.3: Light intensity

Attenuation:This is the area in which light gets faded in to or from the atmosphere. In the following figure, you can see the near and far attenuation of light in the scene.
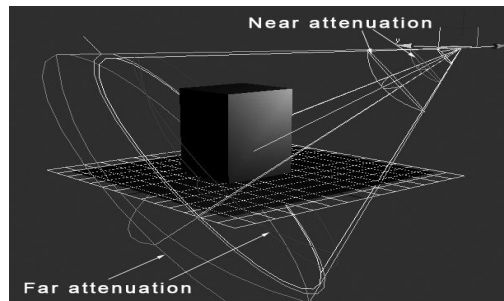
Fig. 1.4: Near and far attenuation

Colour: This is the colour of light.

Atmosphere and Effects:This is the atmosphere that is generated due to time, whether and other elements of nature like fog, mist etc.

Shadows:This is the element that makes the scene to look 3 Dimensional as each object that comes under light gets a shadow generated due to light. In addition, shadow quality is based on the time and atmosphere. In the following figure, you can see the shadows of object generated by the lights.

Fig. 1.5: Shadows

🔔	Study Notes

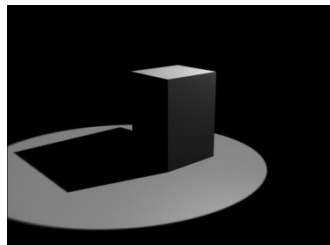| 👁	Assessment
	Define and explain the sub objects of light such as colour, attenuation, intensity, shadows and atmosphere and effects. Explain the use of atmosphere and effects.

🗣	Discussion
	Discuss the uses of sub objects of light in various situations.

1.4   Concept of Photons, Fake Radiosity and Caustics

A light ray is made up of photons. They are the particles, which make up a light. The photons are radiant energy capable of producing visuals for human eye.

However, this is not possible to simulate using the standard light, as they do not provide physically accurate calculations. Photometric lights are designed to serve this purpose. As they can accurately measure light using standard light parameters like luminance flux, luminance and luminous intensity, they allow highly realistic light renderings.

There are two plug-ins to work with these advanced lighting :

Light Tracer: Light Tracer works with Skylight

Radiosity: Radiosity works with Photometric lights.

Fake radiosity: This is a commonly used style in interiors for a fast render as radiosity is a long process for each frame for rendering. As does so many calculations of photons. To avoid these problems people generally use omni lights and set them in the manner that can produce similar result to radiosity.

Caustics:You might have seen several effects of light that take shape due to the reflection or refraction of light through another object. These are called caustics. You can get these effects by using Mental ray renderer of 3DS MAX.

Study Notes

Assessment
Explain the concept of photons.   Explain fake radiosity and caustics.

Discussion
Discuss the uses of fake radiosity and caustics in various scene types.

1.5 Environment

As we all know, the environment is the surrounding of any scene. For that, you can use either a plain solid colour background or an image as an environment. It also allows assigning an animated backgro und as well as numerous maps to choose from, as an environment.

When you use Advanced Lighting in conjunction with exposure controls, the environment affects the way the objects in the scene are rendered.

This environment contai ns fog, mist, clouds, etc. that makes it more re al and full of depth. These all things are helpful for adding moods and appearance of the sce ne as per the situation and story demands.

In 3DS MAX, you get environment option in Rendering menu. The environment window looks like the following f igure shows.
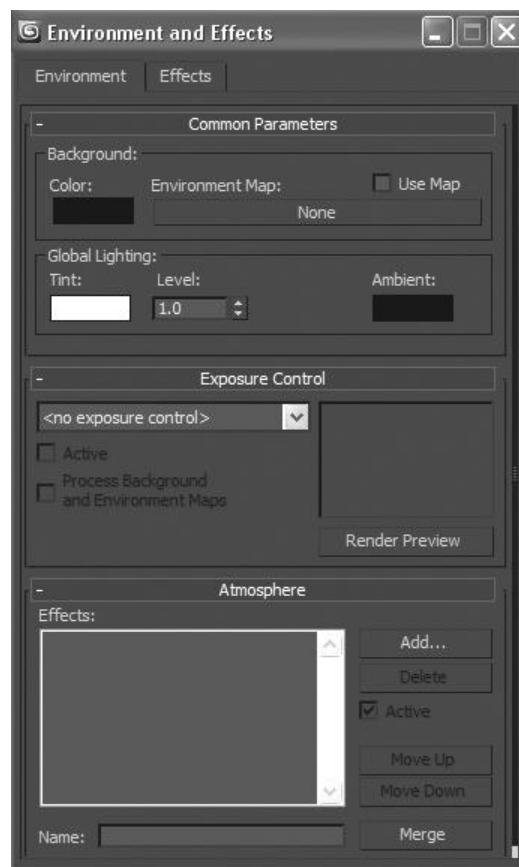

Fig. 1.6: Environment

Here you will get many options to set the result quality as per the requirements. We will see details about them in next topics.

![bell icon]	Study Notes

![eye icon]	Assessment
	Define and explain the uses of Environment in a 3D scene. Explain various types of environment with proper examples.

![speaking head icon]	Discussion
	Discuss various types of environments.

1.6 Ambient

Ambient is the general light with no identifiable source or direction. In other words, if you increase the ambient in the scene and render it, you do not need lights for a good lighting in the scene. This makes the scene look brighter as it has good amount of lights in it.

To increase the ambient amount you can make the colour from the option available in the palette. The lighter colour you select here it makes the scene to look like having more light in it.
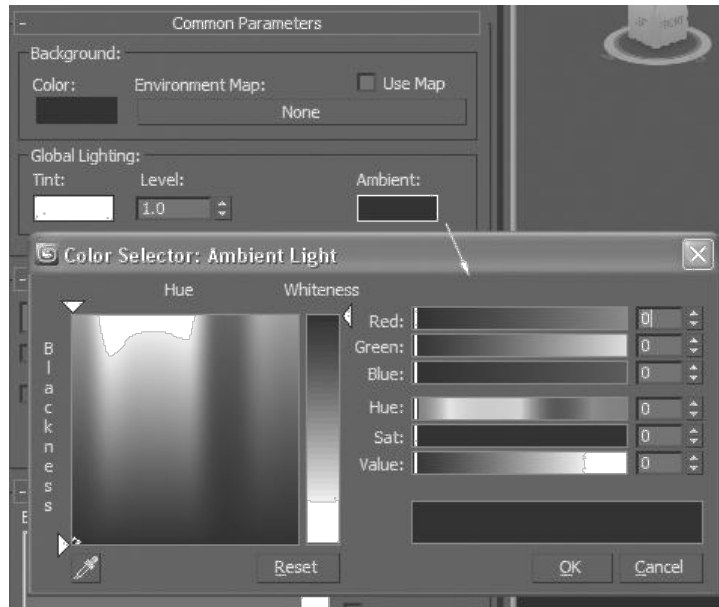
Fig. 1.7: Ambient Light

![bell icon]	Study Notes

![eye icon]	Assessment
Define and explain Ambient and its uses.	
Explain various types of sce ne where you can use Ambient.	

	Discussion
Discuss the uses of Ambient in various 3D scenes.	

1.7 Exposure Control

Exposure controls adjus t the level and colour range of the output, in rendering as well as viewport display to crea te realism. These exposure controls are plug-in components, which are useful to adjust the output levels and colour range of a rendering, like you are adjusting film exposure.
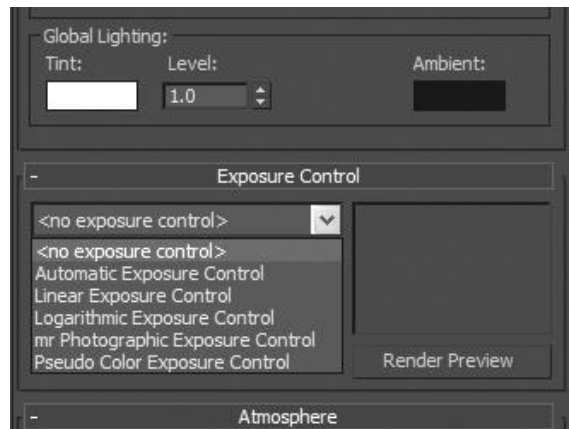

Fig. 1.8: Exposure Control

Automatic Exposure Contr ol:This Exposure Control samples the rendere d image and builds a histogram to give go od colour separation across the entire dynamic range of the rendering. This enhances so me lighting effects that would otherwise be too dim to see.
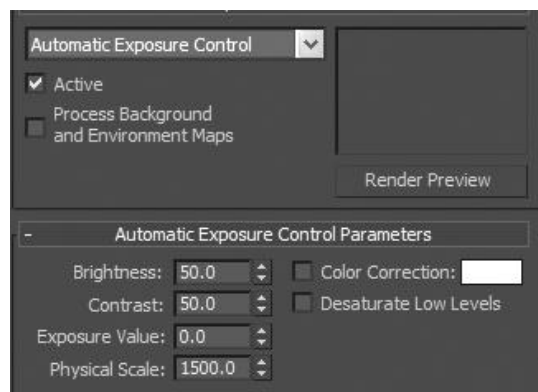

Fig. 1.9: Automatic Exposure Control

The options available here are as followings:

Brightness: Adjusts the brightness of the converted colors.

Contrast: Adjusts the contras t of the converted colors.

Exposure Value: Adjusts the overall brightness of the rendering.

Physical Scale: Sets a physical scale for exposure control to use with lights that are not physically based.

Colour correction check box and colour swatch:Colour correction shifts all colors so the colour displayed in the colour swatch appears as white.

Desaturate Low Levels: Rend ers dimly lit colors as if the light were too dim.

Linear Exposure Control:This Exposure Control samples the rendered image and uses the average brightness of the s cene to map physical values to RGB values. T his Exposure Control is best used for scen es with a fairly low dynamic range.
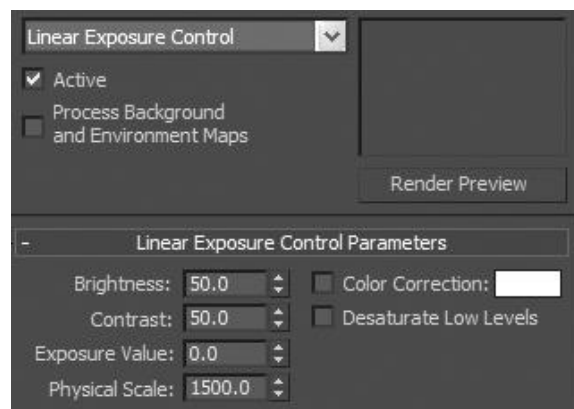

Fig. 1.10: Linear exposure control

The options available here are as followings:

Brightness: Adjusts the brightness of the converted colors.

Contrast: Adjusts the contras t of the converted colors.

Exposure Value: Adjusts the overall brightness of the rendering.

Physical Scale: Sets a physical scale for exposure control to use with lights that are not physically based.

Logarithmetic Exposure Co ntrol:This Exposure Control uses brightness an d contrast. It also checks whether the sc ene is outdoors in daylight so as to map phys ical values to RGB values. This can be use d with either the default scanline renderer or the mental ray renderer. This Exposure Control is best for scenes with a very high dynamic range.
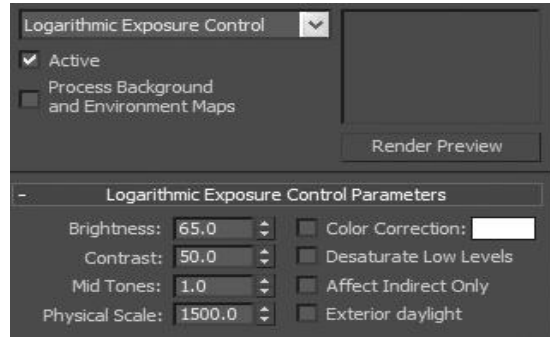

Fig. 1.11: Logarithmic exposure control

The options available here are a s followings:

☐ℜ☐ℜ   Brightness: Adjusts the brigh tness of the converted colors. Range=0 to 200.

☐ℜ☐ℜ   Contrast: Adjusts the contrast of the converted colors. Range=0 to 100. Default=50.

☐ℜ☐ℜ   Mid Tones: Adjusts the mid: tone values of the converted colors. Range=0.01 to 20.0.

☐ℜ☐ℜ   Physical Scale: Sets a physic al scale for exposure control to use with lights that are not physically based.

☐ℜ☐ℜ   Color Correction check box and colour swatch: colour correction shifts all colors so the colour swatch appears as wh ite.

☐ℜ☐ℜ   Affect Indirect Only: This ex posure control is applied only to areas of indirect lighting.

☐ℜ☐ℜ   Exterior daylight: When on, converts colors for an outdoor scene.

4.Mr. Photographic Exposure Control:This Exposure Control lets you mo dify rendered output with camera-like controls. This can be a general exposure value or s pecific shutter speed, aperture and film sp eed settings. This also gives you image-control settings with values for highlights, midtones and shadows. This is intended for high-dynamic-range scenes rendered with the m ental ray renderer.
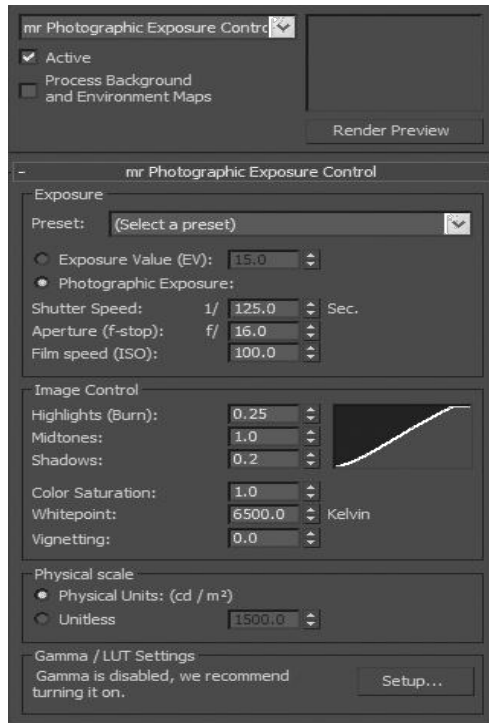
Fig. 1.12: Mr. Photometric Exposure Control

Pseudo colour Exposure Co ntrol: ThisExposure Control is in fact a lighting analysis tool that provides you with an int uitive way of visualising and evaluating the lig hting levels in your scenes. This maps lumi nance or luminance values to pseudo colours that show the brightness of the values being converted. From darkest to brightest, the ren dering shows blue, cyan, green, yellow, ora nge and red.
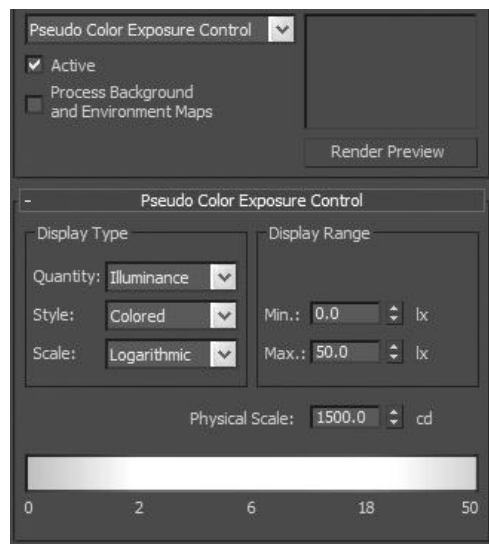
Fig. 1.13: PseudoColour Exposure Control

![bell icon]	Study Notes

![eye icon]	Assessment
	Define and explain various exposure controls and their uses.
	Explain various types of scenes where you can use exposure controls.

![discussion icon]	Discussion
	Discuss various exposure controls and their uses for different types of results.

1.8 Tint

This option is under the global lighting. This works on the overall look of the scene. This is used to apply a shade of the colour on the rendered scene. It is like using a colour filter in front of the camera. This allows you to add a colour tint on the overall scene to create a mood like – morning time, evening time, disco, party etc.

Fig. 1.14: Tint

In addition, you get option named level that is used for increasing the intensity of that tinted light of the scene.

🔔	Study Notes

👁	Assessment

Define and explain Tint and its importance in making of a scene.

Explain various types of situations where you need to use Tint for required results.
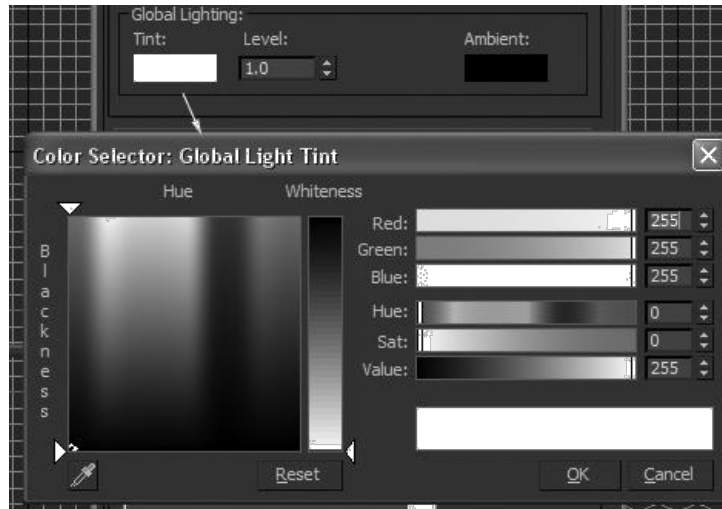
![Discussion icon]	Discussion
Discuss the importance and uses of Tint in a 3D scene.	

1.9 Parameters of Environment Window

Let us talk about other parameters in the environment window now.
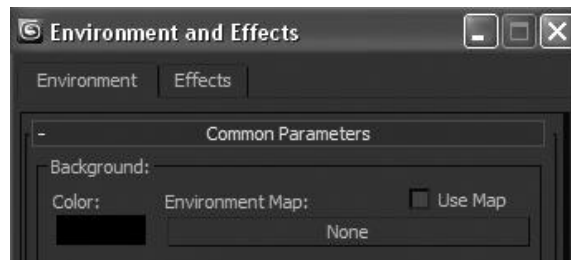
Fig. 1.15: All Parameters

Background Colour:This allows you to apply the background colour in the scene which will be looking throughout the transparent areas of the scene like sky, land, etc.

Environment Map: This allows applying a background texture for the scene. Here you can apply sky, land, etc. material for making the scene look real.

Use Map:This is used for making the applied map applicable while rendering when checked. If it is not checked then it makes the map to be non applicable while rendering.

Most of the parameters in all the standard lights are similar. Generally, following are the parameters:

Light Type: From the dropdown, you can convert the light to any of the other standard lights.

Shadows: Shadows add realism to the scene. If you want the light to cast shadows, check the ON button.

Fig. 1.16: Standard lights

Intensity / colour / Attenuation: Adjust the intensity, sets the colour that we want and also the range of light
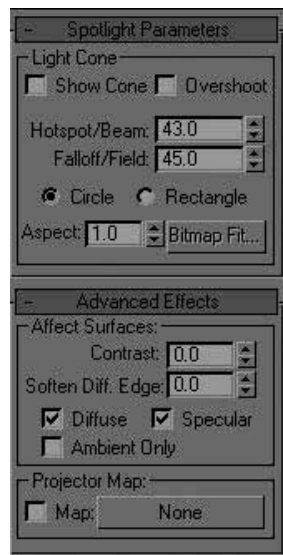
Fig. 1.17: Standard lights properties

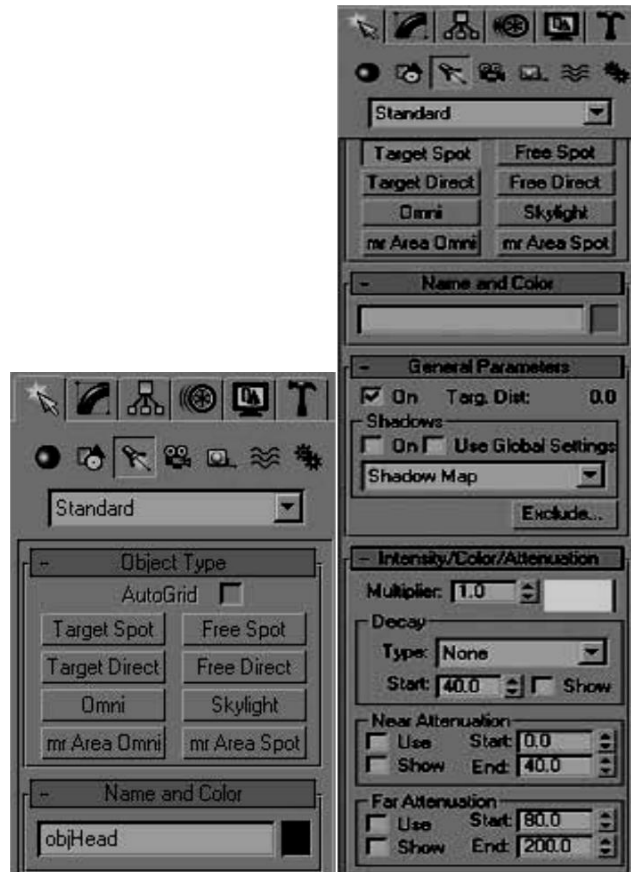Advanced Effects: Adjust the Contrast spinner to increase or decrease the contrast cast by the light.

Soften Diffuse edge controls the edge smoothness between diffuse and ambient.

The Projector Map button:allows choosing a map to project through the light.
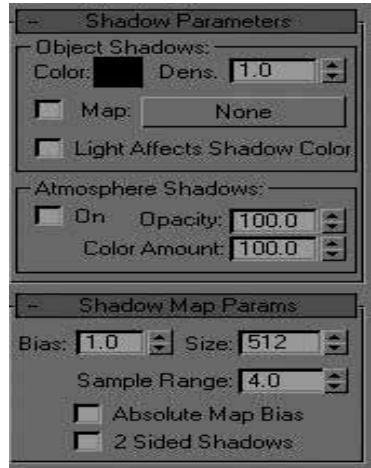
Fig. 1. 8: Standard Lights Projection Map

Colordisplays a colour selector to choose the colour of shadow cast by the light.

Show Cone shows the cone of the light, even when the light is not selected.

Overshoot sees that the light is cast in all directions, like omni.

Hotspot / Falloff: Hotspot a nd falloff options are available with Spot and Direct lights. Hotspot is the area where th e light has maximum intensity and is faded of gradually till it reaches the falloff are and fa lloff is controlled by an outer zone.

If the type of hotspot is set to Rectangular, you can set the aspect ratio of width to height using Aspect spinner.

Projector Map: This projects the image through spot / direct light.

⚠️	Study Notes

👁️	Assessment
	Define and explain the Background map and environment map
	Explain various types of Standard Lights and their uses.

🗣️	Discussion
Discuss the uses of various options available in Standard Lights.	

1.10 Atmosphere and Effects

This rollout is available for all light types and comprises two options, viz. Lens Effects and Volume Light.
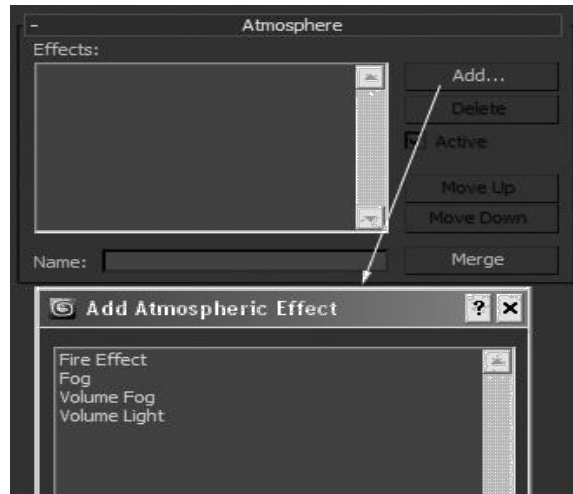
Fig. 1.19: Atmosphere and Effects

ĀÀ Ā Fire Effect:This effect is used for making a fire effect in the scene. For that you can select one of the gismo avai lable in 3DS MAX and apply the same effect on that.Use Fire to produce animated fire, s moke and explosion effects. We can create a f ire apparatus, or "gizmo," to position the effect in our scene and to define the maximum boundaries of the effect.
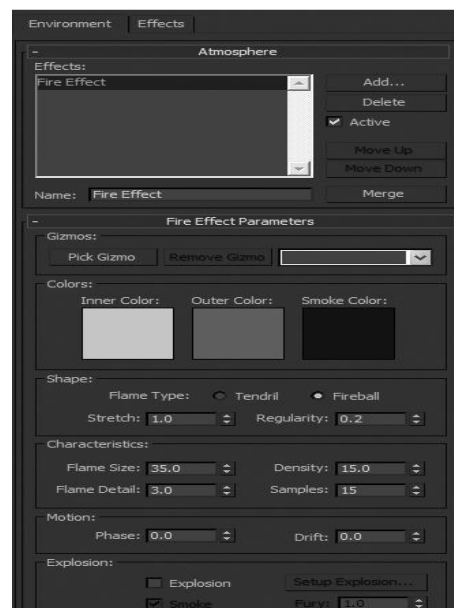
Fig. 1.20: Fire Effects

There are more options available to change the colour, strength, regularity, flame size, density, samples, flame details, etc. for the fire effect in the window as y ou can see in

the above figure. Let usDiscuss these all options now.The apparatus is a Helper object found in the Atmospheric Apparatus subcategory.

There are three kinds of apparatus: Box Gizmo, Sphere Gizmo andCyl Gizmo.

Box Gizmo: Box Gizmo lets us create a box shaped gizmo in our scene.

Sphere Gizmo: Sphere Gizmo lets we create a sphere or hemisphere shaped gizmo in our scene.

Cylinder Gizmo: Cylinder Gizmo lets us create a cylinder shaped gizmo in our scene.

Use the following Gizmo group buttons or parameters to manage the list of apparatus objects:

Pick Gizmo: Enters an atmospheric apparatus in the scene.

Remove Gizmo: Removes the gizmo selected in the gizmo list.

Gizmo List: Lists apparatus objects assigned to the fire effect.

Inner Color: Sets the colour of the densest part of the effect.

Outer Color: Sets the colour of the sparsest part of the effect.

Smoke Color: Sets the colour of smoke for use with the Explosion option.

Tendril: Creates directional pointed flames with veins along their center.

Fireball: Creates round puffy flames.

Stretch: Scales flames along the Z-axis of the apparatus.

Regularity: Modifies how the flames fill the apparatus.

Flame Size: Sets the size of individual flames inside the apparatus.

Flame Detail: Controls the amount of colour change and edge sharpness seen within each flame.

Density: Sets the opacity and brightness of the fire effect.

Samples: Sets the rate at which the effect is sampled.

Phase: Controls the rate of change for the fire effect. FIG 10

Drift: Sets how flames are rendered along the Z-axis of the fire apparatus.

Explosion: Animates size, density and colour automatically based on the animation of the Phase value.

Smoke: Controls whether or not the explosion creates smoke.

Fury: Varies the churning effect of the Phase parameter.

Set Up Explosion: Displays the Set Up Explosion Phase Curve dialog.

Fog:This is used for applying fog effect in the scene. The parameters are as you can see in the following figure.
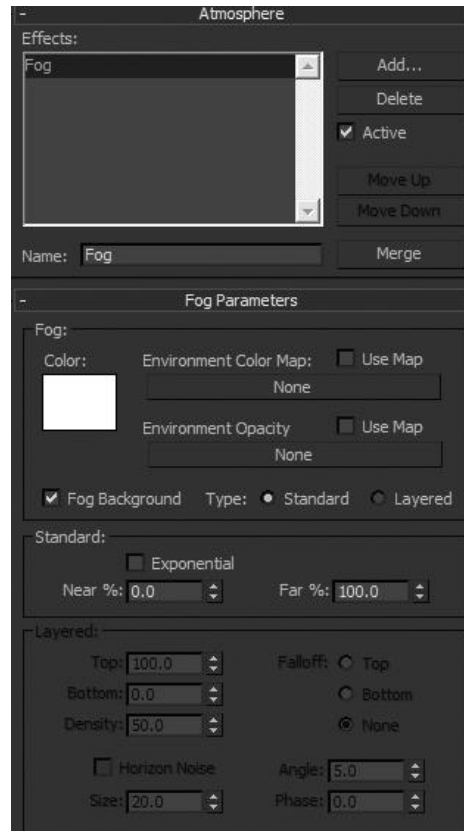
Fig. 1.21: Fog effects

Here you will get the options like fog colour, environment colour map, use map, environment opacity, fog background, type for the same, standard options like – exponential, near % and far % etc. to change the look of the fog.

This command provides fog and smoke atmospheric effects. The extent of the fog layer is done in world units.

Volume Fog:This is useful for applying volume fog on the gismos available in 3DS MAX with the parameters for changes as shown in the following figure.
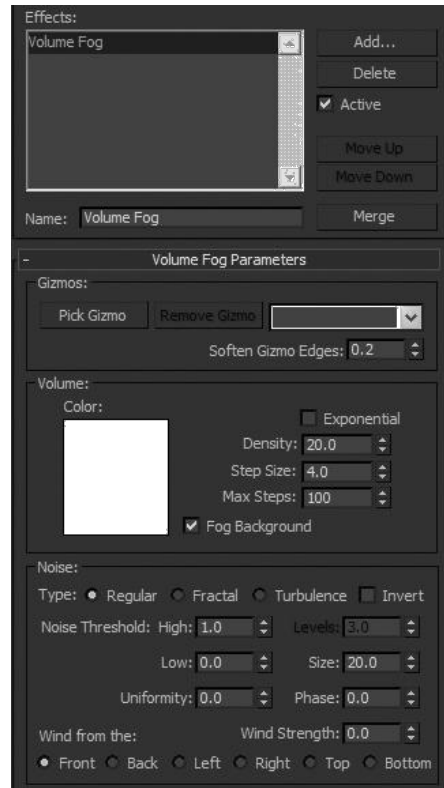
Fig. 1.22: Volume Fog Effects

Here you get options like volume color, density, step size, max steps, fog background, Noise type, wind from (direction), etc. options for changes in the volume fog. Volume Fog provides a fog effect in which the fog density is not constant through 3D space.

Volume Light:This is the effect for lights for realistic lighting effects like rays entering in a dark room or a morning time lights entering from the window, etc.
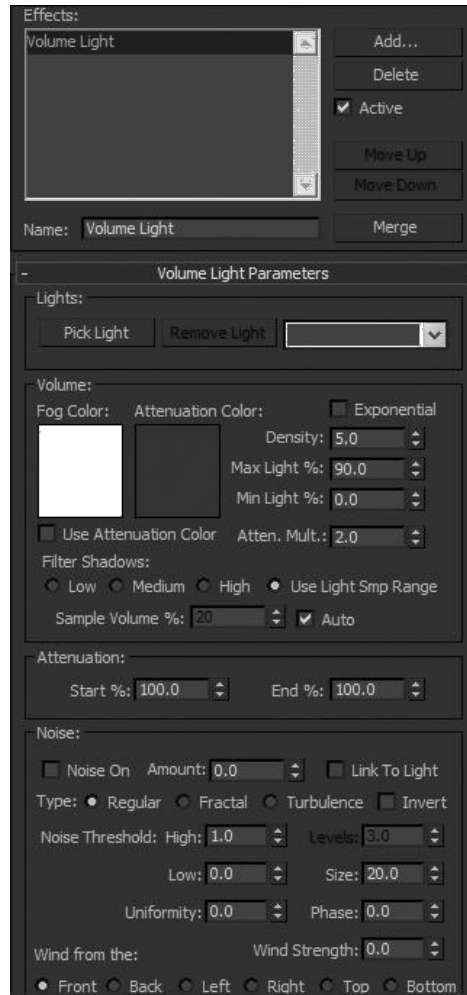
Fig. 1.23: Volume Light Effects 1

This contains the options like – pick light, volume options for fog colour, attenuation color, density, max light, min light, attenuation mult., filter shadows, Noise, Noise amount, Noise types, noise threshold, Wind from direction, etc. These all options are useful for making variations in the default volume light and its result in the scene.

Likewise, when you select a spot or direct light and add Volume Light from the effects category. Click setup to access volume light options. It creates a light beam effect initiating from the source of the light. Depending upon the light, spot or direct, the shape of the beam will be either conical or parallel.

Checking Exponential will ensure the constant intensity of the light, which when off, will intensify the light near to its target. To add an effect of dust particles, put on Noise, located at the bottom of the dialogue box and manipulate the options to achieve variety of dust particles.
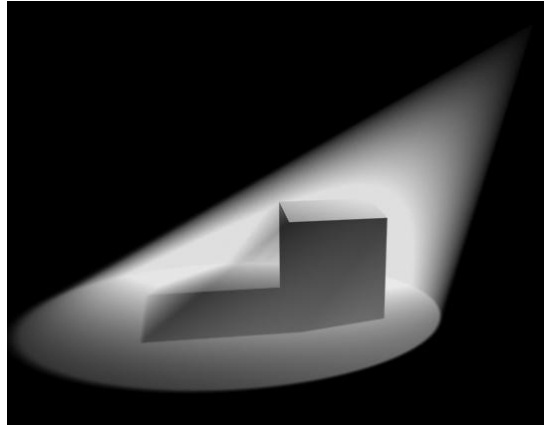
Fig. 1.24: Volume light effects final

In the above figure, you can see volume light applied to a spot light and the result in the final rendered output.To ap ply the atmosphere and effects you can use th e atmosphere and effects parameters from ligh t properties.

Fig. 1.25: Atmosphere and Effects in Light

![bell]	Study Notes

	Assessment
	Define and explain various atmosphere and effects in 3DS Max. Explain various types of effects with proper examples.

| 🗣	Discussion
	Discuss various effects and their uses in different types of 3D scenes.

1.11 Photometric Lights

The standard Max lights rely on parameters like Multiplier, Decay and Attenuation, but the last time I was in the hardware store looking for a lightbulb with a 2.5 Multiplier value, I was disappointed. Lights in the real world have their own set of measurements that define the type of light that is produced. Photometric lights are lights that are based on real-world light measurement values such as Intensity in Lumens and temperatures in degrees Kelvin.

If you select the Lights menu or the Lights category in the Create panel, you will notice another subcategory called photometric. Photometric lights are based on photometric values, which are the values of light energy. The lights found in this subcategory include Point, Linear and Area (both Free and Target) and IES and mental ray Sun and Sky.

Imagine a scene that includes an umbrella with a light source directly overhead. If you rendered the scene, the object caught in the umbrella's shadow would be too dark to see clearly. To fix this situation, you would need to add some extra lights under the umbrella and set them to not cast shadows. Although this work around provides the solution we want, it is interesting to note that this is not the case in real life.

Photometric lights use photometric (light energy) values that enable us to more accurately define lights, as they would be in the real world.

We can set their distribution, intensity, colour temperature and other characteristics of real world lights. We can also import specific photometric files available from lighting manufacturers to design lighting based on commercially available lights.

Photometry: The measurement of light is known as photometry.

When we use photometric lights, provides physically based simulation of the propagation of light through an environment. The results are not only highly realistic renderings, but also accurate measurements of the distribution of light within the scene.

Four photometric quantities are used in the lighting simulation system:

Luminous flux: Luminous flux is the quantity of light energy per unit time arriving, leaving or going through a surface.

Illuminance: Illuminance is the luminous flux incident on a surface of unit area.

Luminance: The light reflected off a surface in a particular direction is called luminance.

Luminous intensity: Luminous intensity is the light energy per unit time emitted by a point source in a particular direction.

⚠	Study Notes

👁	Assessment
	Define and explain the Photometric lights and their uses.
	Explain various types of lights available in Photometric lights with proper examples.

	Discussion
Discuss various situations in which you can use Photometric lights.	

1.12 Radiosity

This technique is called Radiosity in the computer graphics world; it differs fundamentally from raytracing.
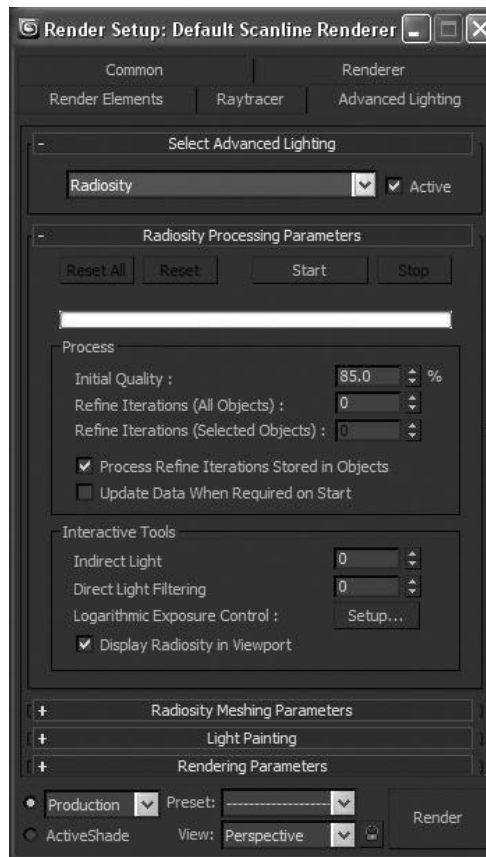
Fig. 1.26: Radiosity

Types of the daylight depend upon the colour temperature.Colourtemperaturedescribesa colour in terms of degrees Kelvin (K).

LIGHT SOURCE	COLOUR TEMP	HUE
Overcast daylight	6000 K	130
Noontime sunlight	5000 K	58
White fluorescent	4000 K	27
Tungsten/halogen lamp	3300 K	20
Incandescent (glowing) lamp (100 to 200 W)	2900 K	16
Incandescent (glowing) lamp (25 W)	2500 K	12
Sunlight at sunset or sunrise	2000 K	7
Candle flame	1750 K	5

Study Notes

Assessment

Define and explain Radiosity and its uses.

Explain various types of 3D Scenes where you can use Radiosity with proper examples.

	Discussion
Discuss the uses of Radiosity in various types of 3D scenes.	

1.13 Sky Light

The Skylight light models daylight. It is meant for use with the Light Tracer. We can set the colour of the sky or assign it a map. The sky is modelled as a dome above the scene.
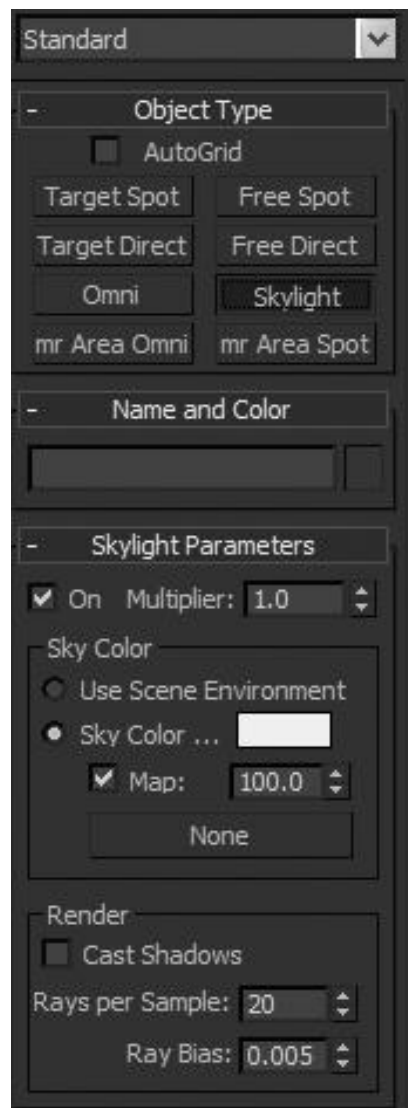
Fig. 1.27: Sky light
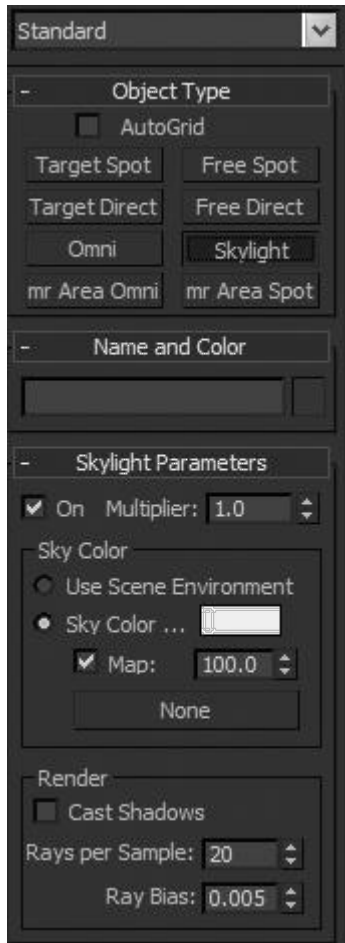
Fig. 1.28: Sky light options

Multiplier: This is useful for increasing light intensity.

Sky Color: This is the colour of sky for making the light of the same color.

Use scene environment: This is to use a bitmap or map as a scene environment.

Map: This is used for applying a map to the sky.

Render/Cast Shadows: This is used for generating cast shadows of all objects in the scene.

In the following figure, you can see a simple scene rendered with sky lights and light tracer.

Fig. 1.29: Sky Light Final

![bell icon]	Study Notes

![eye icon]	Assessment
Define and explain Sky light and its uses in 3D scene. Explain various options available in sky light parameters roll out.	

![speaking head icon]	Discussion
Discuss the sky light and its uses.	

1.14 Light Tracer

The Light Tracer provides soft edged shadows and colour bleeding for brightly lit scenes such as outdoor scenes. Unlike Radiosity, the Light Tracer does not attempt to create a physically accurate model and can be easier to set up.
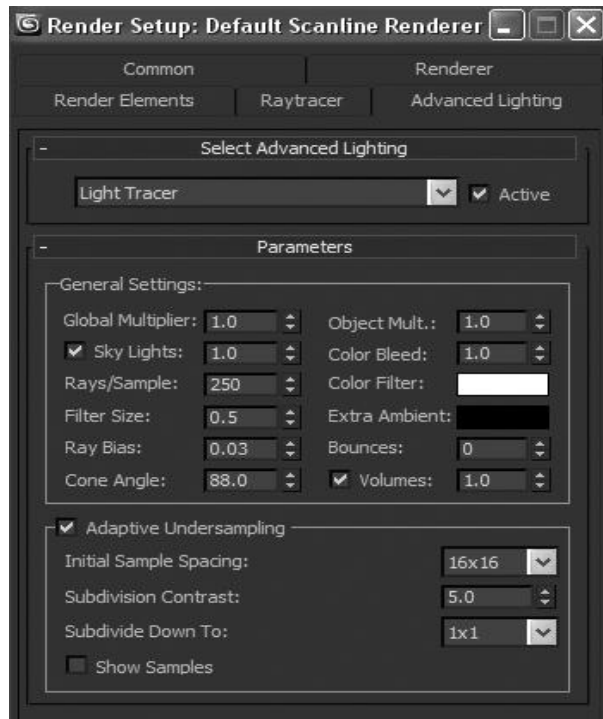
Fig. 1.30: Light Tracer

You can use light tracer with sky light for a smooth and realistic exterior scene. Light tracer can provide you colour bleed of the objects in the scene in their respective shadows for a better result.

With a combination of 1 sky light, 1 directional light and light tracer you can get a smooth result like the following figure.
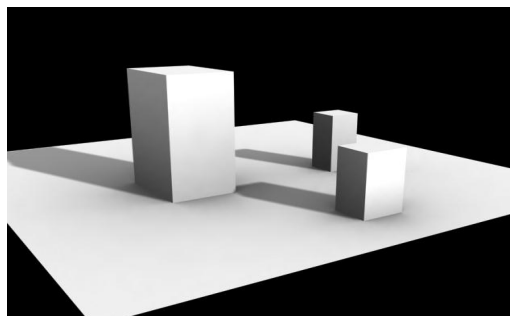
Fig. 1.31: Light Tracer Final

⚠	Study Notes

👁	Assessment
Define and explain Light Tracer and its uses. Explain various types of 3d scenes where you can use Light Tracer with proper examples.	

🗣	Discussion
Discuss various types of 3D scenes where you can use Light Tracer for various results.	

1.15 Mental Ray

The mental ray material lets you create a material exclusively for use by the mental ray renderer. A mental ray material consists, at the top level, from one to 10 kinds of shaders or shading components.

Note: You must assign a shader to the material's surface component. Otherwise, the mental ray material will not be visible when you render.

The primary feature of mental ray is the achievement of high performance through parallelism on both multiprocessor machines and across render farms.

The software uses acceleration techniques such as scan line for primary visible surface determination and binary space partitioning for secondary rays. It also supports caustics (Caustics are the effects of light cast onto an object via reflection off or refraction through another object.) and physically corrects simulation of global illumination employing photon maps.

Any combination of diffuse, glossy (soft or scattered) and specular reflection and transmission can be simulated.

Mental ray was designed to be integrated into a third-party application using an API or be used as a standalone program using the .mi scene file format for batch-mode rendering.

Up to this moment there are many programs integrating this renderer such as:

AutoDesk Maya

Softimage XSI

AutoDesk 3D Studio Max

Houdini

CATIA.

Some definition of its uses or outputs:

Scan line
Caustics
Binary space partitioning
Caustics
Global illumination
Photon maps

The MR LightShader rollout adds Mr shaders to lights. The MR renderer alters or adjusts the light's effect.

To adjust the settings for a light shader, drag the shader's button to an unused Material Editor sample slot. Be sure to choose Instance when prompted to use an instance or a copy. (If you edit a copy of the shader, you will have to drag the sample slot back to the shader button on the Light Shader rollout before you see any changes take effect.)

Most of these software front-ends provide their own library of custom shaders.

However assuming these shaders are available to mental ray, any mi file can be rendered, regardless of the software that generated it.

The mental ray Light Shader rollout lets us add mental ray shaders to "Lights". This can alter the light's effect.
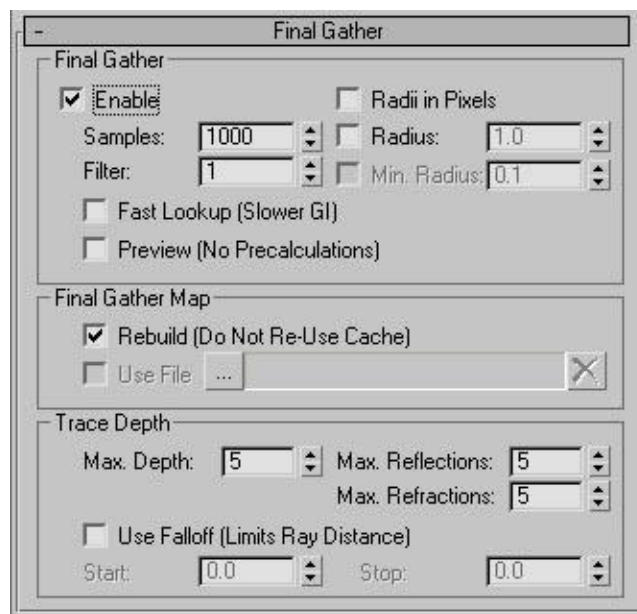
Fig. 1.32: Mental Ray

Light Shader and Photon Emitter Shader: Selects a light shader.

MR Shaders: A shader is a function that calculates light effects.
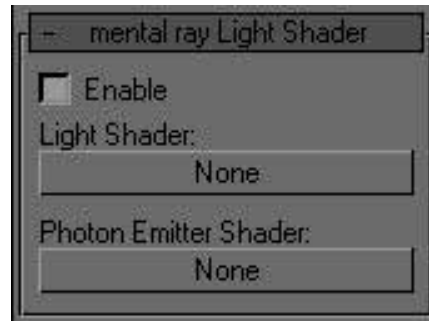
F ig. 1.33: Mental Ray Shader

Depth of Field: These con trols are comparable to the depth-of-field controls for cameras.

Motion Blur: The mental ray renderer calculates motion blur.

Contours: These enable co ntours and let us use shaders to adjust the results of a contour shader.

Camera Shaders: These controls let us assign mental ray camera shaders.

Mental ray Contour Shading: Contour shading renders vector-based contour lines.

The mental ray renderer renders physically correct simulations of lighting effects. This includes

Ray-traced reflections

Ray-traced refractions

Caustics

Global illumination

Ray-Traced Reflections and Refractions with the mental ray Renderer. The renderer can generate reflections and refractions by ray tracing. Ray tracing traces the path of rays sampled from the light source.

Caustic: Caustics are the effects of light cast onto an object by means of reflection or refraction through another object.

Global Illumination: Global illumination improves the realism of a scene. Th is is done by simulating radiosity, or the in ter-reflection of light in a scene.

Final Gather: Final gathering improves the quality of global illumination.

Luminance: Luminance is the value of light reflected off a surface. It is a measure of how bright or dark we perceive the surface.

Illuminance: Illuminance is the luminous flux incident on a surface of unit area. It measures how much energy has fallen on a surface.

Quantity: Chooses the value being measured.

Illuminance displays values of light incident on surfaces.

Luminance displays values of light reflected off

surfaces. Style: Chooses the way to display values.

Colored shows a spectrum.

Grayscale shows gray tones that range from white to black.

Scale: Chooses the technique used to map values.

Logarithmic uses a logarithmic scale.

Linear uses a linear scale.

Minimum: Sets the lowest value to measure and represent in the rendering.

Maximum: Sets the highest value to measure and represent in the rendering.

Physical Scale: Sets a physical scale for exposure control to use.

Spectrum bar: Shows the spectrum to intensity mapping.

	Study Notes

	Assessment
Define and explain Mental Ray and its features Explain various types of scenes where you can use the Mental Ray features for more realistic results with proper examples.	

	Discussion
Discuss GI and Caustics and their uses for making more realistic 3D scene.	

1.16 Indirect Illumination

In the Mental Ray, the Indirect Illumination controls for the effect of Caustics and Global Illumination and Photon Map.

PHOTON MAP

A photon map is a technique to generate the indirect illumination effects of caustics and global illumination when you render with the mental ray renderer. When it calculates indirect illumination, the mental ray renderer traces photons emitted from a light. The photon is traced through the scene, being reflected or transmitted by objects, until it strikes a diffuse surface. When it strikes a surface, the photon is stored in the photon map.

	Study Notes

	Assessment

Define and explain Indirect Illumination and its uses.

Explain various types of 3D scene where you can use Indirect Illumination with proper examples.

🗣	Discussion

Discuss various 3D scenes where you can use Indirect Illumination for realistic results.

1.17 Caustics

Caustics are the effects of light cast onto an object via reflection off or refraction through another object.

Procedures:

To render with caustics:

Select each object you want to generate caustics, by either reflection or refraction. Right-click and choose Properties, then on the mental ray panel of the Object Properties dialog, turn on Generate Caustics.

Objects receive caustics by default. If you think this value might have changed for the objects you want to receive caustics, use those objects' Object Properties dialog to make sure Receive Caustics is turned on. Also, to speed rendering time, you might want to turn off Receive Caustics for those objects that do not need to show them.

On the Render Setup dialog, go to the Caustics And Global Illumination rollout and turn on Caustics.

Adjust the caustics parameters to get the effect you want.

Render the scene.

Fig. 1.34: Caustics

🔔 Study Notes

👁 Assessment
Define and explain Caustics and their uses.
Explain various types of 3D scenes where you can use caustics with proper examples.

🗣 Discussion
Discuss the uses of caustic in making of realistic 3D scenes.

1.18 Global Illuminatio n

Global illumination enh ances the realism in rendered images by simulating all light interreflection effects in a sce ne (except caustics). It generates such effects as "color bleeding," where for example; a white shirt next to a red wall appears to hav e a slight red tint.
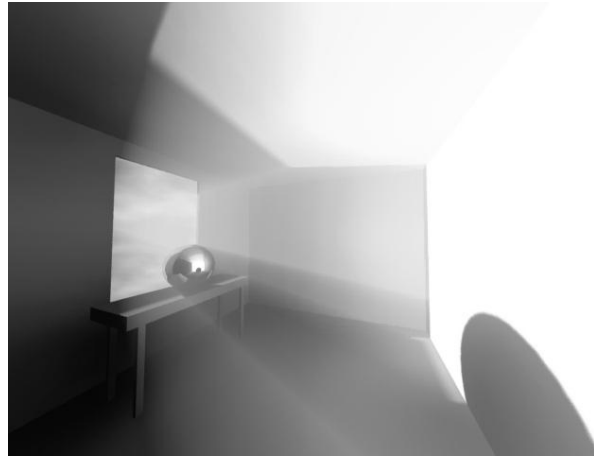

Fig. 1.35: Global Illumination

To render with global illumination:

Objects generate and receive global illumination by default. If you think these settings might have changed for any objects in the scene, use the Object Properties dialog to make sure the proper settings a re enabled.

Select each object you want to generate and/or receive global illuminati on. Right-click and choose Properties, the n on the mental ray panel of the Object Prop erties dialog, turn on Generate Global Illumination and/or Receive Global Illumination. Also, to speed rendering time, you might w ant to turn off Receive Global Illumination for those objects that do not need it.

On the Render Setup dialog, go to the Indirect Illumination panel > Caustics And Global Illumination rollout > Global Illumination (GI) group and turn on Enable.

Adjust the global illuminatio n parameters to get the effect you want.

For the final rendering, tur n on Final Gather as well as Global Illumination. See Final Gather Rollout (mental ray Renderer).

Render the scene.

👁	Assessment
Define and explain GI and its uses. Explain various types of 3D scenes where you can use GI for realistic results with proper examples.	

🗣	Discussion
Discuss the various uses of GI in different types of scenes and environments.	

1.19 Final Gather

It 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.

Fig. 1.36: Final gather map

This calculates the final gather map for indirect illumination.The map i s an FGM file. An FGM file is a final gather map file.
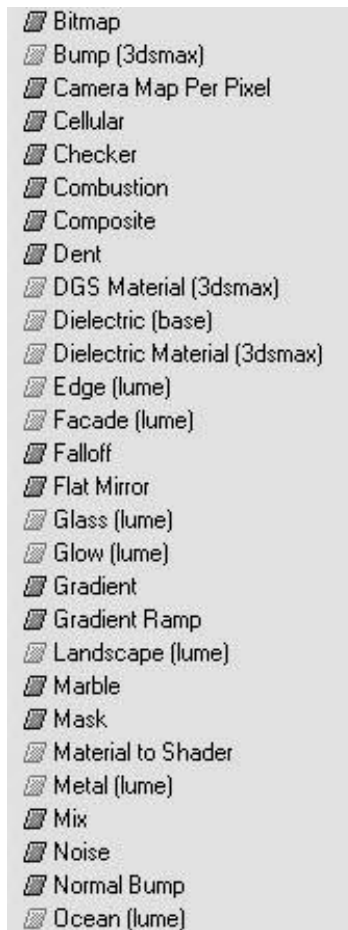
!	Study Notes

	Assessment
Define and explain Final Gather and its uses. Explain various types of 3D scenes where you can use Final Gather for realistic results with proper examples.	

	Discussion
Discuss the various scenes where you can use Final Gather for good results.	

1.20 Rendering Scenes > Renderer
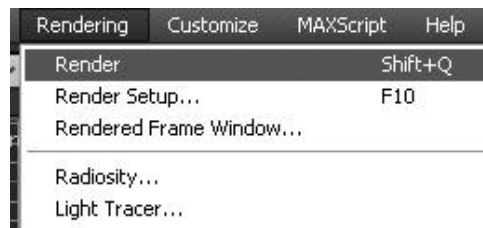
RENDERING

Fig. 1.37: Renderer

Rendering is the process of generating an image from a model, by means of computer programs. The model is a description of three-dimensional objects in a strictly defined language or data structure. It would contain geometry, viewpoint, texture and lighting information. The image is a digital image or raster graphics image.

The term may be by analogy with an "artist's rendering" of a scene. 'Rendering' is also used to describe the process of calculating effects in a video editing file to produce final video output.

Here you get default three types of Renderers in the render palette. To check the current render type and change it to another available renderer you can go to Common tab of render setup window. Here you can go to the assign renderer options and change current renderer to another one.
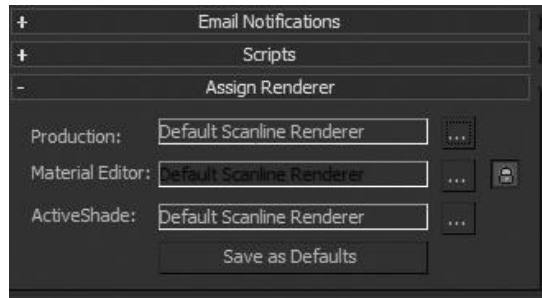
Fig. 1.38: Assign Renderer

Here you get three types of renderers as followings:

Scanline Renderer: This is the default renderer available in 3DS Max. It does line by line rendering and simple calculation of lights.

Mental Ray Renderer: This is called as bucket or box rendering also. This works on photon calculation and GI and Caustics in scene.

Mental ray is a production quality rendering application developed by mental images (Berlin, Germany). As the name implies, it supports ray tracing to generate images. Its feature set is comparable to that of PhotoRealistic (PRman) RenderMan, the RenderMan compliant renderer by Pixar, over which it holds certain advantages and disadvantages.

Mental ray has been used in several feature films, including Hulk, The Matrix Reloaded & Revolutions, Star Wars Episode II: Attack of the Clones, The Day After Tomorrow and lately in Poseidon.

VUE Renderer: This renderer is used for network rendering as well as to render the .VUE files which are called – Visual Understanding Environment.

Study Notes

	Assessment
Define and explain Rendering process and its importance for output quality. Explain various types of Renderers and their uses.	

(speaking head icon)	Discussion
Discuss Rendering Techniques and their uses.	

1.21 Trace Depth

The Trace Depth controls calculate reflections and refractions. They refer to the photons used by FG.

Mental ray Shadow Map: Generates the shadows using the mental ray Shadow-map algorithm.

No shadows appear in the rendering if we render with the default scan line renderer instead.

Transparent Shadows: In here, the shadow maps are saved with multiple Z-layers so as to have transparency.

Indirect Illumination: Indirect Illumination rollout provides controls for the behavior of light with the MR renderer.
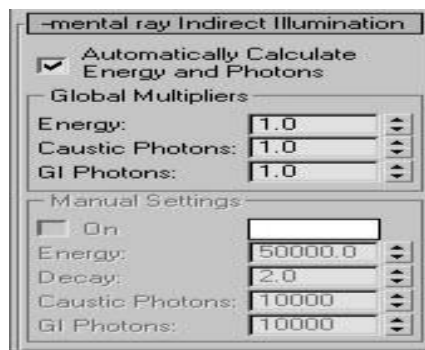
Fig. 1.39: Indirect Illumination

Global Multipliers: Globally multiplies the energy to set the energy of the particular light.

Mental ray Connection: This is available for all types of materials except the "multi/sub-object" material and the MR materials themselves.

<div align="right">BASICSHADERS</div>

The surface component can be assigned the following mental ray materials or shaders.

Shader	Library
☐ Bump	3ds max
☐ DGS Material	3ds max
☐ Dielectric	base
☐ Dielectric Material	3ds max
☐ Edge	lume
☐ Façade	lume
☐ Glass	lume
☐ Glow	lume
☐ Landscape	lume
☐ Material to Shader	3ds max
☐ Metal	lume
☐ Ocean	lume
☐ Opacity	base
☐ Reflect	base
☐ Refract	base
☐ Shader List	3ds max
☐ Stain	lume
☐ Translucency	lume
☐ Transmat	physics

	Transparency	base
	Two Sided	base
	UV Generator	3ds max
	Water Surface	lume
	Wet-Dry Mixer	lume
	XYZ Generator	3ds max

Shadow: Assigns a shadow shader.

The shadow component can be assigned the following shaders:

Shader	Library
	Edge Shadow	lume
	Facade	lume
	Glass	lume
	Glow	lume
	Material to Shader	3ds max
	Metal	lume
	Shader List	3ds max
	Shadow Transparency	base
	Translucency	lume
	Transmat	physics
	Water Surface Shadow	lume

Photon: Assigns a photon shader.

The photon component can be assigned the following shaders:

Shader	Library
☐ DGS Material	3ds max
☐ Dielectric Material Photon	3ds max
☐ Edge	lume
☐ Glow	lume
☐ Material to Shader	3ds max
☐ Metal	lume
☐ Photon Basic	base
☐ Translucency	lume
☐ Transmat	physics

Photon Volume: Assigns a photon volume shader.

The photon volume component can be assigned the following shaders:

Shader	Library
☐ Material to Shader	3ds max
☐ Parti Volume Photon	physics
☐ Shader List	3ds max

Extended Shaders group

Displacement : Assigns a displacement shader.

The displacement component can be assigned the following shaders:

Shader   Library

☐ 3D Displacement   3ds max

☐ Material to Shader   3ds max

☐ Ocean   lume

Volume: Assigns a volume shader.

The volume component can be assigned the following shaders:

Shader   Library

☐ Beam   lume

☐ Material to Shader   3ds max

☐ Mist   lume

☐ Parti Volume Photon   physics

☐ Shader List   3ds Max

☐ Submerge   lume

Environment: Assigns an environment shader.

The environment component can be assigned the following shaders:

☐ Environment   3ds max

☐ Material to Shader 3ds max

☐ Shader List   3ds max

Contour: Assigns a contour shader.

The contour component can be assigned the following shaders:

Combi   contour

Curvature   contour

Depth Fade   contour

Factor Color   contour

Layer Thinner   contour

Simple   contour

Width From Color   contour

Width From Light   contour

Width From Light Dir contour

Light Map: Assigns a light map shader.

 "Render To Texture", or "Texture Baking" allows us to create texture maps. This is completely based on an object's appearance in the rendered scene.

 The textures become part of the object through mapping. Later this can be used to display the textured object. This can make the process rapid.

![bell]	Study Notes

👁	Assessment

Define and explain Trace Depth and its uses for making more realistic 3D scenes.

Explain various types of Shaders with proper examples.

🗣	Discussion

Discuss all types of shaders and their uses in different situations.

1.22 Samples

Samples

Samples per Pixel group

Set the minimum and maximum sample rates for antialiasing the rendered output.

Note:Presets for several sample rate combinations are available on the Rendered Frame Window as the Image Precision (Antialiasing) slider.

☐Ā☐Ā   Minimum: Sets the minimum sample rate. The value represents the number of samples per pixel. A value greater than or equal to 1 indicates that one or more samples are computed per pixel. A fractional value indicates that one sample is computed for every N pixels (for example, 1/4 computes a minimum of one sample for every four pixels). Default=1/4.

☐Ā☐Ā   Maximum: Sets the maximum sample rate. If neighbouring samples find a difference in contrast that exceeds the contrast limit, the area containing the contrast is subdivided to the depth specified by Maximum. Default=4.

The values of the Minimum and Maximum lists are "locked" together so that the value of Minimum can't exceed the value of Maximum.

🔔	Study Notes

👁	Assessment
	Define and explain the Importance and uses of Samples for required outputs. Explain various types of Sample Rates with proper examples.

🗣	Discussion
	Discuss the various uses of Samples.

1.23 Sampling Quality

Sampling is an antialiasing technique. It provides a "best guess" colour for each rendered pixel. The mental ray renderer first samples the scene colour at locations within the pixel or along the pixel's edge and then uses a filter to combine the samples into a single pixel color.

(In 3ds Max, this technique is called "super sampling." Because the mental ray renderer performs sampling on a scene basis, in the Material Editor, you donot need to turn on super samplingfor materials rendered using mental ray.)

<image_placeholder/>	Study Notes

<image_placeholder/>	Assessment
	Define and explain Sampling quality.
	Explain various uses of sampling quality and super sampling.

<image_placeholder/>	Discussion
	Discuss Super sampling in 3DS Max.

1.24 Summary

<div align="right">INTRODUCTION TO LIGHT</div>

In this Unit we talked about the concept of light and different type soft lights available in 3DS MAX. In addition, we talked about sub objects of light as well as different ways to render the lights as per the required results like mental ray. We talked about various types of maps available for a good environment in the scene.

<div align="right">CONCEPT OF LIGHT</div>

In this topic we talked about the lights and the concept of lights in 3DS MAX.

Here we talked about the sub objects of lights and their importance in the final output.

CONCEPT OF PHOTONS, FAKE RADIOSITY AND CAUSTICS

A light ray is made up of photons. They are the particles, which make up a light.

ENVIRONMENT

As we all know, the environment is the surrounding of any scene. This environment contains fog, mist, clouds, etc. that makes it more real and full of depth.

CONCEPT OF PHOTONS, FAKE RADIOSITY AND CAUSTICS

We also talked about the idea and use of fake radiosity and caustics.They are the particles that make up a light. The photons are radiant energy capable of producing visuals for human eye.

ENVIRONMENT

Here we have talked about the environment and its importance in the completion of a 3D scene.The environment is the surrounding of any scene. For that, you can use either a plain solid colour background or an image as an environment.

AMBIENT

Ambient is the general light with no identifiable source or direction. In other words, if you increase the ambient in the scene and render it, you do not need lights for a good lighting in the scene.

EXPOSURE CONTROL

Here we talked about the exposure controls and their uses with various lighting systems for a realistic result. These exposure controls are plug-in components that are useful to adjust the output levels and colour range of a rendering, like you are adjusting film exposure.

TINT

This works on the overall look of the scene. This is used to apply a shade of the colour on the rendered scene. It is like using a colour filter in front of the camera.

Here we talked about all the other parameters of lights.Background Color: This allows you to apply the background colour in the scene, Environment Map:Here you can apply sky, land, etc. material for making the scene look real.

ATMOSPHERE AND EFFECTS

This rollout is available for all light types and comprises two options, viz. Lens Effects and Volume Light. Here we talked about the atmosphere and effects and their uses for various outputs like fire, fog, volume light etc.

PHOTOMETRIC LIGHTS

Photometric lights are based on photometric values, which are the values of light energy. The lights found in this subcategory include Point, Linear and Area (both Free and Target) and IES and mental ray Sun and Sky. Here we talked about the photometric lights and their uses.

RADIOSITY

This technique is called Radiosity in the computer graphics world; it differs fundamentally from raytracing. Types of the daylight depend upon the colour temperature.Here we talked about radiosity and its uses for photon calculation for a realistic result.

SKY LIGHT

The Skylight light models daylight. It is meant for use with the Light Tracer. The sky light is used for exterior as well as interior in certain cases with other supporting lights.

LIGHT TRACER

Light tracer is used for calculating realistic light and shadows with skylights as well as other lights in open environment scenes.

MENTAL RAY

Mental ray is a rendering technique used for realistic photon calculations and getting global illumination and caustics.

INDIRECT ILLUMINATION

This is the calculation of light and its photons, which are bounced by one object and get on to another in the environment.A photon map is a technique to generate the indirect illumination effects

Caustics are the effects of light cast onto an object via reflection off or refraction through another object. Here we talked about caustics and the importance of these type of effects in scene.

GLOBAL ILLUMINATION

Here we talked about the global illumination that includes direct and indirect illumination for a realistic result of lights in a 3D scene.Objects generate and receive global illumination by default.

FINAL GATHER

Here we talked about the procedure of final gather for the final calculations of direct and indirect illumination for the final rendered scene. It 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.

RENDERING SCENES > RENDERER

Rendering is the process of generating an image from a model, by means of computer programs. Here we talked about using the renderer and its various options. The term may be by analogy with an "artist's rendering" of a scene. 'Rendering' is also used to describe the process of calculating effects in a video editing file to produce final video output.

TRACE DEPTH

The Trace Depth controls calculate reflections and refractions. They refer to the photons used by FG.

SAMPLES

Here we talked about the concept and advantages of samples.

SAMPLING QUALITY

Sampling is an antialiasing technique. It provides a "best guess" colour for each rendered pixel. The mental ray renderer first samples the scene colour at locations within the pixel or along the pixel's edgeand then uses a filter to combine the samples into a single pixel color.

1.25 Self-Assessment Test

Broad Questions

Explain the concept of light in a 3D scene.

What is photon?

What is Ambient?

What is Illumination?

How many types of lighting system are available in 3DS MAX?

How many types of lights are available in standard lights?

How many types of lights are available in Photometric lights?

What is the difference between standard and photometric lights?

What is Exposure control?

How many exposure controls are available in 3DS MAX?

What is the use of Linear exposure control?

What is the use of Automatic exposure control?

Mental ray renderer

Radiosity and light tracer

Atmosphere and effects in 3DS MAX

1.26 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a 3D scene and apply materials on that as per the theme. This scene can be an interior or exterior scene. Include some objects as part of it, which can generate caustics like glass objects, water, etc. Render the scene with the use of Mental ray.

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Unit 2   Effects

	Learning Outcome

After going through this unit, you will be able to:

Explain Lens effects and their uses

Define Blur effect and its uses

Describe Brightness and contrast effect and its uses

Discuss colour balance effect and its uses

Explaindepth of field effect and its uses

Describefile output effect ad its uses

Discuss film grain effect and its uses

Explain motion blur effect and its uses

Discuss gizmos and their uses

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	Content Map

2.1   Introduction to Effects

2.2   Lens effects

2.3   Blur

2.4   Brightness and Contrast

2.5   Colour balance

2.6   Depth of Field

2.7   File Output

2.8   Film Grain

2.9   Motion Blur

2.10 Gizmos

2.11 Summary

2.12 Self-Assessment Test

2.13 Further Reading

2.1 Introduction to Effects

In this Unit, we will discuss the effects that can be added in the scene in 3DS MAX for the betterment of the scene, lik e – glow, lens flair, etc. In the real world, an en vironment of some kind surrounds all objects . The environment does much to set the am biance of the scene.

For example, an animatio n set at night in the woods has a very different environment than one set at the horse races during the middle of the day. Max includes dia log boxes for setting the color, background i mages and lighting environments; these feat ures can help define your scene.

This chapter covers atm ospheric effects, including the likes of clouds, fog, fire and volume lights. These effects can be seen only when the scene is rendered.

2.2 Lens Effects

In 3DS MAX the Effects panel is used to assign Render Effects plug in,, apply image processing without using Video Post, adjust and view effects interactively and animate parameters and references to scene objects.
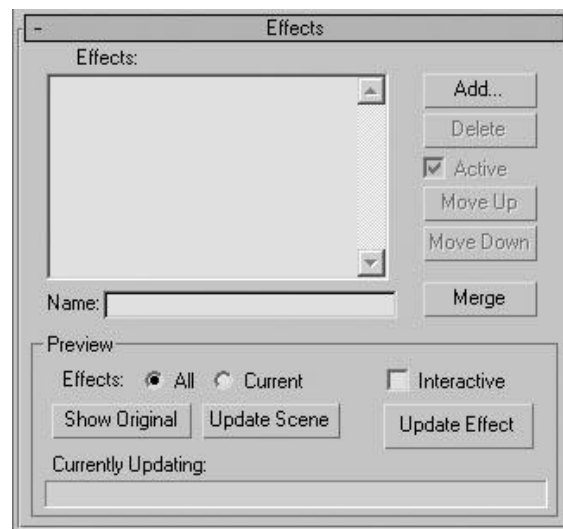

Fig. 2.1: Lens effects

Effects: Displays a list of selected effects.

Name: Displays the name of the selected effect. Edit this field to rename th e effect.

Add: Displays a dialog listing all available rendering effects.

Delete: Removes a highlighte d effect from the window and from the scene.

Active: Specifies whether the selected effect is active in the scene.

Move Up: Moves the highlighted effect up in the window list.

Move Down: Moves the highlighted effect down in the window list.

Merge: Merges rendering effects from scene files.

Interactive: This changes occur-interactively in the rendered frame window as we adjust the parameters of an effect.

Show Original/Show Effects toggle:Show Original to display the original rendered image without any of the effects applied.

Update Scene: Updates the rendered frame window with all changes made in Rendering Effects as well as any changes made to the scene itself.

Update Effect:Manually updates the preview rendered frame window when Interactive is not on.

Now let us talk about the various types of effects you get here. The first one is Lens effect.

Lens Effects is a system used to create real life effects commonly associated with a camera. These effects include:

Glow

Ring
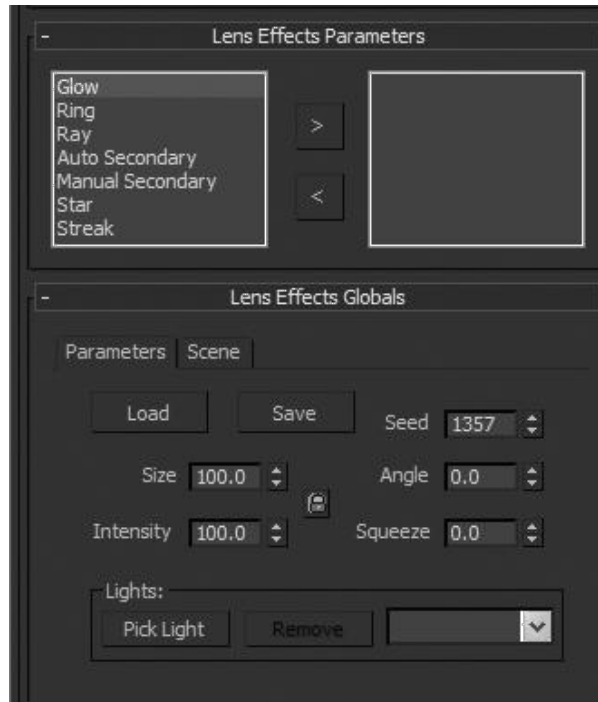
Ray

Auto Secondary

Manual Secondary

Star

Streak

Fig. 2.2: Lens Effects 2

Glow Effect: The Glow effect is used for making an object to look like it has a fairy light around it, which is coming out of it. Like you see the stars, moon, magic wand of fairies, magic balls in movies or serials etc. These all look like they are having their own fairy light around them emitting from themselves only.
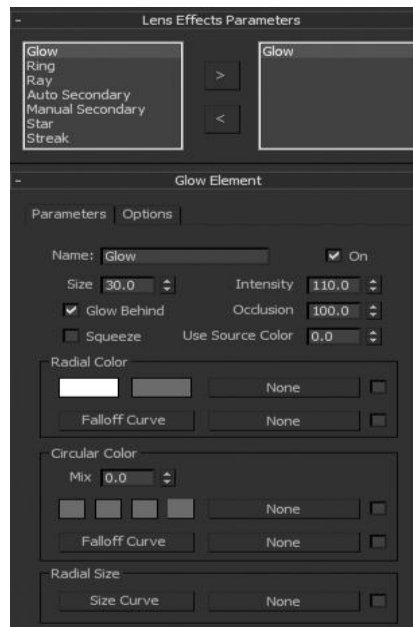

Fig. 2.3: Lens Effects - Glow

In the following figure, you can see the options available for application of glow effect on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
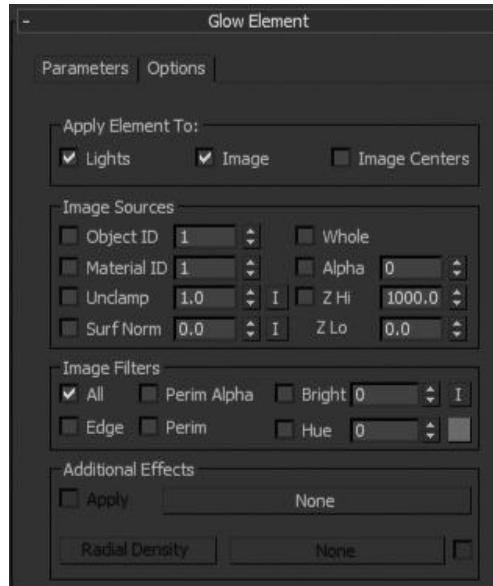

Fig. 2.4: Lens effects – glow parameters

In the following figure, you can see the glow effect give to a sphere. You can set the options of glow effect for various types of results.
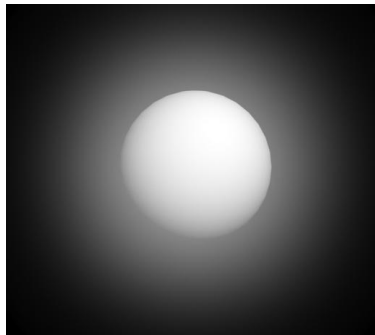

Fig. 2.5: Lens effects – glow final

Ring Effect:This effect is like a ring of light with various colours around an object. You might have seen streetlights at night which sometimes get a ring type of effects around themselves. Also, this effect can be used for making planets in the galaxy with glows and rings of lights around themselves.
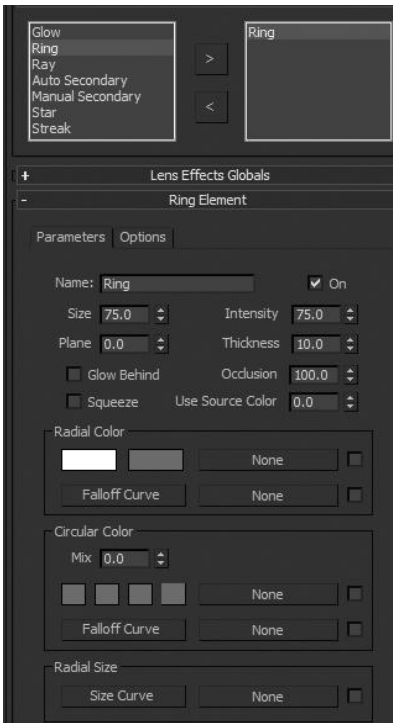
Fig. 2.6: Lens Effects – Ring

In the following figure, you can see the options available for application of Ring effects on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
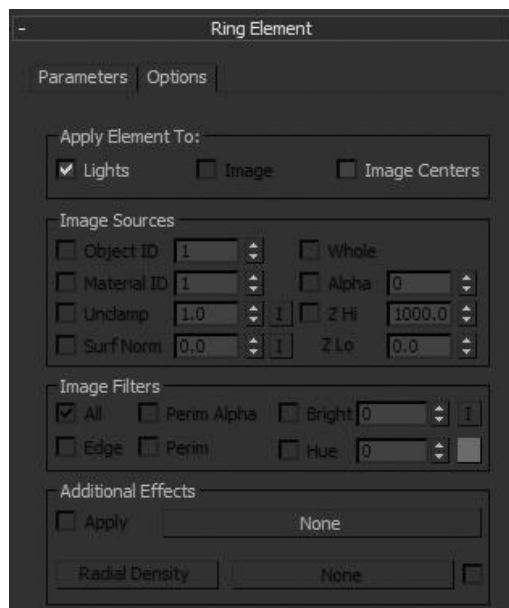

Fig. 2.7: Lens Effects – Ring 2

In the following figure you can see the ring effect applied on a sphere in the scene. Here you can set the options for the ring effect as per your requirement in the output.
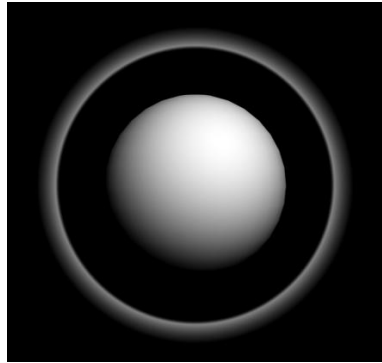

Fig. 2.8: Lens Effects – Ring Final

Ray Effect:This effect is used for making a ray type OF effect on an object. Like you might have seen the effects of a single ray with glow on diamonds and jewellery several times in the advisements. Also, this effect is used for making something more highlighted in the scene. This ray is animated with the option of angle for more effective results on diamonds and jewellery.
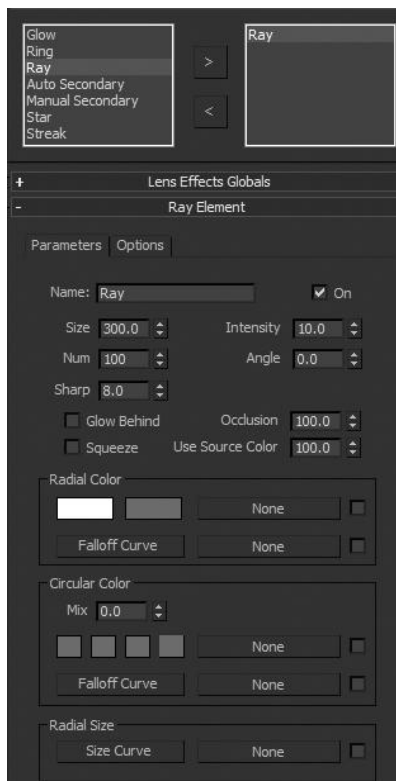

Fig. 2.9: Lens Effects – Ray Effect

In the following figure, you can see the options available for application of Ray effects on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
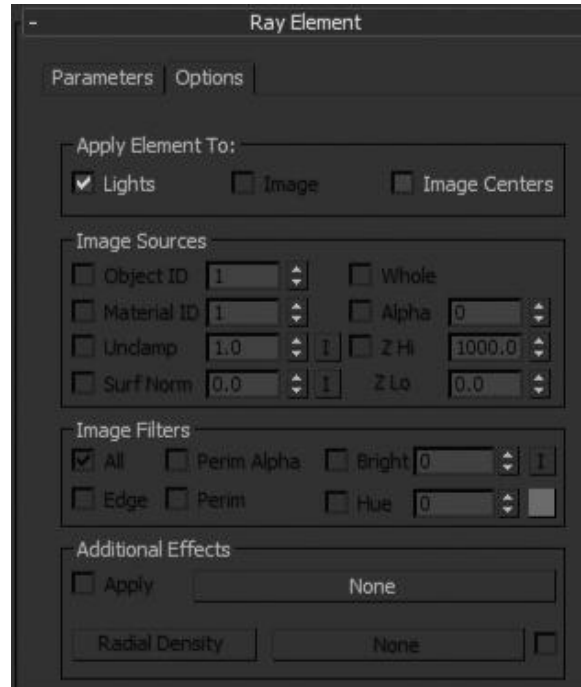

Fig. 2.10: Lens Effects – Ray Effect 2

In the following figure, you can see a ray effect given to a light in a simple scene. Here you can set the number of rays as well as the intensity of the ray light.
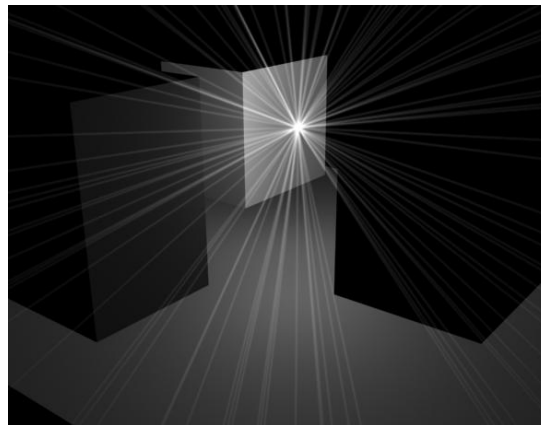

Fig. 2.11: Lens Effects – Ray Effect Final

Auto Secondary Effect:This effect contains a group of circles or other given shapes of light, which together make a flare type of glow effect around the object you have

chosen. Here you can decide the shape from the given options like – circle, polygons, etc. Also you can change the colors of the rings and their intensity as per your choice.
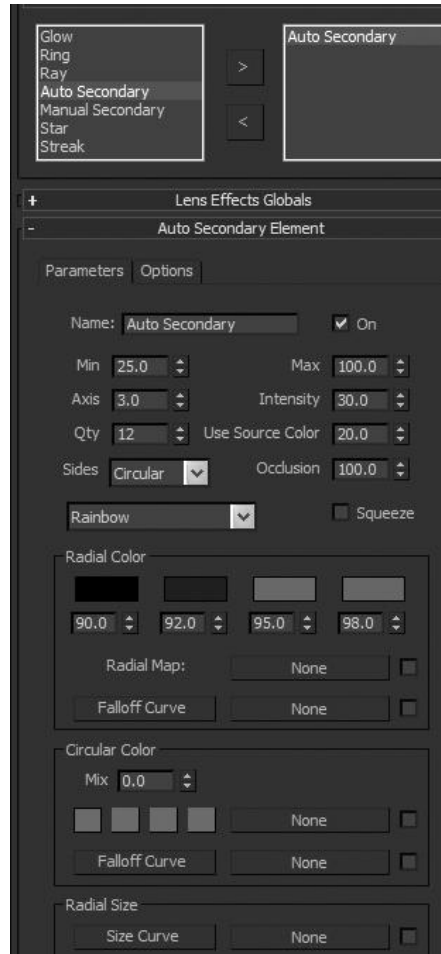

Fig. 2.12: Lens Effects – Auto Secondary

In the following figure, you can see the options available for application of Auto secondary effect on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
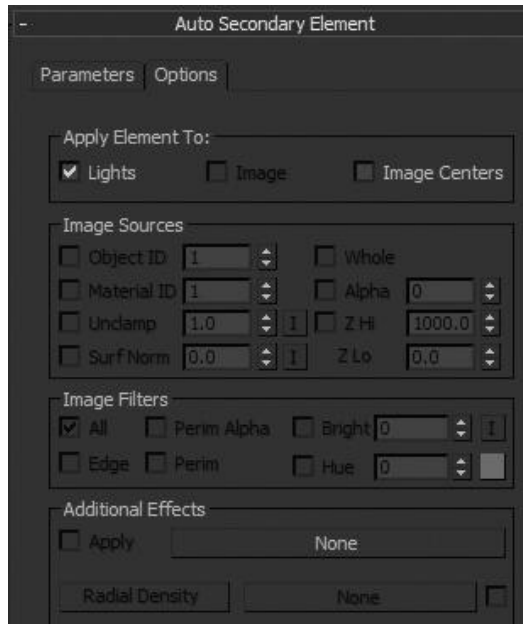
Fig. 2.13: Lens Effects – Auto Secondary 2

Secondary flares are the small circles we would normally see coming out from the source of the lens flare along an axis relative to the camera position.

In the following figure, you can see the auto secondary effect applied to a light in a simple scene. You can change th e number of rounds as well as the intensity o f the effect in the scene. Also you can change the circle shapes of light in to rectangles, poly gonal shapes etc. as they are given in the opti ons.

Fig. 2.14: Lens Effects – Auto Secondary Final

Manual Secondary Effect: This effect is used for making a rainbow type of effect around the selected object or light.
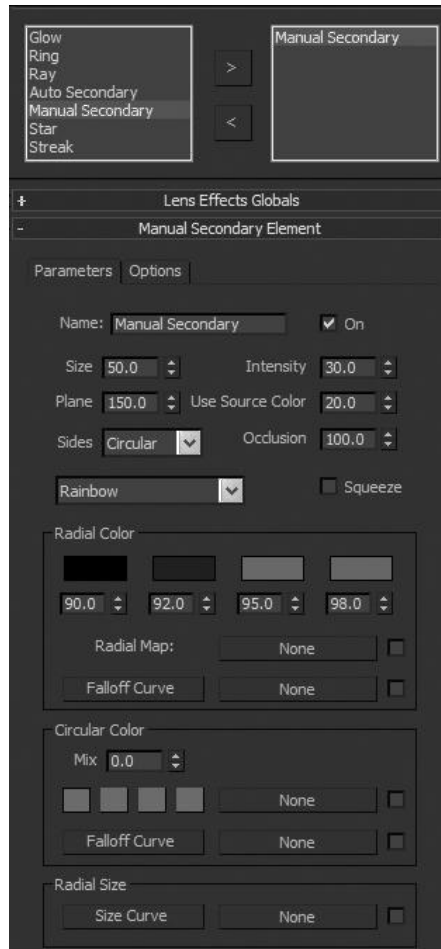
Fig. 2.15: Lens Effects – Manual Secondary

In the following figure, you can see the options available for application of Manual secondary effect on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
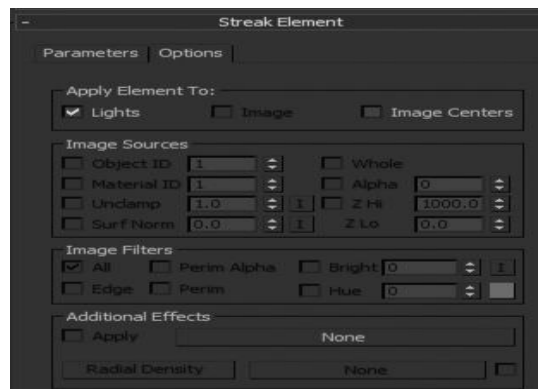
Fig. 2.16: Lens Effects – Manual Secondary 2

In the following figure, you can see the manual secondary effect applied to a light in a simple scene. You can change the intensity of the effect in the scene. Also you can change the circle shapes of light in to rectangles, polygonal shapes etc. as they are given in the options.
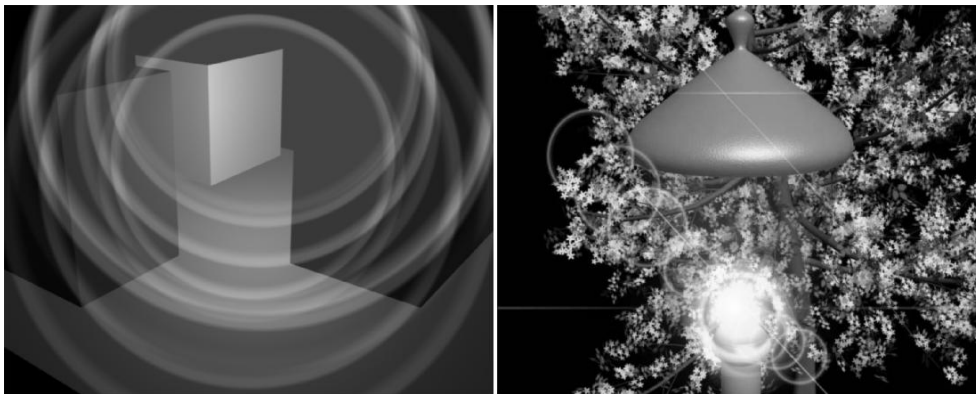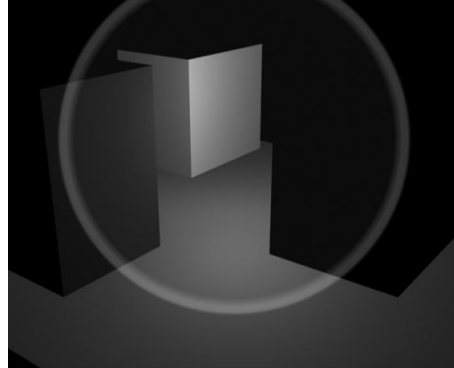

Fig. 2.17: Lens Effects – Manual Secondary Final

Star Effect:A Star is larger than a Ray effect and is composed of 0 to 30 spokes, instead of hundreds like a ray.
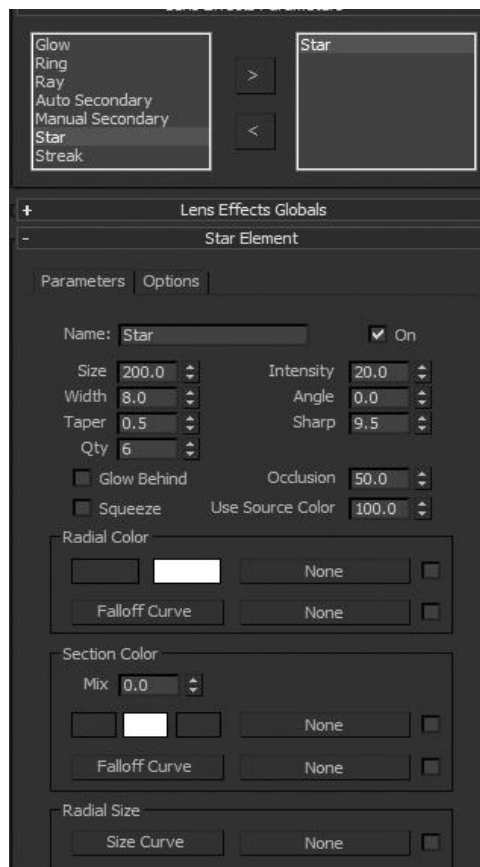
Fig. 2.18: Lens Effects – Star Effect

Here you will get various options like size, intensity, width, angle, tap er, sharp, qty, radial colour, section colour, radial size, etc. for modification in the effect as per your choice. You can see all the options in th e above figure.
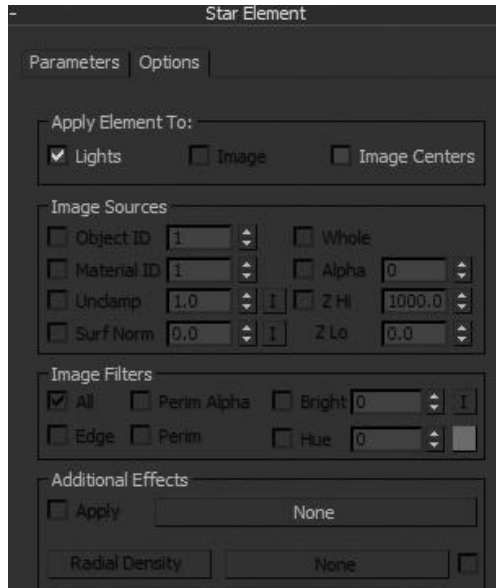
Fig. 2.19: Lens Effects – Star Effect 2

In the above figure, you can see the options for parameters and opti ons. Here you can decide that on which object or light you want to apply the effect. You can use object id, material id, etc. for applying the effect on a particular object or light in the scen e.

In the following figure, you can see the star effect and a diamond that can be animated with the use of option called – angle.

Fig. 2. 20: Lens Effects – Star Effect Final

Streak Effect:A streak is a wide band that runs through the centre of the source object. In real camera work, it is produced when using anamorphic lenses t o film a scene.
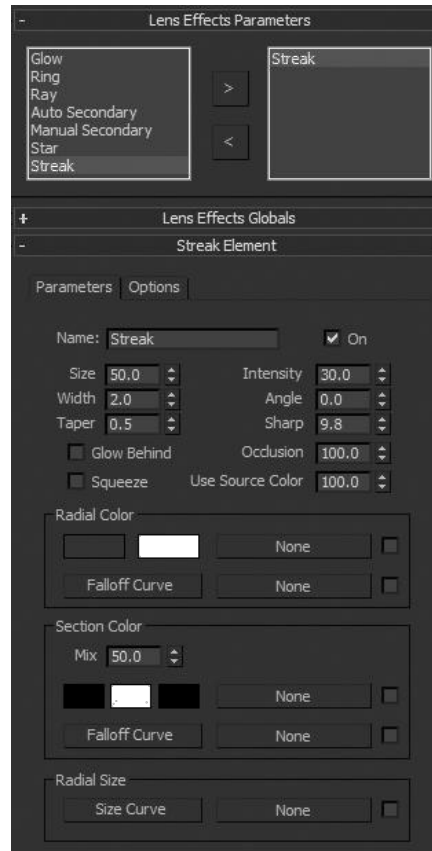
Fig. 2.21: Lens Effects – Streak Effect

In the following figure, you can see the options available for applications of Streak effect on any object of the scene as well as on any light you can apply it. Here you can apply the effect on any object by using its material id, object id, etc. You can see the other options here for the application as you can see in the figure here.
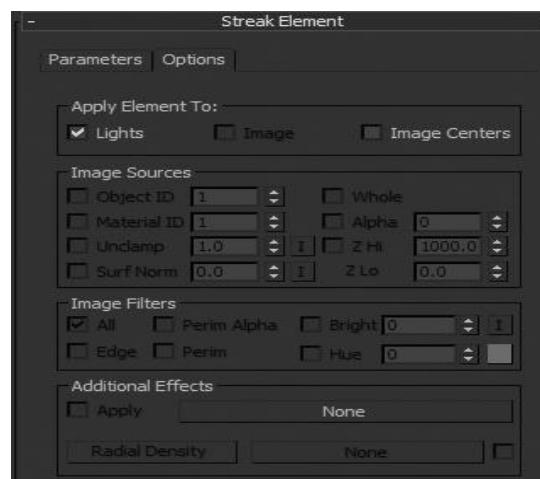

Fig: 2.22: Lens Effects – Streak Effect 2

In the following figure yo u can see the effect of streak on an object as it gives a single ray of light, which can be easily animated, with the use of the option available c alled – angle.
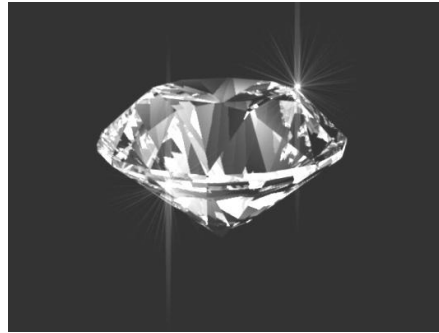
Fig. 2.2 3: Lens Effects – Streak Effect Final

⚠	Study Notes

👁	Assessment
Define Lens effects and their uses. Explain various types of Lens effects with proper examples.	

🗣	Discussion
Discuss various situations and examples where you can use different lens effects for more real looks in the scene.	

2.3 Blur

The Blur effect allows us to blur our image in three different methods: Uniform, Directional and Radial.
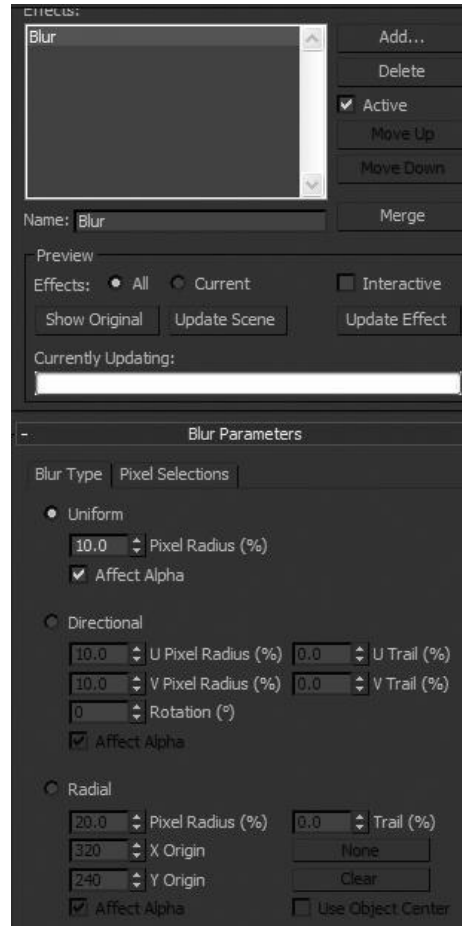
Fig. 2.24: Blur Effect

In the above figure, you can see that the blur can be given in a whole image as well as it can be directional too. You can make it horizontal as well as vertical as per the requirements.

This effect is normally used for making a gassy look in the scene. This effect can be applied as a radial blur also to make certain type of feelings in the scene like dreaming or back to memories, etc.
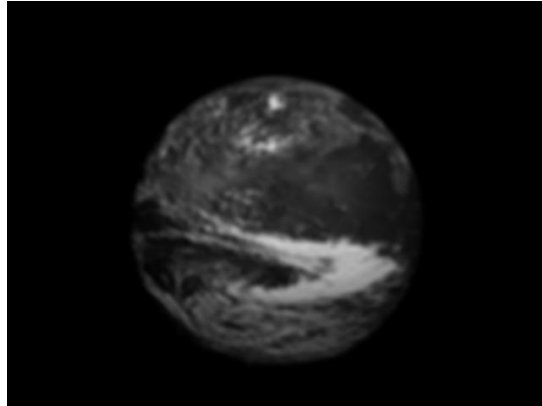
Fig. 2.25: Blur Effect 2

In the above figure, you can see a simple earth is applied blur effect on it. In the following figure, you can see the radial blur effect applied to a simple scene.
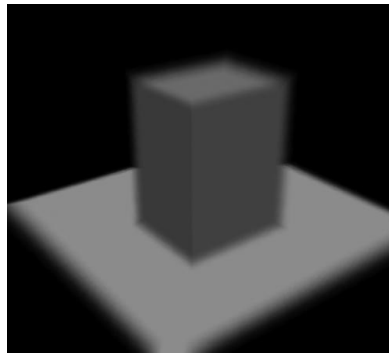
Fig. 2.26: Blur Effect 3

Study Notes

![eye icon]	Assessment

Define Blur effects and their uses.

Explain various types of Blur effects with proper examples.

![discussion icon]	Discussion

Discuss various situations and examples where you can use different Blur effects for more real looks in the scene.

2.4   Brightness and Contrast

This effect is used for enhancing brightness as well as contrast in a rendered result of the scene you have made in 3DS MAX.
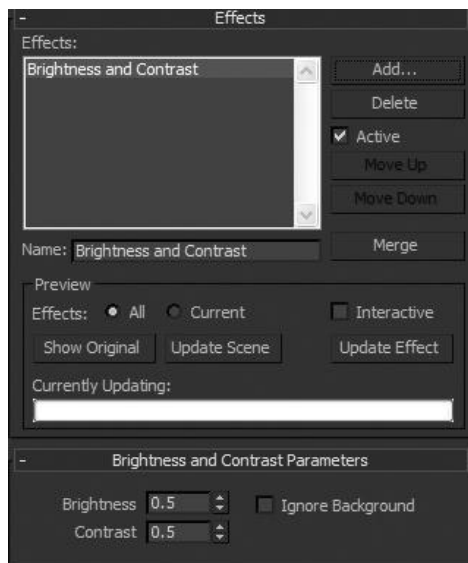
Fig. 2.27: Brightness and Contrast 1

Here, you get facility similar to work on the brightness and contrast you adjust for images in Photoshop. The advantage of this effect is that you do not need to go to any other software after rendering the avi or jpeg from here only for adjusting brightness and contrast.

![eye icon]	Assessment
	Define brightness and contrast effect and its uses.
	Explain various examples where brightness and contrast effect can be used.

![discussion icon]	Discussion
	Discuss various situations and examples where you can use Brightness and Contrast effect for desired results.

2.5   ColorBalance

With this, effect, you can set the colour balance in the scene while rendering the final output. For example, you need more cyan, magenta, etc. colour instead of the opposite colour in the scene then you can set from here. This effect is similar to colour balancing in Photoshop. This will be a beneficial element here as you do not have to edit the image or avi in Photoshop or After effects etc. software after rendering it from 3DS Max.
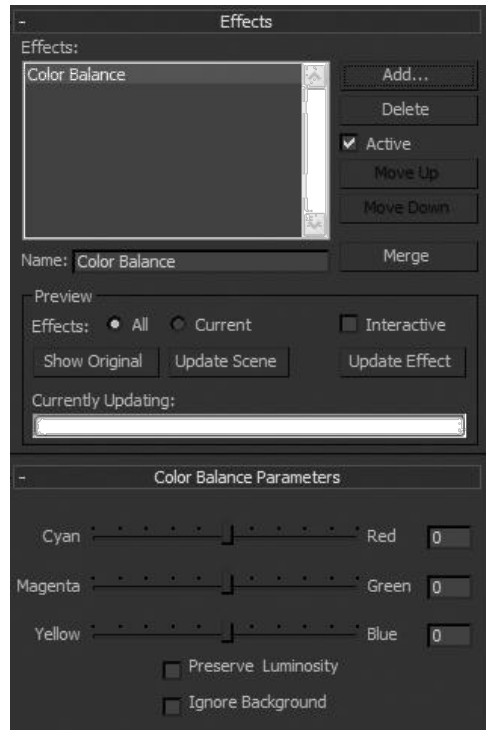
Fig. 2.28: Brightness and Contrast 2

🔔	Study Notes

👁	Assessment
	Define colour Balance effect and its uses. Explain various examples where you can use colour balance for more effective results in the scene.

	Discussion
Discuss various situations and examples where you can use colour Balance effect for more real looks in the scene.	

2.6 Depth of Field

The Depth of Field effect simulates the natural blurring of foreground and background scene elements when viewed through a camera lens.
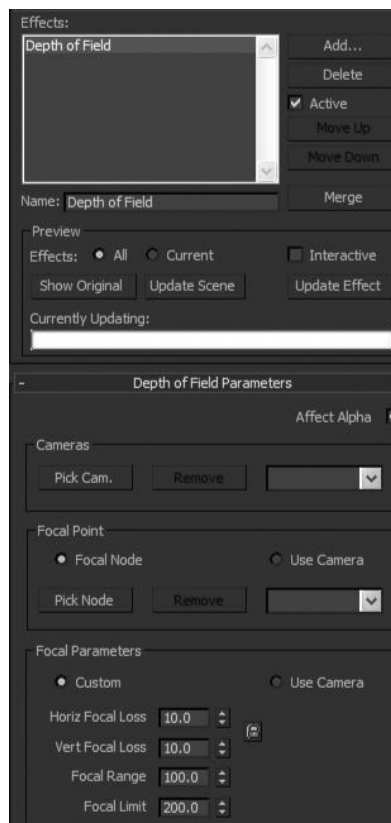
Fig. 2.29: Depth of Field 1

Here, you can chose the camera as you will be setting the depth in context of one object to others from the view of camera that is chosen. You can see the options in the above figure where you can select the camera for setting the depth in the scene.

In the depth of field effect, you get the options to set the Horizontal Focal loss, Vertical Focal loss, Focal range and Focal limit for setting their values for desired results.
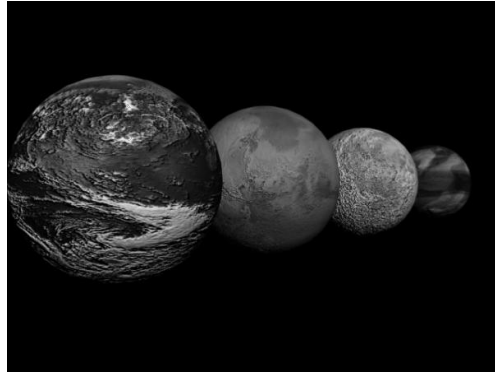
F ig. 2.30: Depth of Field Final

In the above figure, you can see the simple scene that does not have a ny depth in it. Here we have applied depth of field with the use of camera and the resu lt is like the following figure. In this figure, you can see the first planet is in front of the ot hers and with the use of depth of field we ha ve set them to look like they are near and gradually their distance from the camera is incr easing order wise.
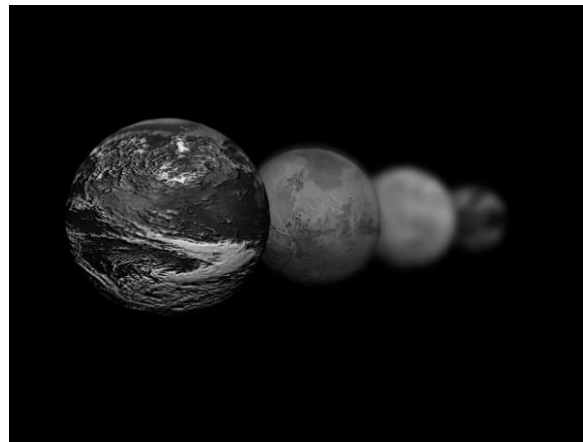
Fig. 2.31: Depth of Field Final 2

🔔	Study Notes

<table><tr><td>Assessment</td></tr></table>
Define Depth of Field effect and its uses.
Explain various examples where you can use depth of field effects.

Discussion
Discuss various situations and examples where you can use Depth of Field effect for more real looks in the scene.

2.7 File Output

File Output allows us to take a "snapshot" of a rendering before some or all of the other Render Effects are applied, depending on the placement of File Output in the Render Effects stack.
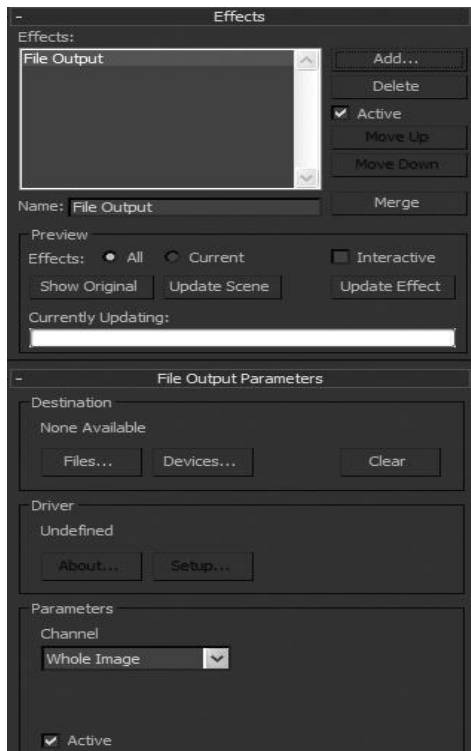
Fig. 2.32: File output

Files: Opens a dialog so we can save the rendered image or animation to disk.

The rendered output can be a still image or an animation, in one of the following file formats:

Autodesk Flic Image File (FLC, FLI, CEL)

AVI File (AVI)

BMP Image file (BMP)

Encapsulated PostScript format (EPS, PS)

JPEG File (JPG)

Kodak Cineon (CIN)

MOV QuickTime file (MOV)

PNG Image File (PNG)

RLA Image File (RLA)

RPF Image File (RPF)

SGI's Image File Format (RGB)

Targa Image File (TGA, VDA, ICB, UST)

TIF Image File (TIF)

Devices: Opens a dialog so we can send the rendered output to a device such as a video recorder.

Clear: Clears any file or device selected in the Destination group box.

About: Provides information on the source of the image-handler software used to bring the image into the software.

Setup: Displays a setup dialog specific to the plug-in. Some plug-ins may not use this button.

Channel: Lets us choose which channels we wish to save or send back in to the Render Effects stack.

Affect Source Bitmap: This will take in an image with any effects previously applied, convert it to the channel selected and send it back into the stack for the rest of the effects to be applied.

Active: Turns the File Output feature on and off.

Copy: Click Copy to use the camera's clipping planes to determine which part of the scene should be rendered into the Depth channel image file.

None: Enables us to select a camera to use for copying clipping planes.

Near Z: Specifies the beginning distance from the camera that should be used in determining where to start rendering the scene's geometry in the depth channel image file.

Far Z: Specifies the ending distance from the camera that should be used in determining where to stop rendering the scene's geometry in the depth channel image file.

Fit Entire Scene: Makes all other Depth parameters unavailable and will render the entire view port's scene geometry in the Depth channel image file, automatically calculating the near and far Z required.

	Study Notes

	Assessment
Define the uses of File output effect.	
Explain various types of file outputs you get in file output effects.	

<image: blue head icon>	Discussion
Discuss various situations and examples where you can use File output effect for desired results.	

2.8   Film Grain

Film Grain is used to recreate the look of film grain in our rendered scene. Film Grain also allows us to match film grain from source material used as a background, such as an AVI, to the rendered scene created in the software.
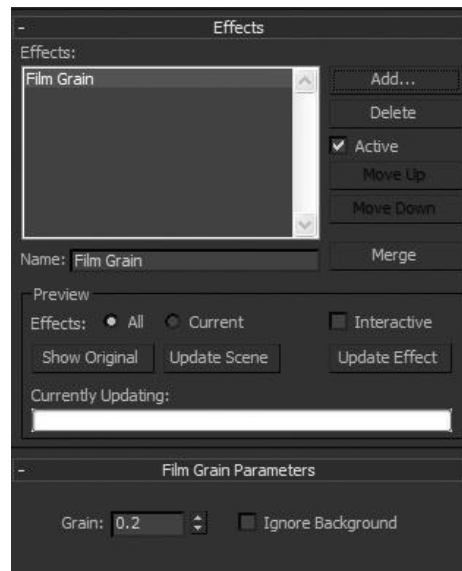
Fig. 2.33: Film grain

Grain: Sets the amount of grain added to our image. Range=0 to 1.0.

Ignore Background: Masks the background so that grain is applied only to geometry and effects in the scene.

In the following figure, you can s ee a simple scene that has no grains in it.
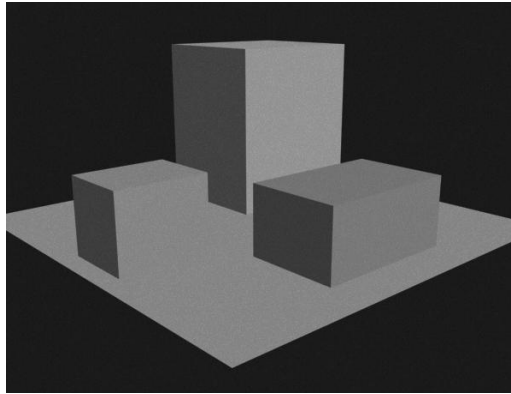
Fig. 2.34: Film Grain 1

Now you can see the sa me scene with grains that we have applied in t he scene with the use of film grain effect.

Fig. 2.35: Film Grain Final

![bell icon]	Study Notes

![eye icon]	Assessment
Define Film Grain effect and its uses. Explain various examples where you can use Film Grain effect.	

![face icon]	Discussion
Discuss various situations and examples where you can use Film Grain effect for more effective looks in the scene.	

2.9 Motion Blur

Motion Blur applies an image motion blur to our rendered scene by blurring moving objects or the entire scene. Motion blur can enhance the realism of a rendered animation by simulating the way a real-world camera works.
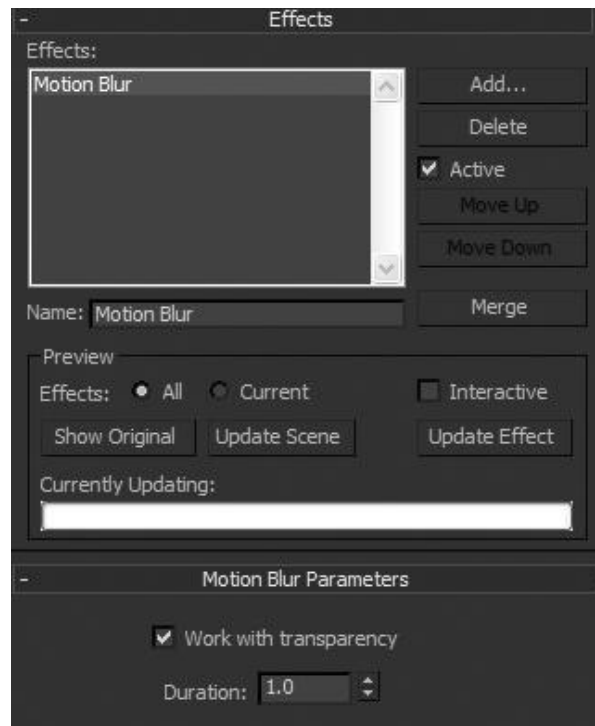
Fig. 2.36: Motion Blur

The options available here are as the followings:

Work with transparency: When on, motion blur is applied to objects behind transparent objects.

Duration : Specifies how long the "virtual shutter" is open.

![bell icon]	Study Notes

![eye icon]	Assessment
Define Motion Blur effect and its uses.	
Explain various examples where you can use Motion Blur effect for more realistic output.	

![speaking head icon]	Discussion
Discuss various situations and examples where you can use Motion Blur effect for more real looks in the scene.	

2.10 Gizmos

In 3DS Max you get 3 types of Gizmos which are used for applying various effects on them for various results.
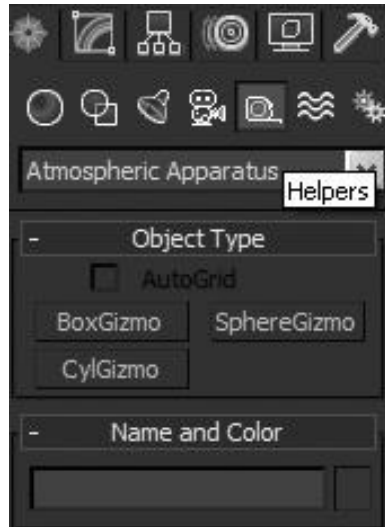
Fig. 2.37: Gizmo

Box Gizmo: This Gizmo is in a Box form, which can give a cube like area in which you can apply Volume Fog, Fire, etc. effects from Atmosphere and Effects list.

In the following figure you can see the Box Gizmo in the view port.
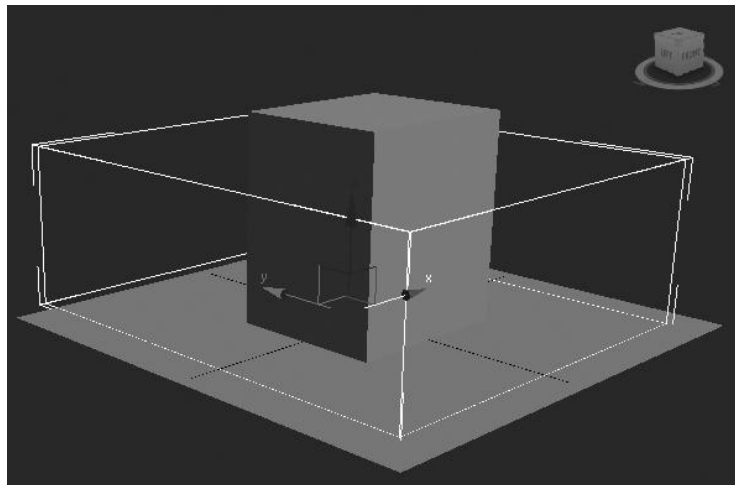
Fig. 2.38: Box Gizmo

In the following figure, you can see the options available for changes in the gizmo.
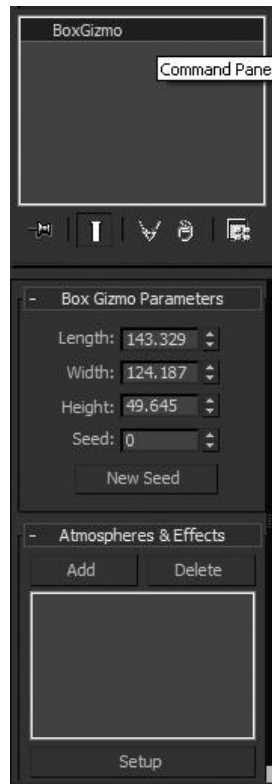
Fig. 2.39: Box Gizmo Options

When you apply fire or fog on the gizmo, it will take it in its shape and then you can animate the fog or fire applied to it by animating the gizmo. In the following figure, you can see the Volume Fog applied to the Box Gizmo.
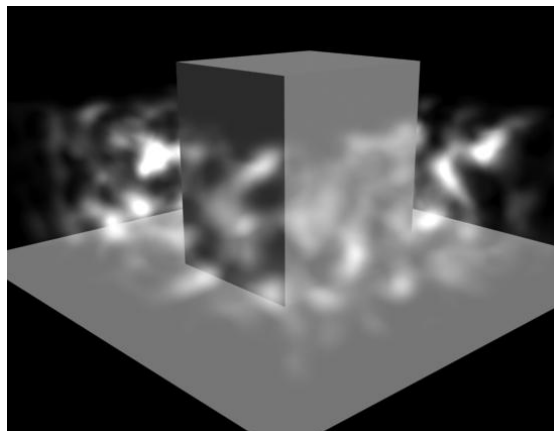
Fig. 2.40: Fog on Box Gizmo Options

Sphere Gizmo:This Gizmo is in spherical shape that can produce a rounded shape of effect applied on it. You can see how the spherical Gizmo looks in the vi ewport in the following figure.
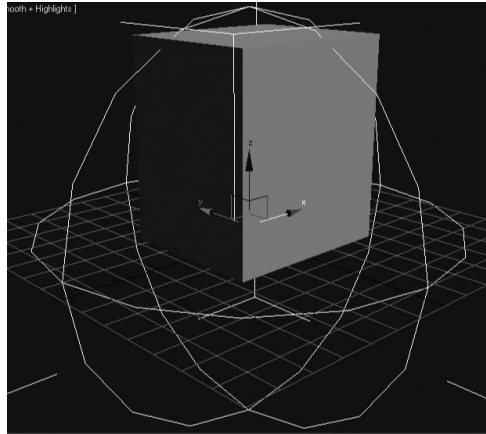
Fig. 2.41: Sphere Gizmo

You can change its properties like radius, Hemisphere, etc. from t he properties available in its modifier options. You can see the options in the following figure.

Fi g. 2.42: Sphere Gizmo Options

In the following figure, you can see how fire effect looks like when applied on a Spherical Gizmo.
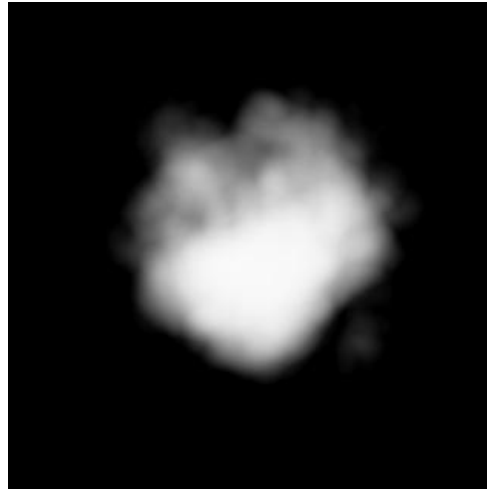
Fig. 2.43: Fire on Sphere Gizmo Options

CylGizmo:This Gizmo has a cylindrical shape that produces the result of effect applied on it in a cylindrical from. In the following figure, you can see how it looks in the viewport.
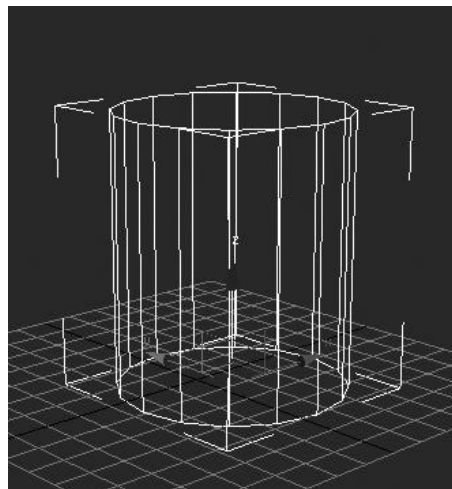
Fig. 2.44: CylGizmo

You can change its properties like radius, height etc. from the properties available in its modifier options. You can see the options in the following figure.
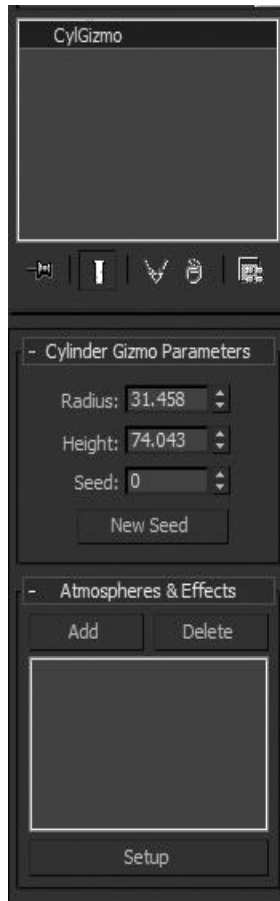
Fig. 2.45: CylGizmo Options

When fire or fog effect is applied on this gizmo, it looks like the following figure.

Fig. 2.46: Effects on CylGizmo

![bell icon]	Study Notes

![eye icon]	Assessment
	Define Gizmo types in 3DS Max and their uses. Explain various applications where you can use Gizmos.

![speaking head icon]	Discussion
	Discuss various situations and examples where you can use different types of Gizmos for more real looks in the scene.

2.11 Summary

INTRODUCTION TO EFFECTS

In this Unit, we talked about various effects available in the Atmosphere and Effects windows. We also talked about how to use them with Gizmos available in 3DS Max.

LENS EFFECTS

In this Topic, we talked about the Lens Effects with a list of various presets inside it like Glow, Ring, Streak, Manual Secondary, etc. effects. Lens Effects is a system used to create real life effects

In this topic, we discussed about the Blur effect and its uses for various situations. This effect is normally used for making a gassy look in the scene. This effect can be applied as a radial blur also to make certain type of feelings in the scene like dreaming or back to memories, etc.

BRIGHTNESS AND CONTRAST

In this topic, we talked about Brightness and Contrast effect and its options available for changes in the final output.

COLOR BALANCE

Here we talked about the facility of colour Balance in 3DS Max for the final output so that you do not need other software after rendering avi or image from here for more colour balancing and corrections.

DEPTH OF FIELD

Here we talked about the Depth of Field effect and its use for adding more depth in the scene with teh use of camera.In the depth of field effect, you get the options to set the Horizontal Focal loss, Vertical Focal loss, Focal range and Focal limit for setting their values for desired results.

FILE OUTPUT

Here we talked about the effect File Output that is used to get various types of outputs after rendering.The rendered output can be a still image or an animation formats such as avi, jpeg, BMP etc.

FILM GRAIN

This effect is used for adding film grains in the scene as per the requirements.

MOTION BLUR

This effect is used for showing motion in the scene especially in the moving objects of the scene.Motion blur can enhance the realism of a rendered animation by simulating the way a real-world camera works.

GIZMOS

These are the Atmospheric apparatuses used for applying effects like Fog and Fire with proper shapes and to animate them in the scene.

2.12 Self-Assessment Test

Broad Questions

What are Lens Effects?

Give the list of presets available in Lens Effects.

Which type of applications can be made with the use of Lens Effects?

What is Blur?

What is Motion Blur?

What is the difference between Blur and Motion Blur effects?

What are the different situations where you can use Blur and Motion Blur Effects?

What is Gizmo?

Which type of Gizmos are available in 3DS Max?

Which type of effects can be applied on Gizmos in 3DS Max?

Lens Effects

Atmospheric Effects

Gizmos

Blur

Brightness and Contrast

2.13 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a scene in 3DS Max that contains an environment like galaxy, sunrise, sun set etc. and enhance it with the uses of effects and environment.

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Unit 3   Cameras and Rendering Techniques

	Learning Outcome

After going through this unit, you will be able to:

    Explain the uses of Ram Player

    Discuss the Rendering Techniques available for 3DS Max

    Give the importance and uses of Cameras

    Illustrate Uses of apparatus

    Explain Uses and advantages of Motion Blur and Depth of Field

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

    1st Reading: It will need 2 Hrs for reading

    2nd Reading with understanding: It will need 3 Hrs for reading and understanding

    Self-Assessment: It will need 3 Hrs for reading and understanding

    Assignment: It will need 4 Hrs for completing an assignment

    Revision and Further Reading: It is a continuous process

	Content Map

3.1   Introduction to Camera

3.2   RAM Player

3.3   Rendering Techniques

3.4   Cameras

3.5   Explain Lens

3.1 Introduction to Camera

In this Unit, you will learn about the camera and its various uses. We will discuss the various features and possible effects for camera here.

As we all know that to shot a movie or take a photograph we need a camera, in the same way in a 3D world we need a camera to shot the animation with the required settings. We can move the camera and shot the animation or scene as per our requirement. In addition, here we get several options to control the camera and its features for better results.

You might have seen several movies and serials where you see objects or characters with depth; like one character seems to be very closer and other looks to be very far from the camera with blur. This type of effects we can generate by using depth of field with the camera. Further, you can generate the motion blur effect for moving or rotating objects with the use of pass blending and motion blur with the camera.

3.2 RAM Player

This is a player given along with 3DS Max which can be used for opening and checking any image or avi file after rendering it. You can open two images or avi files parallel to compare the quality and dimensions. Ram Player uses a part of the ram that is used by 3DS Max at a single time, so you do not have to open media player or any other players outside of the software to check the output.

Here, when you import / open any file, it will ask you for the desired resolution as well as how many frames you want to open here to check.
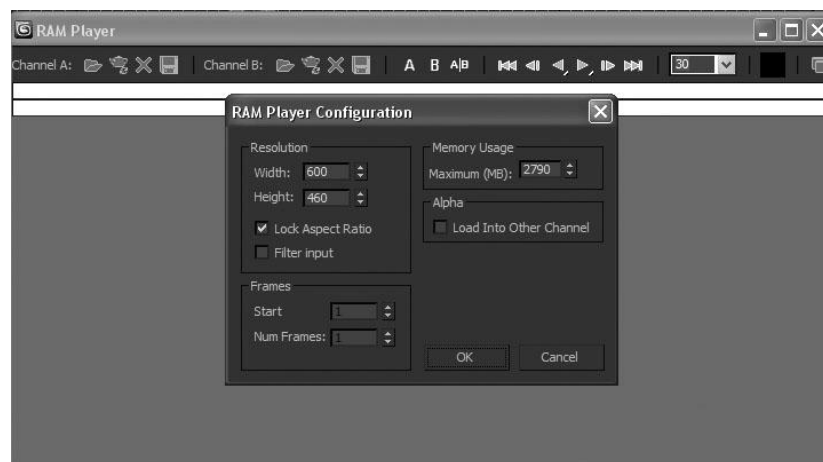
Fig. 3.1: Ram Player

Here you can load a particular number of frames from any avi as here you want to compare or check it.
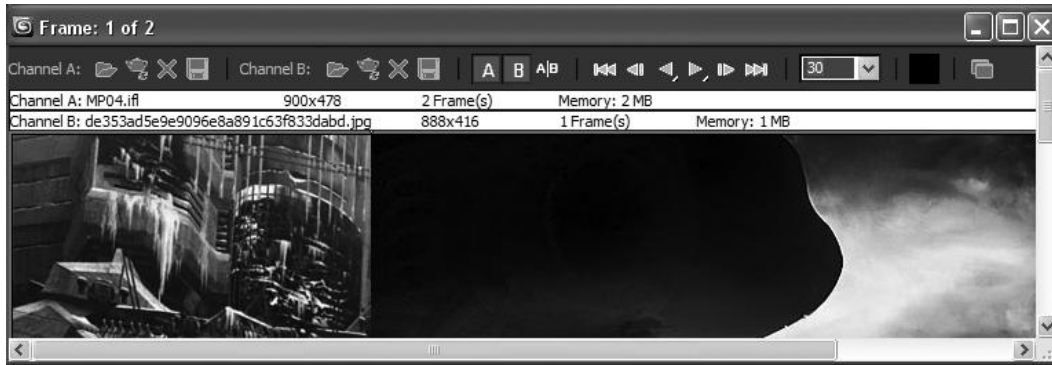
Fig. 3.2: Ram player window

Here you can change the frame per second rate for play back in the Ram Player to get a preview as you want.

Fig. 3.3: Ram player window fps

You can play forward and backward as well as play and pause the avi for desired preview.

Fig. 3.4: Ram player window playback options

Also, you can get a separator in horizontal or vertical direction to compare two outputs at a single time as there are two channels to open the media – A and B.
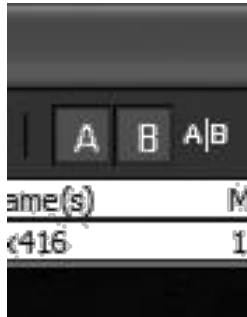
Fig. 3.5: Ram player window channels

⚠	Study Notes

👁	Assessment
Define and explain Ram player and its options. Explain various uses of Ram player.	

🗣	Discussion
Discussthe uses of Ram player.	

3.3 Rendering Techniques

If you want to get the output of the scene from 3DS MAX, you have to use render window. You can use the render command also for rendering with default settings and renderer.
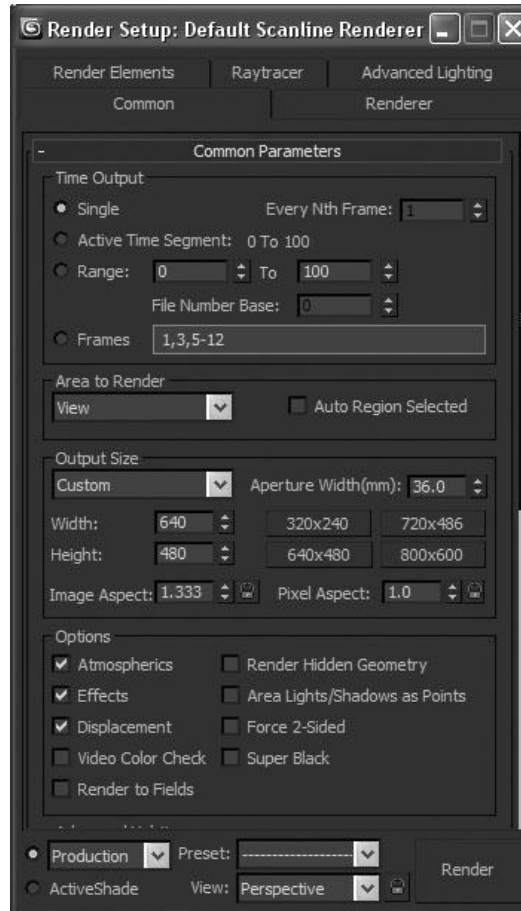
Fig. 3.6: Rendering Techniques

Here, you will get three types of renderers:

Scan line Renderer, Mental ray Renderer and VUE Renderer about all of them we have talked in earlier units.Also, in 3DS MAX 2011 version you will get one more type of renderer and that is QuickSilver Hardware Renderer.

Let us talk about some good rendering techniques now. You might have seen so many Hollywood movies where the scenes are shot in a dramatic way, faster or slower. These all things can be easily done with the use of camera and its various options. You can play around with the camera and its available features to get better effects in final outputs.

👁	Assessment
	Explain various rendering techniques of 3DS MAX. Explain the uses of rendering.

🗣	Discussion
	Discuss rendering techniques of 3DS MAX.

3.4   Cameras
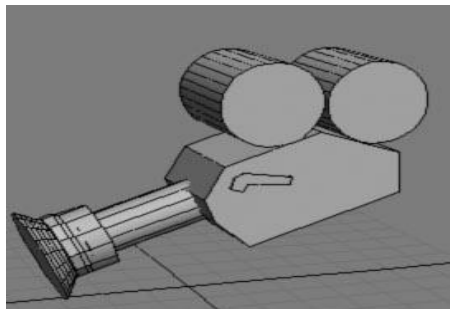
Fig. 3.7: Camera

Whatever you make and animate in 3D world may not seem real or original unless and until you place a "Camera" in our scene.

The cameras can be used to create a simple scene into a more dynamic scene. The cameras play a very important role in adding special effects to the movies, games, presentations and advertisement. Now a days these special effects are often seen in the movies.

Mostly seen in the Hollywood movies like " the fast and the furious", "Constantine", "The Mask", "Mission Impossible", "Men In Black","Vanilla Sky", ……… now a days these

effects are even seen in the bollywood movies like "Koi Mil Gaya", "Dhoom", "Dus", "Khel", "JaaniDushman", ……

The cameras in short play a very vital role in animations as they add special effects like motion blur, jerks, DOF etc.

The main aim of the camera is to "FOCUS". The vieyour sees what the camera focuses. The motion is seen where the camera moves. You feel as if you are seeing the real world in the computer.

The reason behind the excellent originality in the 3d animated movies like " Finding Nemo", "Monsters Inc", "Shrek", etc... are due to cameras.

There are several Camera Attributes which can be easily used for certain type of outputs:

PointOfInterest

Zoom

DepthOfField

FocusDistance

Aperture

BlurLevel

When you put camera in the scene, it looks like the following figure.
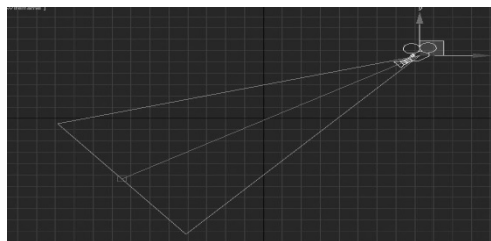
Fig. 3.8: Camera 2

There are two types of camera given in 3DS MAX:

Target Camera

Free Camera
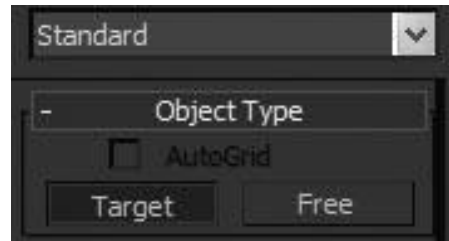
Fig. 3.9: Camera 3

You can use any of them as per the requirement. Well both of them have same parameters and the only difference between them is that the target camera has a target point that can be selected and moved separately where the free camera gives only target distance instead of a separate selectable target.

	Study Notes

	Assessment
	Explain the uses and importance of camera.
	List down the important camera attributes.

	Discussion
Discuss the uses of camera.	

3.5 Explain Lens

In camera, the lenses are given as stock lenses.Camera lens is a very important and useful feature. This is the main feature that captures and passes the picture to the camera. There are various type of lenses for camera. Majorly camera lens is measured in their size. In other words, they behave like the focal length for the camera which is generally measured in mm.

There are set of the camera's focal length in millimeters like:

15mm

20mm

24mm

28mm

35mm

50mm

85mm

135mm

200mm
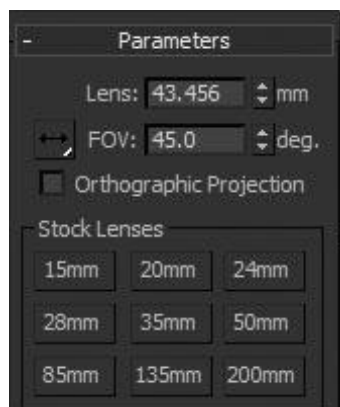
Fig. 3.10: Camera Lens

Type: This changes the camera's type from a target camera to a free camera and vice versa.

Show Cone: This displays the cone defined by a camera's field of view.

Show Horizon: This displays the horizon line.

Near Range and Far Range: This determines the near and far range limits for the atmospheric effects set on the Environment panel.

Show: This Displays rectangles within the camera's cone to show the Near and Far range settings.
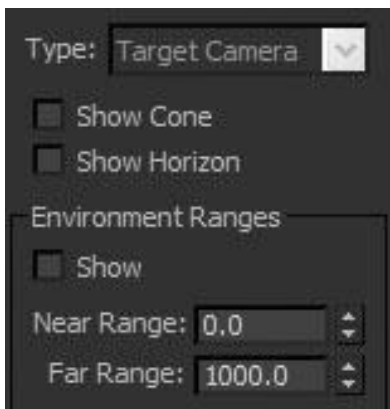
Fig. 3.11: Camera options

⚠	Study Notes

![eye icon]	Assessment
Explain various options of lens camera.
List the set of the camera's focal length.

![discussion icon]	Discussion
Discuss the uses of camera and its options.

3.6 Focus

When you are using a camera to shot a scene, it is very important to decide how much area you want to cover in the view. Also you have to decide how much depth you want to get in the scene as well as which is the main object of the scene so that you can shot the scene in such a way that the main object is in the center and highlighted or look more clear that the other objects of the scene.

You can use focus distance and focal length for this type of output.

Focus Distance: Here, in 3DS MAX this is given as target distance. This specifies the distance from the camera's position to the plane that is in perfect focus. This is a very useful option available in camera.
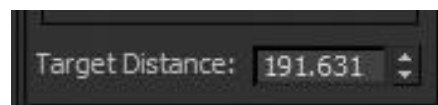
Fig. 3.12: Camera Target Distance

Environment Range: This is a parameter where you can decide as how much environment effects you want to cover in the area of shooting as well as the depth of them in the scene. This means if you have fog in the scene then how much near that fog will start and till which distance it will be looking.
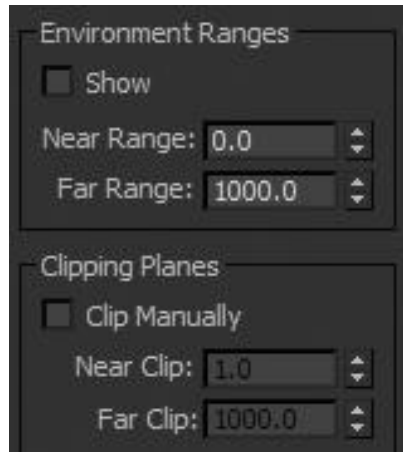
Fig. 3.13:Camera Environment Range

Study Notes	

Assessment
Explain the environment range of camera and its uses.
Write note on focal distance.

Discussion
Discuss various uses of environment range in camera.

3.7 Focal Length

Focal Length specifies the distance from the film plane to the camera lens. Also this specifies the zoom factor and is like a camera's zoom lens. Here it is given as Focus Distance.

Also, you have Focal Depth which can be used for shooting depth of the scene.
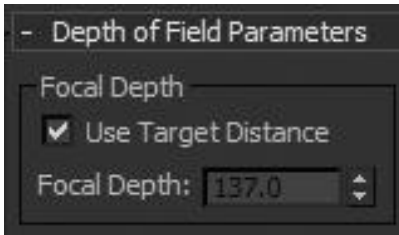
Fig. 3.14: Camera Focal Length

This is used with the camera position for the best output.

Camera Position Controls: Camera Position controls specify the camera position.

X Rotation, Y Rotation, Z Rotation: Rotate the camera around the corresponding axis. Use these controls to look at the layer from the top, side, back, or any other angle.

X, Y Position: Specifies where the camera is positioned in X / Y / Z space.

Also, you can use Zoom and Angle of View for desired results.

Zoom: This specifies the distance from the position of the camera to the image plane.

Angle of View: This specifies the width of the scene captured in the image. The Focal Length, Film Size and Zoom values determine the angle of view. A wider angle of view creates the same effect as a wide-angle lens.

Lock to Zoom: This makes the Focus Distance value match the Zoom value

⚠	Study Notes

⊚	Assessment
Explain focal length of camera and its uses.	

🗣	Discussion
Discuss focal length of camera.	

3.8 Aperture

Aperture is a hole or an opening in the camera through which light travels and this size of camera helps in creating variation in picture or video quality. Aperture specifies the size of the lens opening.
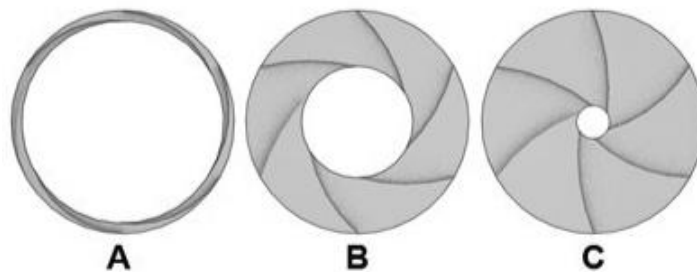
Fig. 3.15: Apertures

Here you can see the aperture size and look, when opened with various sizes in the following text.

Figure A = f1.8

Figure B = f5.6

Figure C = f11

F-Stop: This represents the ratio of the focal length to aperture.

Blur Level: This controls the amount of depth-of-field blur in image

Film size: This specifies the size of the exposed area of film

Units: This specifies the units of measurement in which the camera setting values are expressed.

Measure Film Size: This specifies the dimensions used to depict the film size.

Transform Order: This specifies the order in which the camera rotates around its three axes.

Roll Camera: Roll Camera rotates a target camera about its line of sight and rotates a free camera about its local Z-axis.

![bell]	Study Notes

![eye]	Assessment
Explain apertures and their uses. Write down the parameters available for setting Aperture.	

![speaking]	Discussion
Discussapertures and their uses.	

3.9   Motion Blur

Multi-pass rendering effects use multiple renderings of the same frame, with slight camera movement between each rendering.The multiple passes simulate the blurring that film in a camera would register under certain conditions.

The pass effect is ready here in 2 manners in max:

Depth of Field

Motion Blur

Blur is used for making the illusion of blur when an object moves or rotates. Like – you might have seen that the fan rotates or the bird flies then the wings look with passes and we can see the blur in the movements there.

In 3DS Max you will get the same effect by using the camera and it's options given in multi-pass effects options.
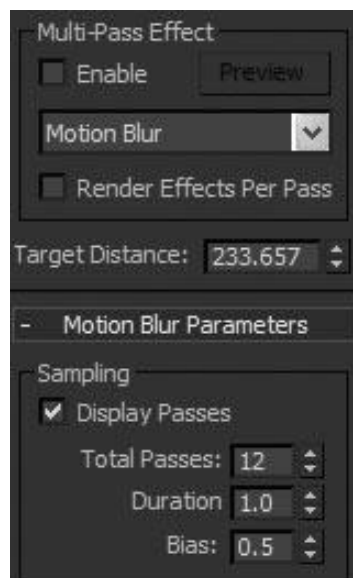
Fig. 3.16: Multi-pass Effect

Here you can check the Enable check box and change the pass values for desired results. You can press the preview button for the preview in viewport only. The preview will be like the following.
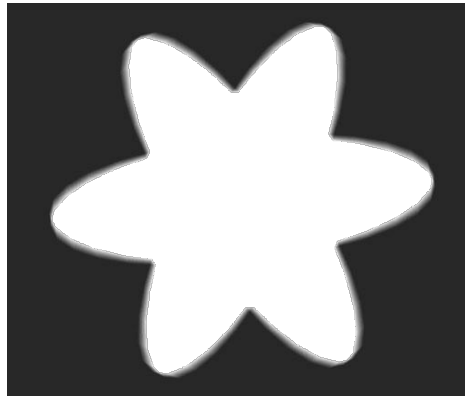
Fig. 3.17: Multi-pass Effect Final

🔔	Study Notes

👁	Assessment
□Ā□Ā	Explain multi pass effect and its uses.
□Ā□Ā	Write a note on Motion Blur Effect.

🗣	Discussion
Discuss multi pass effect and its uses.	

3.10 Depth of Field

Along with the motion blur, you will get depth of field option. This is used for showing the depth of the scene as per the order of objects near or far from the camera. This effect is very much used in films as well as in photographs for making them more real and focused on the main subject or character. Depth of Field choice has been added to the Multi-Pass Effect drop-down list to support the mental ray renderer's depth-of-field effects.
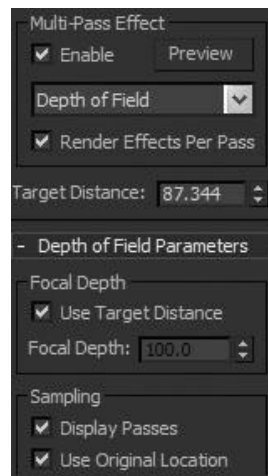
Fig. 3.18: Depth of Field 1

Here, the main object that is taken at the target distance remains clear to the vision of the camera but the other ob jects look blurred so that they are not so focused like the main one.
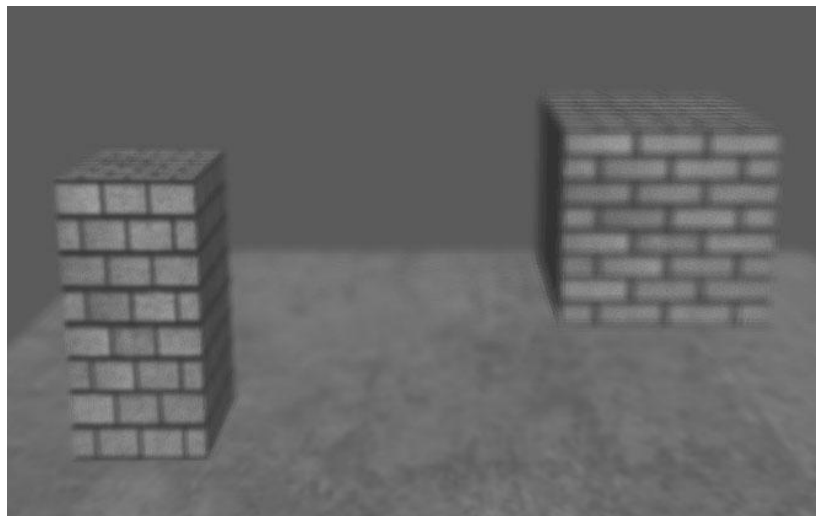
Fig. 3.19: Depth of Field 2

⚠	Study Notes

👁	Assessment
	Explain depth of field. Where can a depth of field be used?

🗣	Discussion
	Discuss depth of field and its uses.

3.11 Field of View

Field-of-View adjusts the amount of the scene that is visible in a view port and the amount of perspective flare.

Fig. 3.20: FOV

If you increase the field of view then the total vision will be increased and you can see more area from the camera but the objects in that will become smaller. In other words, if you decrease the fov, then the objects will look bigger but the total area of vision will be smaller. You can use the ready given lenses sizes from the below stack which adjust the camera fov as per their sizes.

⚠️	Study Notes

👁️	Assessment
Explain what FOV is.	
Where can one use FOV?	

🗣️	Discussion
DiscussFOV and its uses with examples.	

3.12 Pass Blending

Pass Blending group contains the following things:

The multiple depth-of-field passes are blended by dithering, which you can control by the parameters in this group.These controls apply only to renderings of the depth-of-field effect, not to previews in viewports.

Normalize Weights: This passes are blended with random weighting to avoid artifacts such as streaking. When Normalize Weights is on, the weights are normalized, giving a smoother result. When off, the effect is a bit sharper but usually grainier. Default=on.

Dither Strength: This controls how much dithering is applied to the rendered passes. Increasing this value increases the amount of dithering and can make the effect grainier, especially at the edges of objects. Default=0.4.

Tile Size: This sets the size of the pattern used in dithering. This value is a percentage, where 0 is the smallest tile and 100 is the largest. Default=32.

🔔	Study Notes

👁	Assessment
	Explain pass blending and its uses.
	Explain Normalize weight.

	Discussion
Discuss pass blending and its uses.	

3.13 Camera Map Modifier

This is used for matching the material uvw with the uvw of the scene material. Here you will get the following options.
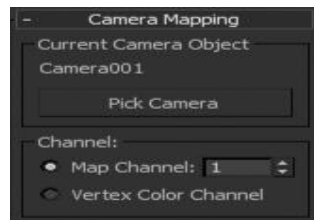
Fig. 3.21: Camera Map 1

Pick Camera: This is used to apply the UVW coordinates.

Map Channel: This is used to choose a map channel to use

Vertex colour Channel: This sets the Vertex colour channel.

In the following figure, you can see the mapped material of an object with the environment.
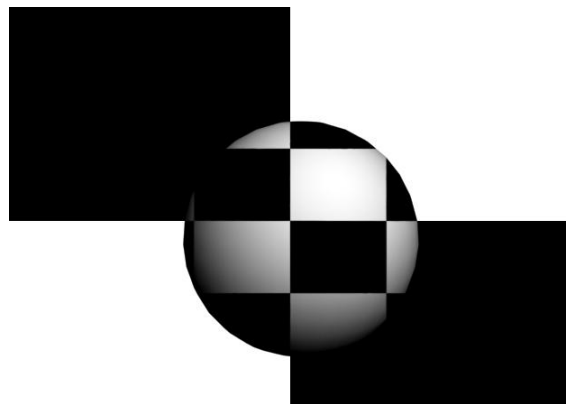
Fig. 3.22: Camera Map 2

The options you will get here are as followings:

Label: Names the current camera used for mapping.

Pick Camera: Used to select the camera for mapping

Map Channel: Specifies the use of a map channel.

Vertex colour Channel: Specifies use of the Vertex colour Channel.

⚠	Study Notes

👁	Assessment
Explain camera map modifier.	
Explain the parameters required for adjusting Map modifier.	

🗣	Discussion
Discuss camera map modifier.	

3.14 Camera Correction Modifier

The Camera Correction modifier applies two-point perspective to a camera view.
Amount: This set the amount of correction for 2-point perspective.
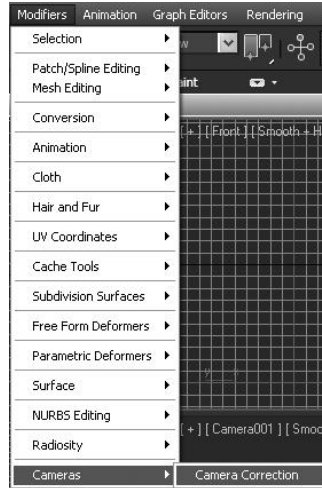
Fig. 3.23: Camera Correction 1

Direction: This biases the correction.

Guess: Use this to have the Camera Correction modifier set a first-guess Amount value.
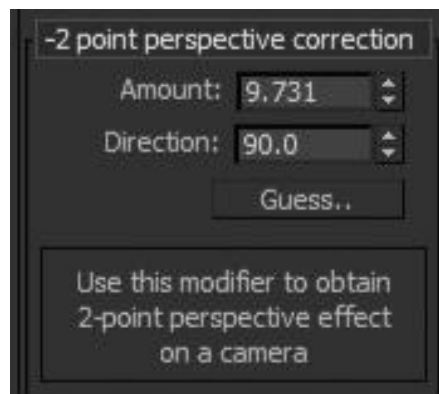
Fig. 3.24: Camera Correction 2

If you want to animate the point of view, you can create a camera and animate its position. For example, you might want to fly over a landscape or walk through a building. You can animate other camera parameters as well. For example, you can animate the camera's field of view to give the effect of zooming in on a scene.

The Display panel's Hide By Category rollout has a toggle that lets you turn the display of camera objects on and off.

A convenient way to control the display of camera objects is to create them on a separate layer. You can hide them quickly by turning off the layer.

The Camera Match utility allows you to start with a background photograph and create a camera object that has the same point of view. This is useful for site-specific scenes.

![bell icon]	Study Notes

![eye icon]	Assessment
Explain camera correction.	
List the parameters available for camera correction modifier.	

![speaking head icon]	Discussion
Discuss camera correction and its uses.	

3.15 Summary

In this Unit, we have talked about various options and effects available with the camera. As you have learnt in this Unit the Camera, Cameras present a scene from a particular point of view. Camera objects simulate still-image, motion picture or video cameras in the real world.

RAM PLAYER

Here we talked about the uses of ram player for previewing the rendered files. This is a player given along with 3DS Max which can be used for opening and checking any image or avi file after rendering it.

RENDERING TECHNIQUES

Here we talked about the techniques of rendering available in 3DS MAX. Here you will get three types of renderers: Scan line Renderer, Mental ray Renderer and VUE Renderer

CAMERAS

Here we talked about the cameras available in 3DS MAX. With a Camera viewport you can adjust the camera as if you were looking through its lens. Camera viewports can be useful for editing geometry as well as setting up a scene for rendering. Multiple cameras can give different views of the same scene.

EXPLAIN LENS

Here we talked about various lenses used in camera.There are various type of lenses for camera. Majorly camera lens is measured in their size.

FOCUS

Here we talked about the focus and its importance in camera.You can use focus distance and focal length for good output.

FOCAL LENGTH

Here we talked about the focal length of camera and its uses.Also you have Focal Depth which can be used for shooting depth of the scene.

Here we talked about the apparatus and their uses.Aperture is a hole or an opening in the camera through which light travels creating different quality of picture.

MOTION BLUR

Here we talked about the motion blur available in camera and its uses.It is used for making the illusion of blur when an object moves or rotates. Like – you might have seen that the fan rotates or the bird flies

DEPTH OF FIELD

Here the main object that is taken at the target distance remains clear to the vision of the camera or vice versa.

FIELD OF VIEW

Here we talked about the field of view in camera.Field-of-View adjusts the amount of the scene that is visible in a view port and the amount of perspective flare.

PASS BLENDING

These controls apply only to renderings of the depth-of-field effect, not to previews in viewports. The multiple depth-of-field passes are blended by dithering, which you can control by the parameters in this group.

CAMERA MAP MODIFIER

Here we talked about the camera map modifier and its uses.

CAMERA CORRECTION MODIFIER

Here we talked about camera correction modifier and its uses. The Camera Correction modifier lets you correct a camera view to 2-point perspective, in which vertical lines remain vertical.

3.16 Self-Assessment Test

Broad Questions

What is the use of camera?How many types of camera are available in 3DS Max?

What is pass blending?What is depth of field?

What is clip manually?What is the use of camera modifiers?What is the use of camera correction?

Short Notes

Cameras in 3DS MAX

Motion Blur and Depth of Field in camera

FOV in camera

Motion blur

Camera map modifier

3.17 Further Reading

http://www.tutorialized.com/tutorials/3dsmax/Basics/1

3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a scene in 3DS MAX containing a complete environment. Now in this scene put a camera and apply motion blur or depth of field as per your requirement for making the scene more realistic.

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ARCHITECTURE DESIGN 2

BCADES-205

BLOCK 2:
EFECTS & ANIMATION

Dr. Babasaheb Ambedkar Open University, Ahmedabad

"

Education is something which ought to be brought within the reach of every one.

"

- Dr. B. R. Ambedkar

Block

2

EFECTS & ANIMATION

UNIT 1 VIDEO POST

UNIT 2MOTION PANEL

UNIT 3 INTERACTIVE ANIMATION CONTROL

Acknowledgment

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 cues, 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)

Unit 1   Video Post

	Learning Outcome

After going through this unit, you will learn:

Explain the uses of lens effects

Give the uses of Image alpha, Star field

Describe the uses of simple wipe, negative

Point out the uses of high light effect

Make various effects like fairy, glow etc.

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	Content Map

4.1   Introduction To Video Post

4.2   Lens Effect

4.3   Image Alpha Filter

4.4   Star Field Filter

4.5   Highlight Filter

4.1 Introductionto Video Post

In this Unit, we will talk about the available effects in 3DS MAX. We w ill talk about the video post, effects and their uses for making more realistic and good scenes .

We will talk about the va rious effects in video post and lens effects options inside it. You might have seen in many movies as well as serials there are so many glow and highlighting effects like magic wand, fairy fountains etc. these all effects can be made with the use of video post – lens eff ects. Here you can make good glow effects for moon, stars, etc. along with highlighting them in a special way.

In addition, there are several ore effects which enable you to add up lens flare as well as other effects to the scen e including transitions in the avi files.

Video Post is self-suffici ent tool. The edit window of the dialog show s when each event occurs in the finished video.
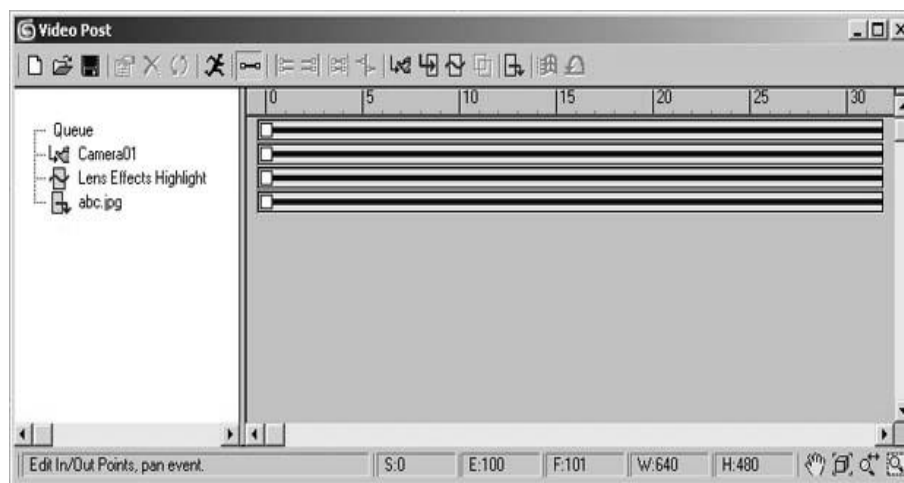
Fig. 4.1: Video Post

4.2 Lens Effect

This produces real life effect like a glow or rays form sun in the 3d wo rld. The Lens effects glow is commonly used in interior scenes. It makes the scenes l ook brighter. Similarly, Flares are normally applied to lights in your scene. The lens flare is generated around that object.
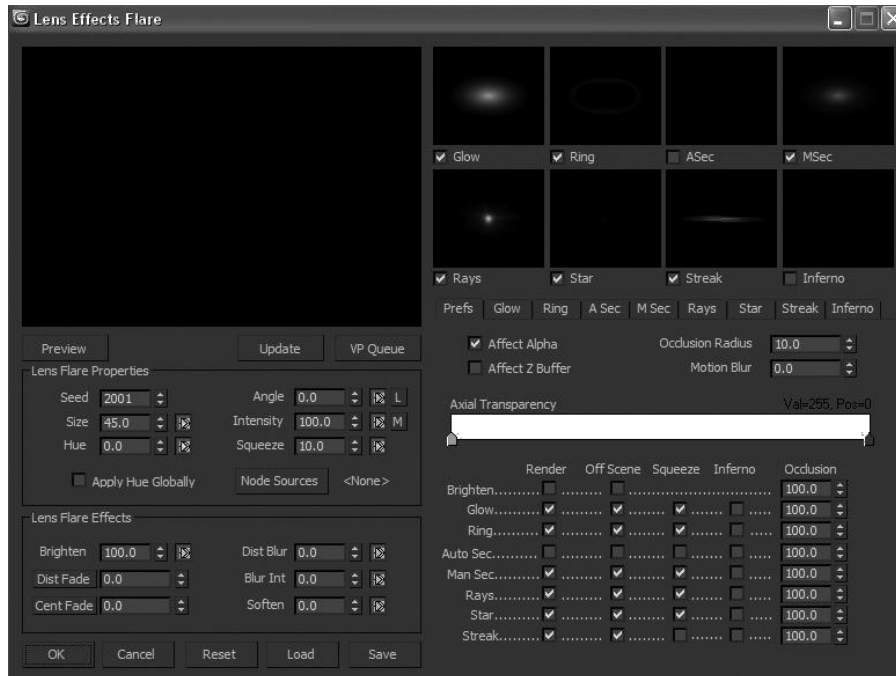
Fig. 4.2: Lens Effect

Following are the parameters required for Lens Effect:

Preview: The window displays the flare in the upper left corner.

Update: Redraws the entire preview window

VP Queue: Displays the contents of the Video Post queue.

Size: Affects the size of the overall lens flare.

Hue: Controls the amount of Hue applied to the Lens Flare effect.

Apply Hue Globally: Applies the hue of the Node Source to the other Flare effects.

Angle: Determines the amount that the flare rotating from its default position.

Intensity: Controls the brightness and opacity.

Squeeze: Squeezes the size of the lens flare.

Node Sources: Selects the source object for the lens flare effect.

Brighten: Sets an overall brightness that affects the whole image.

Distance Fade: Fades with its distance from the camera.

Cent Fade: Fades the secondary flares near the center of the row of flares.

Distance Blur: Blurs the flare based on its distance from the camera.

Blur Intensity: Controls the strength of the blur.

Soften: Provides an overall softening effect

Flare Parameter: Lets us create and control the lens flare. A flare is composed of eight basic parts.

Prefs: This lets us control which parts of a lens flare are active and the way they effect the overall image.

Glow: A general glow centered around the source object of the flare.

Ring: A circular colour band that surrounds the center of the source object.

☐ A Sec: Auto Secondary Flares. The small circles we see coming out from the source of the lens flare.

As the camera position changes relative to the source object, the secondary flares move.

M Sec: Manual Secondary Flares. Additional secondary flares that are added to the lens flare effect. They appear in the same axis

Rays: Bright lines that give out from the center of the source object.

Star: Again same as rays but generally composed of 6 or more spokes

Streak: They are the wide horizontal bands that run through the center of the source object.

Inferno: Adds special effects like to the flare effect.

🔔	Study Notes

4.3   Image AlphaFilter

The Image Alpha Filter replaces the image's alpha channel with the channel specified by the filter mask.

Whatever channel selected in the Mask option, the filter takes whatever channel is selected. This is then applied to the queue's alpha channel, thereby replacing what's there.
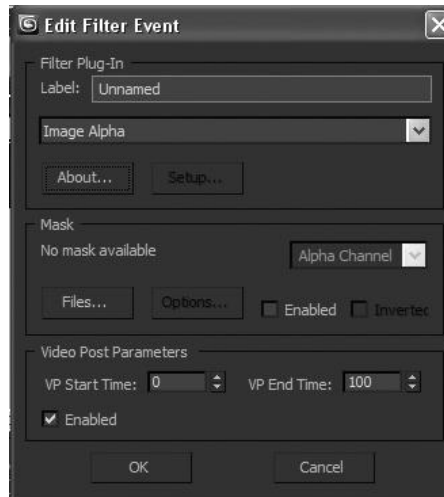
Fig. 4.3: Image Alpha

This is used for advance compositing in any output of a scene.

🔔	**Study Notes**

👁	**Assessment**
Define image alpha and its uses.	

🗣	**Discussion**
Discuss and create an alpha image using After Effects.	

4.4   Star Field Filter

This is used for rendering a camera view with stars in the background or foreground of the scene.
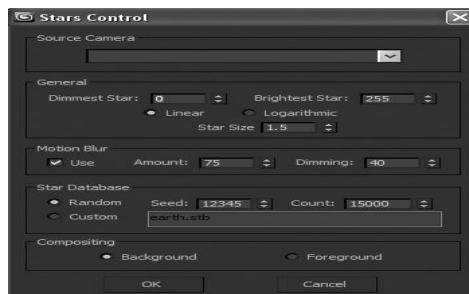
Fig. 4.4: Star Field

Following are the parameters required for creating Star effect:

Source Camera: Allows us to choose from a list of cameras in the scene.

General: Sets the brightness range and size of the stars.

Dimmest Star: Determines the dimmest star.

Brightest Star: Determines the brightest star.

Linear / Logarithmic: Specifies whether the range is calculated linearly or logarithmically.

Star Size: Specifies the size of the stars. This is done in pixels

Use: Determines if to use the motion blur.

Amount: Specifies the percentage of the frame time that the camera "shutter" is open.

Dimming: Determines how the stars will dim and their trails lengthen.

Random: Generates the number of stars indicated by the spinner.

Custom: Reads the specified file.

Count: Specifies the number of stars.

Background: The stars are composited the stars in the background.

Foreground: The stars are composited the stars in the foreground.

	Study Notes

	Assessment
Write down the parameters required to create a desirable star field effect.	

	Discussion
Discuss star field and its uses.	

4.5 Highlight Filter

This type of filter lets you highlight the object like a sparkling object or diamond.

Following are the parameters that let you control the look of highlight:

Reset: Resets Lens Effects to its default settings.

Load: Displays file open dialog from which we can select the settings.

Save: Displays Save As dialog in which we can specify a directory and filename.

Fig. 4.5: Highlight

PROPERTIES

Whole: Applies highlights to the whole scene.

Object ID: Applies highlights to particular objects with a defined ID.

Effects ID: Applies the highlight to an object or part of an object with a specific effect ID.

Unclamped: Determines the lowest pixel value that is highlighted.

Surf Norm: The highlights depend on the angle of the surface normal to the camera.

Mask: Enables the mask channel of an image.

Alpha: Enables the alpha channel of an image.

Z Buffer Hi and Lo: Specifies the objects based on their distance.

All: Selects all source pixels in the scene.

Edge: Selects all source pixels along a boundary edge and applies a highlight.

Perimeter Alpha: Applies a highlight on the object's alpha channel.

Perimeter: Applies highlight effect only to the object based on Edge inference.

Bright: The source objects are filtered depending on their brightness values.

Hue: The source objects are filtered depending on their hue.

	Study Notes

4.6   Negative Filter

The Negative Filter inverts the colours in the image. This type of filter gives the filter a negative film look that can be used for some special shots like a flashback shot or reminder shots etc. Following are the parameters:
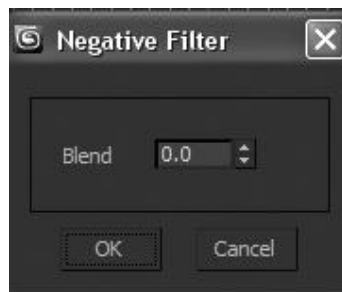
Fig. 4.6: Negative

Blend: Sets the amount of blending that occurs.

This effect is used for making negative like effect that is normally used for making flashback effects in movies as well as serials.

![eye icon]	Assessment
Explain the uses and importance of negative effect. Explain the parameters for producing negative effect.	

![discussion icon]	Discussion
Discuss various conditions where you can use negative effect.	

4.7 Simple Wipe Filter

The Simple Wipe Filter either reveals or erases the foreground image with a wipe transition. This is used for joining more than one avi files with transitions and render for final output.

Fig. 4.7: Simple Wipe

Following are the parameters:

Right / Left pointing arrow: Wipes from left to right or right to left.

Push: Reveals the image.

Pop: Erases the image.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain the uses and importance of simple wipe effect. List the parameters for Simple Wipe.

![speaking head icon]	Discussion
	Discuss various situations where one can use simple wipe effect.

4.8 Contrast Filter

This allows adjusting the brightness and contrast values of the scene. By adjusting the Contrast filter, it compresses or expands the latitude between maximum black and maximum white by creating a 16-bit look-up table for any given gray value in the image.Following are the parameters:

Contrast: Adjusts the contrast value of the file.

Brightness: Adjusts the brightness value of the file.

Absolute/Derived: Determines the calculation of the gray value for contrast.This is used for rendering a camera view with stars in the background or foreground of the scene.

Fig. 4.8: Contrast

⚠	Study Notes

👁	Assessment
Explain contrast effect and its uses. List the parameters used for creating contrast effect.	

🗣	Discussion
Discuss the uses of contrast effect.	

4.9 Summary

In this Unit, we discussed about various types of effects available in 3DS MAX for making the scene more realistic and effective like glow, highlights, negative, etc.

As you have learnt in this Unit the Video post, Video Post, available from the Rendering menu, lets you combine (composite) and render output of various types of events, including the current scene, bitmap images, image-processing functions and so on.

Video Post is a self-contained, modeless dialog, similar in appearance to Track View. The edit window of the dialog shows when each event occurs in the finished video. Each event is associated with a track that has a range bar.

LENS EFFECT

Here we talked about the lens effects given in video post and their uses.This produces real life effect like a glow or rays form sun in the 3d world.

IMAGE ALPHA FILTER

Here we talked about the uses of image alpha for various purposes. The Image Alpha Filter replaces the image's alpha channel with the channel specified by the filter mask.

STAR FIELD FILTER

This is used for rendering a camera view with stars in the background or foreground of the scene. Here we talked about the star field and its uses.

HIGHLIGHT FILTER

This type of filter lets you highlight the object like a sparkling object or diamond. Here we talked about the highlight effect and its options.

NEGATIVE FILTER

This type of filter gives the filter a negative film look that can be used for some special shots like a flashback shot.Here we talked about the negative effect and its uses.

SIMPLE WIPE FILTER

This is used for joining more than one avi files with transitions and render for final output.Here we talked about the simple wipe effect and its uses.

Here we talked about the uses of contrast effect and its various options. This allows adjusting the brightness and contrast values of the scene.

4.10 Self-Assessment Test

Broad Questions

What is video post?Which effects are available in video post?

Which effects of video post are useful as transitions in movies? Why?

What is the difference between normal rendering and Video post rendering?

Video post

Lens effects

Star field effect

Negative effect

Simple wipe

4.11 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a scene in 3DS MAX with the subject of fairy tale, universe, stars etc. In this scene, use video post effects for more realistic effects and outputs. Now render the final avi of the same.

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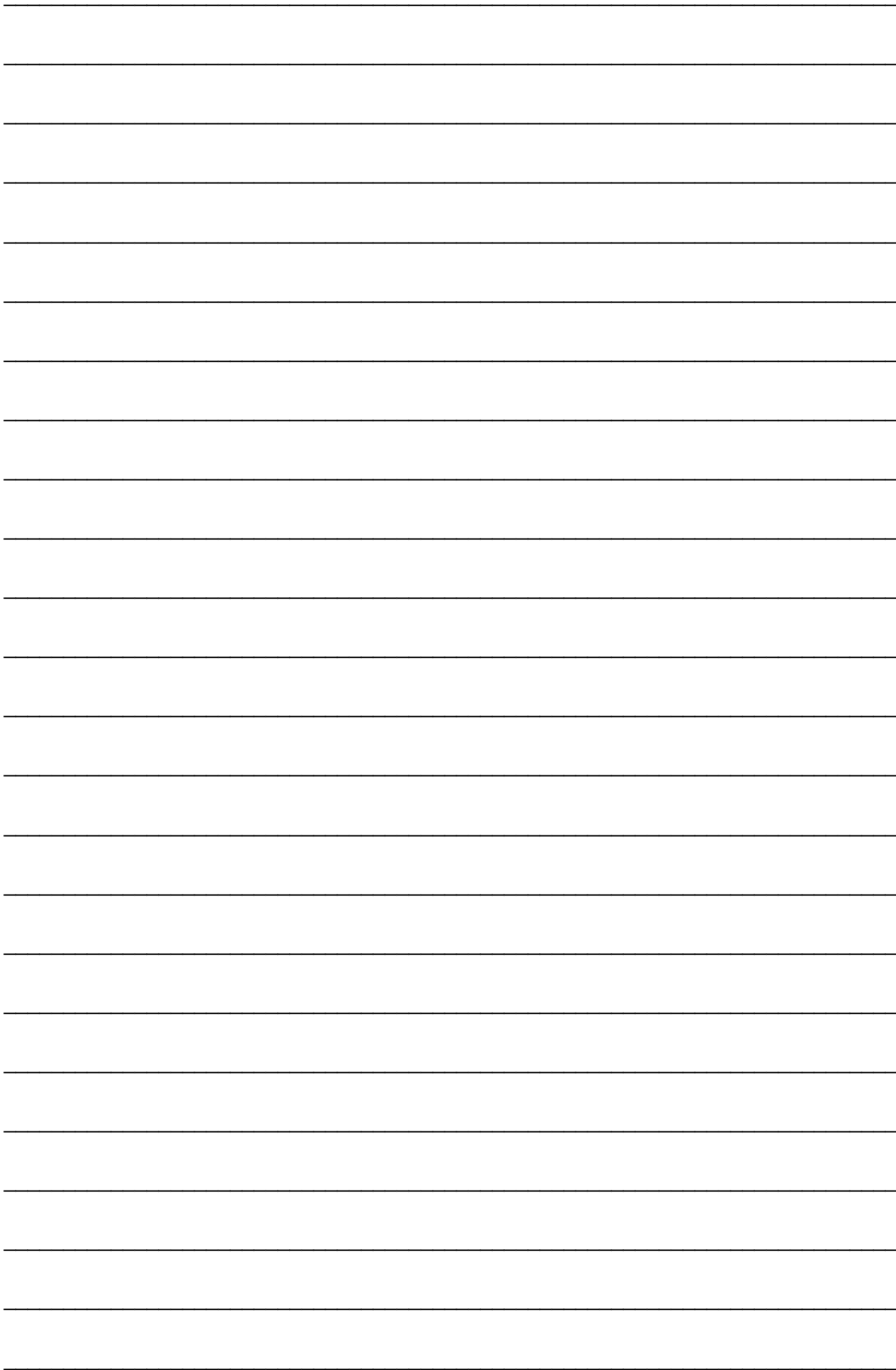
Unit 2   Motion Panel

	### Learning Outcome

After going through this unit, you will learn:

Elaborate on the uses of constraints like attachment, Surface constraint, Path constraint, Position constraint, Link constraint and Orientation constraint

Describe the uses of controllers like - Transform Controllers, Position Controllers, Rotation Controllers, Scale Controllers

Give the uses of Attribute holder, Parameter collector, Parameter editor and Wire parameter

List Uses of Curve Editor

Explain each curve and the tracks

	### Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	### Content Map

5.1   Introduction to Motion panel

5.2   Attachment Constraint

5.3   Surface Constraint

5.1 Introduction to Motion Panel

In this Unit, we will talk about the Motion panel and its various uses for making animation.

The Motion panel provides tools to adjust the motion of the selected object. Key timing and easing in and out of a key are parameters that you can adjust with tools on the Motion panel, for example. The Motion panel also provides an alternative to Track View for assigning animation controllers.

5.2 AttachmentConstraint

Attachment constraints keep the cylinders on the surface. The Attachment constraint is a position constraint that attaches an object's position to a face on another object
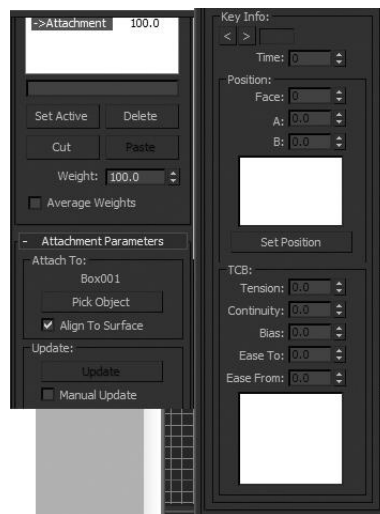
Fig. 5.1: Attachment Constraint

Objects Name Text: This specifies the target object to which the source object is attached.

Pick Object: This selects and picks the target object in the view ports for the attachment.

Align to Surface: This fixes the orientation of the attached object to the face where it's assigned.

Update: This updates the display.

Manual Update: This enables Update.

Current Key: This displays the current key number and lets you move to another key.

Time: This displays the current frame and lets you move the current key to a different frame.

Face: This provides the index of the face to which the object is attached.

A/B: This contains the barycentric coordinates defining the position of the attached object on the face.

Set Position: This adjusts the placement of the source object on the target object.

⚠	Study Notes

👁	Assessment
Define and explain the uses of attachment constraint.	

🗣	Discussion
Discuss various condition where you can use attachment constraint for animation.	

5.3   Surface Constraint

Surface constraints position the weather symbols on the globe. The Surface constraint positions an object along the surface of another object. The type of object that can be used as the surface object is limited to those whose surfaces can be represented parametrically.

Use the Surface constraint with the following types of objects:

Sphere

Cone

Cylinder

Torus

Quad Patches

Loft object

NURBS object
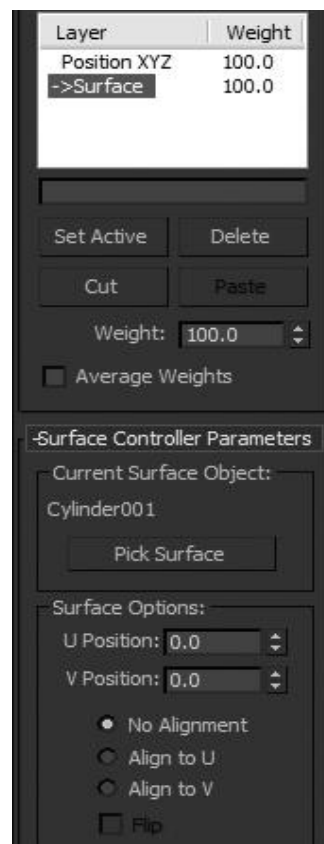
Fig. 5.2: Surface Constraint

The Surface Constraint Parameters rollout is on the Motion panel.

Text: This displays the name of the selected object.

Pick Surface: This selects the object you want used as a surface.

U Position: This adjusts the position of the controlled object along the U coordinates of the surface object.

V Position: This adjusts the position of the controlled object along the V coordinates of the surface object.

No Alignment:When this is on, the controlled object is not reoriented, regardless of its position on the surface object.

Align to U: This aligns the local Z-axis of the controlled object with the surface normal of the surface object and the X-axis with the U axis of the surface object.

Align to V: This aligns the local Z-axis of the controlled object with the surface normal of the surface object and the X-axis is aligned with the V axis of the surface object.

Flip: This flips the alignment of the local Z-axis of the controlled object. This check box is not available if No Alignment is turned on.

TCB

All of the items in this group are the same as in other TCB controllers. The orientation of the source object is also interpolated and affected by these settings.

Tension: This ranges from 0 to 50

Continuity: This ranges from 0 to 50

Bias: This ranges from 0 to 50

Ease To: This ranges from 0 to 50

Ease From: This ranges from 0 to 50

5.4   Path Constraint

Path constraint positions the service platform along the side of the bridge. A path constraint restricts an object's movement along a spline or at an averaged distance between multiple splines. A path target can be any type of spline. The spline curve defines a path of motion for the constrained object.
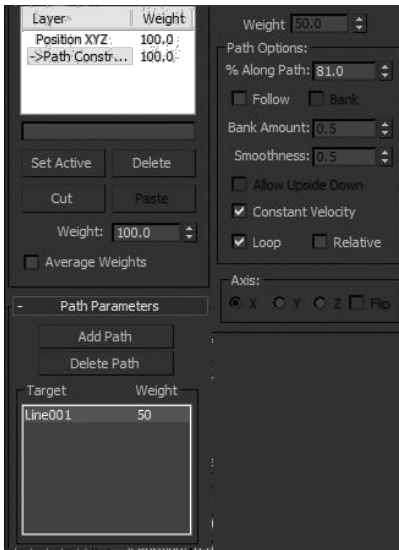
Fig. 5.3: Path Constraint

Adds Path: This adds a new spline path that influences the constrained object.

Delete path: This removes a path from the target list. Once removing the path target, it will no longer influence the constrained object

Weight: This assigns and animates weight values for each target.

% Along Path: This set the percent that the object is positioned along the path.

Follow: This aligns the object to the trajectory as it follows the contour.

Bank: This allows the object to bank (roll) as it negotiates the curves of the spline.

Bank Amount: This adjusts the amount of the banking to one side or the other, depending on whether the value is positive or negative.

Smoothness: This controls how rapidly the roll angle changes as the object moves through bends in the trajectory.

Allow Upside Down: This turns ON to avoid the situation in which an object flips when going around a vertically oriented path.

Constant Velocity: This provides a constant velocity along the path.

Loop: This by default, when the constrained object reaches the end of a path it can no longer move past the end point.

Relative: This turn ON to maintain the original position of the constrained object.

Axis: This defines which axis of the object is aligned to the trajectory of the path.

Flip: This turn ON to flip the direction of the axis.

Active: This activates an axis (X/Y/Z). Allows the selected object to animate along the activated path.

Limited: This limits the range of motion allowed on an active path.

Ease: This causes a joint to resist motion as it approaches its From and To limits.

From and To Spinners: This determine for path limits. Use in conjunction with the Limited function.

Damping: This applies resistance over a joint's motion along the path. Simulates the natural effect of joint friction or inertia.

⚠	Study Notes

👁	Assessment
Explain options of path constraint.	

🗣	Discussion
Discuss path constraint and its various uses.	

5.5   Position Constraint

Position constraints align the elements of the robot assembly. The position constraint causes an object to follow the position of an object or the weighted average position of several objects.

Fig. 5.4: Position Constraint

Add position target: This adds new target objects that influence the position constrained object.

Delete position target: This removes targets. Once a target is removed, it will no longer influence the constrained object.

Weight: This assigns and animates weight values for each target.

Keep Initial Offset: This uses Keep Initial Offset to preserve the original distance between the constrained object and the target object.

![bell icon]	Study Notes

5.6   Link Constraint

Link constraint is used to animate an object linking from one target object to another. The Link constraint causes an object to inherit the position, rotation and scale of its target object.
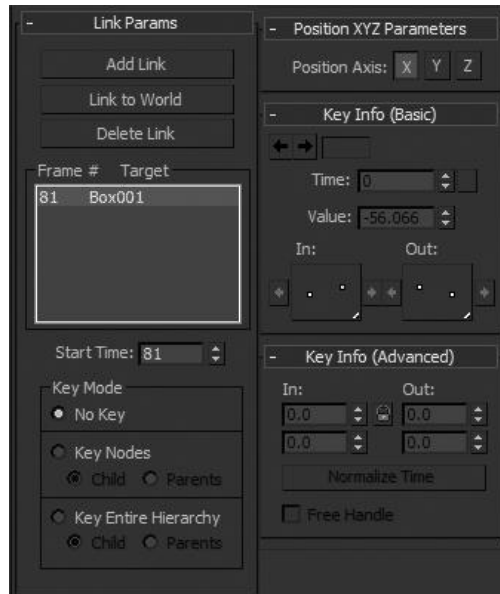
Fig. 5.5: Link Constraint

Add Link: This Adds a new link target.

Link to World: This Links the object to the world.

Delete Link: This removes a link target. Once a link target is removed, it will no longer influence the constrained object.

Start Time: The start time spinner is used to assign or edit the frame value of a target.

No Key:When used, no key frames are written to the constrained object or its targets.

Key Nodes: When used, key frames are written to the specified option.

Key Entire Hierarchy: This set key frames up the hierarchy for the specified option. There are 2 options: Child and Parents.

⚠	Study Notes

5.7 Look at Constraint

The Look At constraint controls an object's orientation so that it's always looking at another object. It locks an object's rotation so that one of its axes points toward the target object.
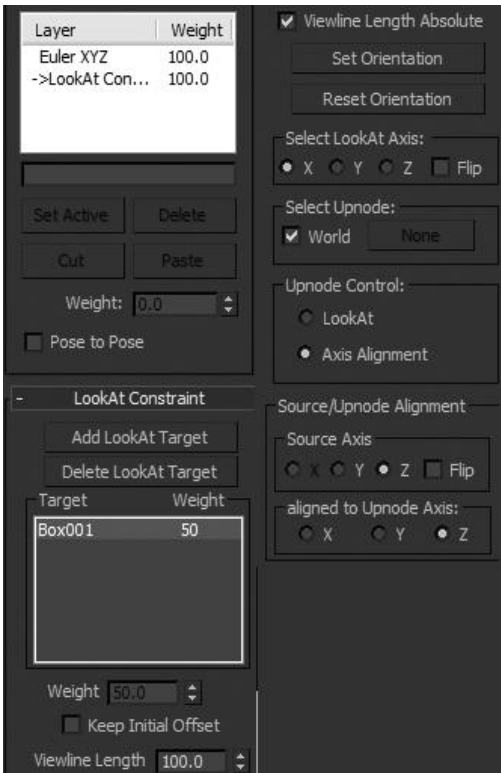
Fig. 5.6: Look at Constraint

Add Look At Target: This uses to add new targets that influence the constrained object.

Delete Look At Target: This uses to remove target objects that influence the constrained object.

Weight: This use to assign and animate weight values for each target. Available only when multiple targets are used.

Keep Initial Offset: This maintains the constrained object's original orientation as an offset to its constrained orientation.

View line Length: This defines the length of the main view line drawn from the pivot of the constrained object to the pivot of its target

View line Length Absolute: When on, the software uses only the View line Length setting for the length of the main view line; the distance between the constrained object and the target has no effect.

Set Orientation: This lets you define the offset orientation of the constrained object manually.

Reset Orientation: This set the orientation of the constrained object back to the default.

Select Look At Axis: This use to define the axis that looks at the target.

Select Up node: This by default Up node is the World.

Look At: When selected the Up node matches the Look At target.

Axis Alignment: When this is selected the Up node Aligns to the object axis.

Source Axis: This chooses the constrained object's axis that is to be aligned to the Up node Axis.

Aligned to Up node Axis: This chooses the Up node axis that the selected Source

![bell icon]	Study Notes

Explain Look at constraint and its uses.

What are the important parameters required for setting look constraint?

Discuss various animations where you can use look at constraint.

5.8   Orientation Constraint

An Orientation constraint causes an object's orientation to follow the orientation of an object or averaged orientation of several objects.
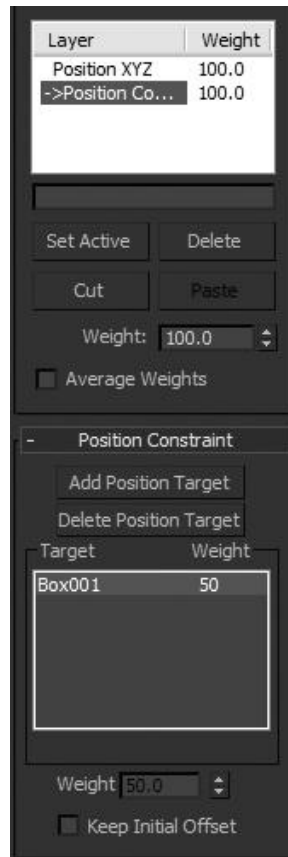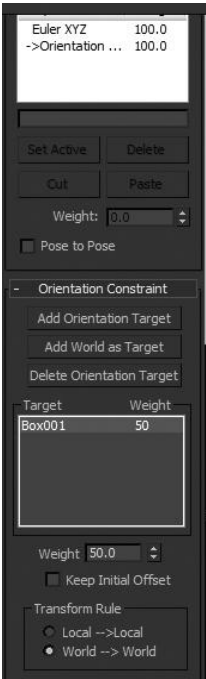

Fig. 5.7: Orientation Constraint

Add Orientation Target: This adds new target objects that influence the constrained object.

Add World as Target: This aligns the constrained object to the world axis.

Delete Orientation Target: This remove targets.

Weight: This assigns and animates weight values for each target.

Keep Initial Offset: This preserves the original orientation of the constrained object.

Transform Rule: This when an orientation constraint is applied to an object that is part of a hierarchy, this determines whether the local node transform or the parent transform will be used for the orientation constraint.

Local: When selected, the local node transform is used for the orientation constraint

World: When selected, the parent or world transform will be applied, rather than the local node transform.

⚠	Study Notes

👁	Assessment
Explain Transform Rule.	

🗣	Discussion
Discuss orientation constraint and its various uses.	

5.9   Transform Controllers

The Assign Controller rollout assigns and appends different transform controllers to individual objects. You can also a ssign controllers in Track View.
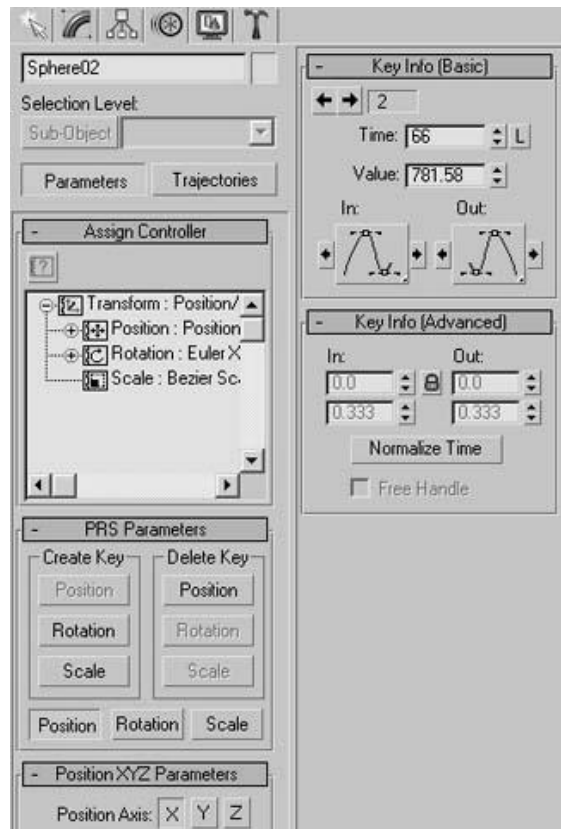
Fig. 5.8: Transform Controller 1

Assign Controller: This displays the Assign Controller dialog. If no track is selected, the Assign Controller button is u navailable.

Assign Controller dialog: This selects a controller from a list of available controllers in this dialog.

Controller dialog display s a subset of the different types of controllers. Rotation controllers, for example, are available only for rotation tracks.
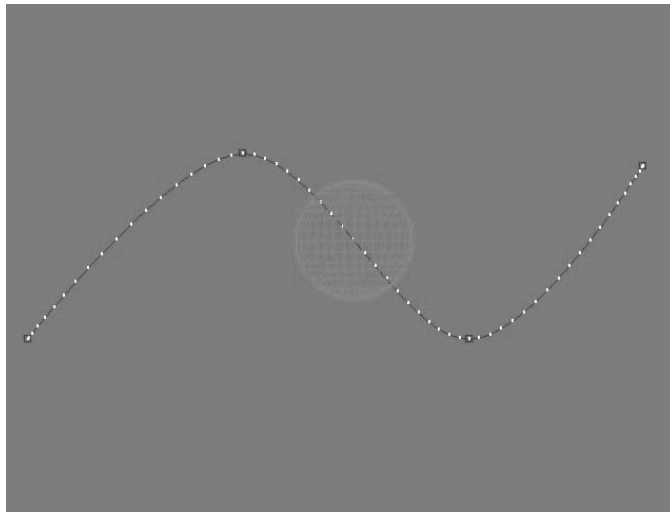
Fig. 5.9: Trajectories
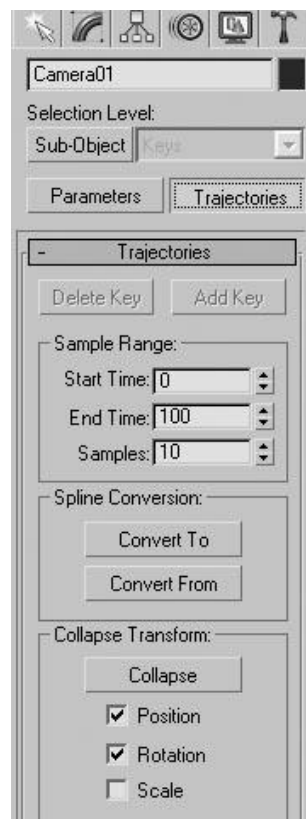
Fi g. 5.10: Transform Controller 2

Trajectories are used to chart a path that an object will travel along in t he view ports. Yellow dots along the path repr esent frames, giving you an idea of velocity and easing.The Trajectories rollout displays the path an object travels over time.

Sub-Object: This enables key editing. Use the Move, Rotate and Scale transforms to change the location of a key displayed on a trajectory.

Delete Key: This deletes the selected key from the trajectory.

Add Key: This adds key to the trajectory.

SAMPLE RANGE GROUP

Start Time/End Time: This specifies the interval for the conversion.

Samples: This set the number of samples for the conversion.

SPLINE CONVERSION GROUP

Convert To/Convert From: This converts key frame position tracks to and from spline objects.

COLLAPSE TRANSFORM GROUP

Generates keys based on the current transformation of the selected object.

Position, Rotation, Scale: This specifies which transforms you want to collapse.

🔔	Study Notes

👁	Assessment
Explain Sample range group.	

	Discussion
Discuss various uses of transform controllers.	

5.10 Position Controllers

PRS (Position Rotation Scale)

The PRS Parameters rollout provides tools for creating and deleting keys. PRS stands for the 3 basic transform controllers:

Position

Rotation

Scale

Create Key/Delete Key: This creates or deletes a move, rotate, or scale key at the current frame.

Position/Rotation/Scale: This determines the contents of the Key Info rollouts that appear below the PRS Parameters rollout on the Motion panel.

Key Info (Basic)

The Key Info Basic rollout or dialog changes the animation value, time and interpolation methods of one or more selected keys.
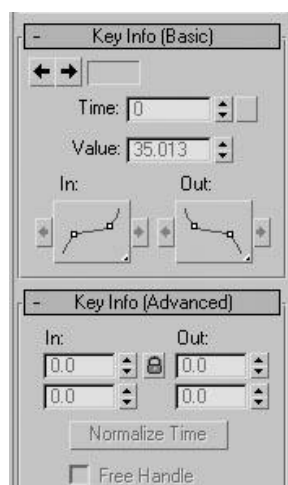
Fig. 5.11: Position Controller 1

Key number: This shows the current key number. Click the right or left arrows to go to the next or previous key.

Time: This specifies at what time the key occurs.

Time Lock: This prevents horizontal key movement in Track View Edit modes.

Value: This adjusts the position of the selected object at the current key.

Key Tangent Fly outs: With Bezier controller types, set the interpolation properties of the In tangent and Out tangent of the key.

Tangent Copy buttons: This can be used to copy the tangent type between the tangents of the current key or between the tangents of the previous and next key.

Key Info Advanced

The Key Info (Advanced) rollout or dialog lets you control velocity in three ways:

You can specify the absolute velocity at a key using the In/Out fields.

You can average velocity over a time period using Normalize Time.

With certain controller types, you can force constant velocity from one component key to the next using Constant Velocity.

In/Out: This field is the rate of change as the parameter approaches the key. The Outfield is the rate of change as the parameter leaves the key.

These fields are only active for keys using the Custom tangent type.

The number in the field is the rate of change expressed as parameter units per tick. By changing the two values for X, Y and Z you are changing the length and angle of the tangent handle.

Lock button: This changes one Custom tangent by changing the other an equal but opposite amount.

Normalize Time: This averages the position of the keys in time and applies them to any consecutive blocks of selected keys.

Constant Velocity: This when on, interpolates values between the key and the next one so that the object moves at a constant velocity across that curve segment.

Free Handle: This used for automatically updating the length of the tangent handle.
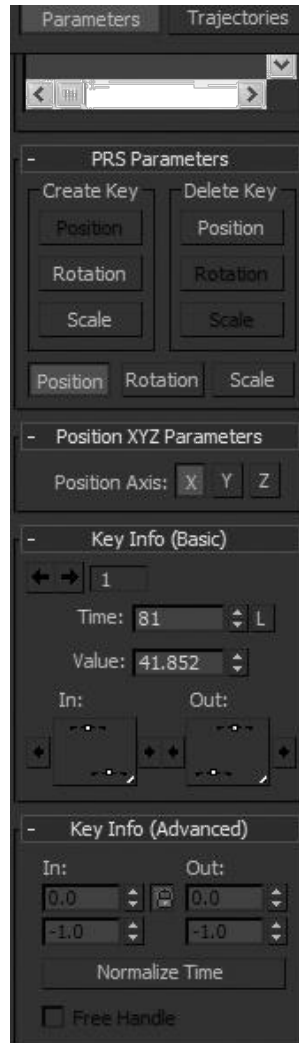
Fig. 5.12: Position Controller 2

	Study Notes

⊙	Assessment
Explain position controllers and their uses. List the parameters and explain them.	

🗣	Discussion
Discuss various situations where you can use position controllers.	

5.11 Rotation Controllers

In the same way, you get rotation controllers to control and make animation of rotations for any selected object.
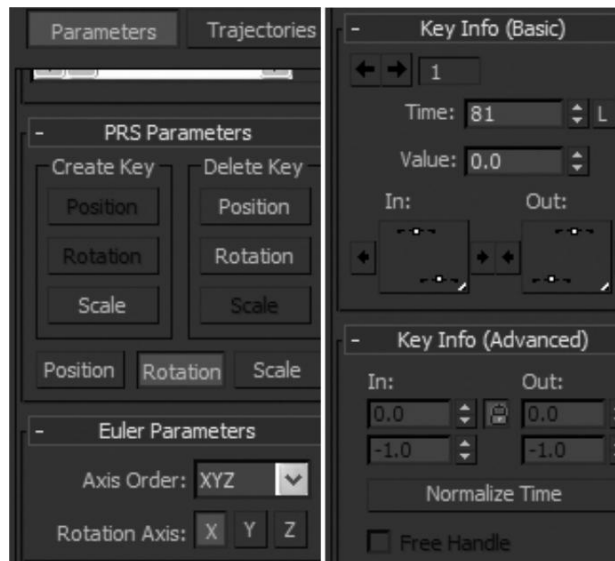
Fig. 5.13: Rotation Controller 2

All the options here are the same as position controller.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain rotation controllers and their uses. List the rotation controller parameters and explain them.

![speaking head icon]	Discussion
	Discuss various uses of rotation controllers.

5.12 Scale Controllers

In the same way, you get scale controllers to control and make animation of X, Y, Z scale for any selected object.
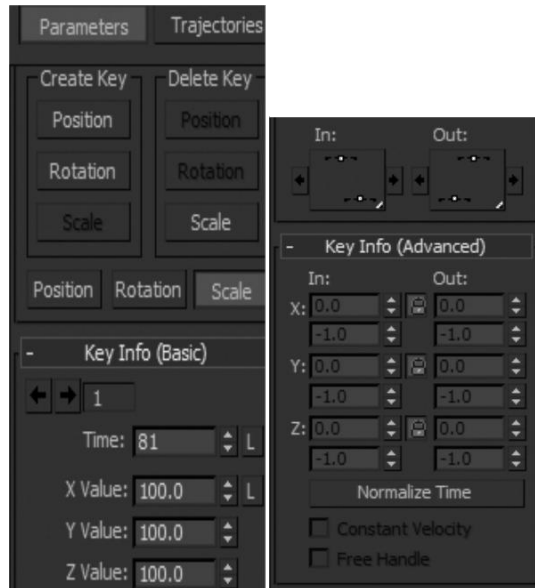
Fig. 5.14: Scale Controllers 2

All the options here are the same as position controller.

⚠	Study Notes

👁	Assessment
	Explain scale controllers and their uses.
	Write down the parameters required for scale controller.

	Discussion
Discuss various animations that can be done with the use of scale controllers.	

5.13 Attribute Holder

This is a modifier that is used for making any object ready for attribute editor. This is not essential for any helper objects but for any poly, mesh or other mesh object this is must before applying attribute editor.

Fig. 5.15: Attribute Holder

![bell icon]	Study Notes

![eye icon]	Assessment
Write a note on attribute holder.	

![speaking head icon]	Discussion/ Activity
Discuss attribute holderand practice using the software.	

5.14 Parameter Collector

Parameter Collector takes the form of a dialog with a menu bar, a toolbar and rollouts that you create and modify using the dialog tools. You can resize the dialog horizontally and vertically; expanding it lets you see all rollouts simultaneously.
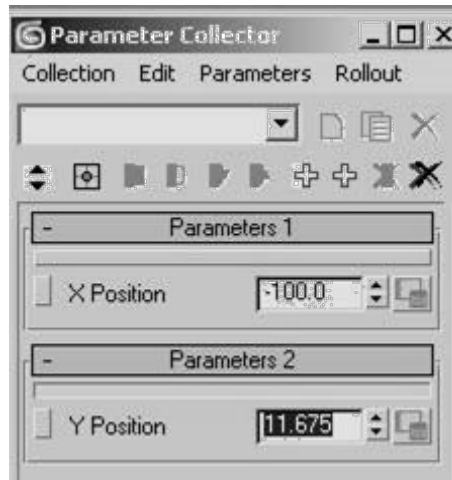
F ig. 5.16: Parameter Collector

The menu bar provides a range of functions for using Parameter Collect or.

The Parameter Collector toolbar provides button access to the most commonly used functions.

Collection name: With this, we c an either

Enter a name for the current collection

Choose a different collection from the drop-down list.

With this, we can create a new, empty collection, clearing the curr ent collection name and the rollout area. You can restore any existing collection by choosi ng it from the drop-down list.

With this, we can create a new, unnamed collection containing the sam e data as the current collection.

With this, we can remov e the current collection from memory.

With this, we can enable multiple editing.

This works the same way as the Absolute/Offset mode toggle on the Coordinate

DISPLAY

When Absolute is chosen, modifying a value changes it to the exact amount you specify.

KEY SELECTED

With this, we can set the keys for selected parameters only at the current frame.

RESET SELECTED

With this, we can set all selected numeric parameters to 0.

MOVE PARAMETERS UP

This moves each selected parameter up one position within its rollout.

ADD TO NEW ROLLOUT

This lets you add new parameters to a new rollout.

DELETE SELECTED

This deletes all selected parameters.

DELETE ALL

This deletes all parameters and rollouts.

⚠	Study Notes

	Assessment
	Explain the uses and importance of parameter collector.
	Explain the parameters.

	Discussion
	Discuss parameter collector and its various uses.

5.15 Parameter Editor

The Parameter Editor takes the form of a dialog with several rollouts: The first rollout set general options for the attribute; the central rollout set options for the current parameter type; and the third lets you preview the attribute user interface (UI).

Add to Type list: This chooses whether the custom attribute is assigned to the selected object, its active modifier, its material, or a picked track.

Pick explicit track: This is used to open the Track View hierarchy window from which to choose an animation track.

Add: Applies the custom attribute parameter to the current object, modifier, material, or track, depending on the current choice in the Add To Type list.
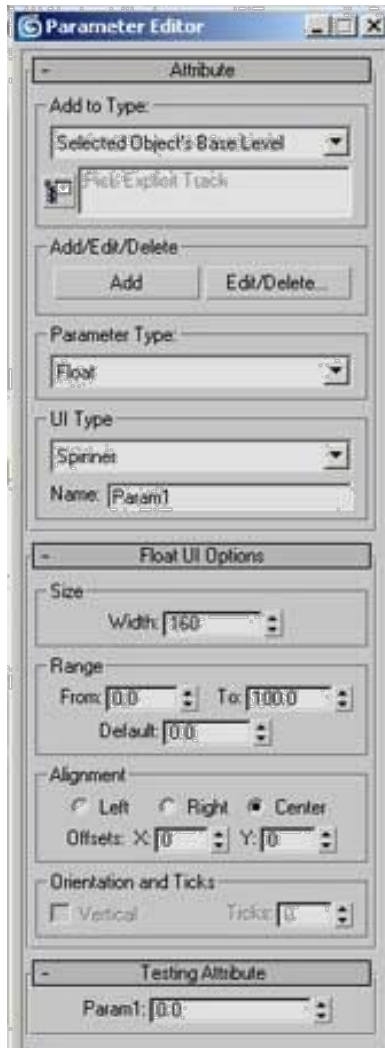
Fig. 5.17: Parameter Editor

Parameter Type: We can use the drop-down list to choose the data type for the current parameter.

The following list includes links to the sections describing the UI settings for each parameter's data type:

Angle

Array

Boolean

Color

Float

fRGBA

Integer

Material

Node

Percent

String

Texture Map

World Units

UI Type:This selects the type of UI element that controls the parameter.

Name: this givesthe name of the parameter.
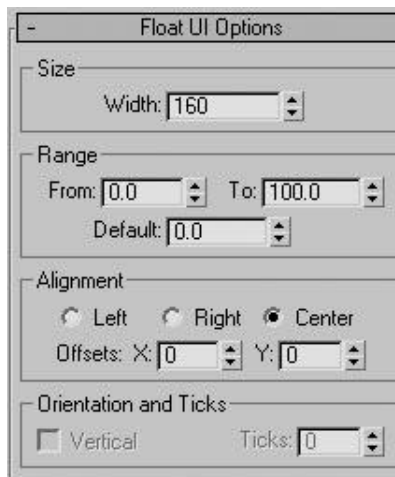
Fig. 5.18: Parameter Editor Option 1

This is a numeric value that the user can set with a standard 3ds max spinner.

Size group

Width: This set the width of the spinner.

From: This set the minimum value of the spinner.

To: This set the maximum value of the spinner.

Default: This set the default value of the spinner.

Left/Right/Center: This set the alignment of the spinner in the rollout.

Offset X/Y: This is used Fin e-tune the position of the spinner on the horizontal and vertical axes.

Angle/Float/Integer/Percen t/World Units UI Options rollout : Slider

This is a numeric value that the user can set with a standard 3ds max slid er.
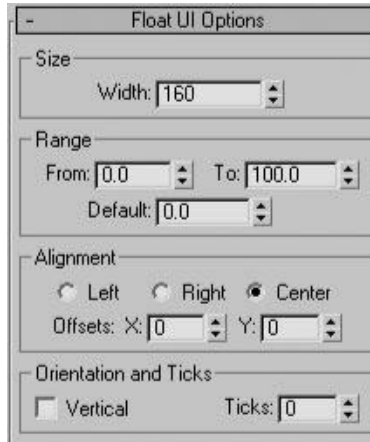
Fig. .19: Parameter editor options 2

Width: This helps in setting the width of the slider.

From: This set the minimum value of the slider.

To: This set the maximum value of the slider.

Default: This set the default value of the slider.

Left/Right/Center: This set t he alignment of the slider in the rollout.

Offset X/Y: This fine-tunes th e position of the slider on the horizontal and v ertical axes.

Vertical: This when on, the slider will be displayed vertically. When off, the slider is displayed horizontally.

Ticks: This set the number of ticks along the slider. The ticks are distributed evenly along the length of the slider.

This is a standard 3ds m ax check box that the user can turn on and off by clicking it with the mouse.

Fig. 5.20: Parameter Editor Option 3

Width: This set the width of the check box.

Height: This set the height o f the check box.

Alignment group

Left/Right/Center: This set the alignment of the check box in the rollout.

Offset X/Y: This fine-tunes t he position of the check box on the horizonta l and vertical axes.

Boolean UI Options Rollout : Check Button

This is a standard 3ds m ax check button that the user can turn on and off by clicking it with the mouse.
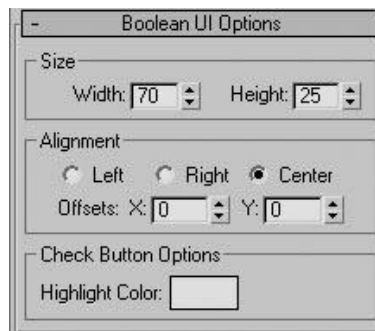
Fig. 5.21: Parameter Editor Option 4

Width: This set the width of the check button.

Height: This set the height o f the check button.

Left/Right/Center: This set the alignment of the check button in the rollout.

Offset X/Y: This fine-tunes the position of the check button on the horizontal and vertical axes.

Check Button Options group

Highlight Color: This set the colour of the button when it is pressed.

Drop-Down List: This only th e current choice is visible by default. The user clicks the field to open the list and then clicks to choose a different item.

Combo Box: This displays a n editable field above a list boxes. The user clicks to choose from the list, or edits the field.

List Box: This displays a list. The user clicks the desired item; the highlighting indicates the current choice.
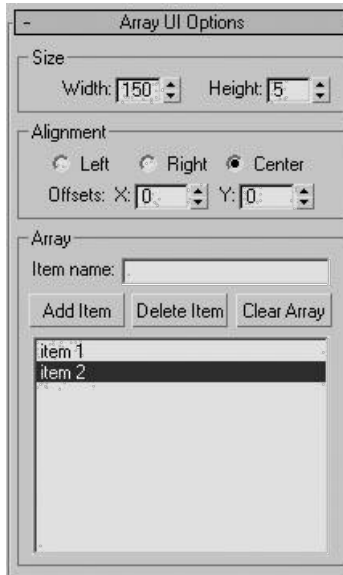
Fig. 5.22: Parameter Editor Option 5

Width: This set the width of the list.

Height: This set the height of the list.

Left/Right/Center: This set t he alignment of the drop-down list in the rollou t.

Offset X/Y: This fine-tunes the position of the array list on the horizontal and ve rtical axes.

Item name: This lets you enter a name into the list.

Array list: This displays the c ontents of the list.

The item at the top of the array list is the default selection.

A node is any object in the 3ds m ax scene.
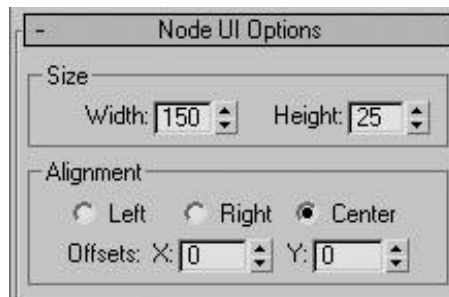
Fig. 5.23: Parameter Editor Option 6

Width: This set the width of the pick button.

Height: This set the height of the pick button.

Alignment group

Left/Right/Center: This set the a lignment of the pick button in the rollout.

Offset X/Y: This fine-tunes the position of the pick button on the horizont al and vertical axes.

Color UI Options Rollout:Co lour Picker

This creates a colour sw tch that displays the current colour and lets th e user click it to choose a new colour with the colour Selector dialog.
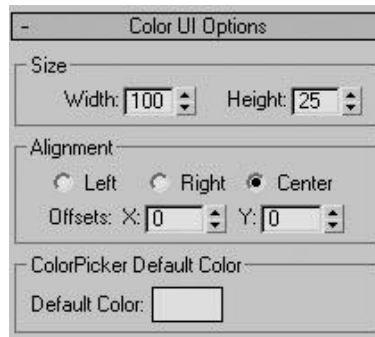
Fig. 5.24: Parameter Editor Option 7

Width: This set the width of the colour picker.

Height: This set the height o f the colour picker.

Left/Right/Center: This set the alignment of colour picker in the rollout.

Offset X/Y: This fine-tune the position of the colour picker on the horizont al and vertical axes.

DefaultColor: This set the de fault color.

Material/Texture Map Options Rollout: Material Button / Map But ton

The options for the Material UI type and Texture Map UI type are the same.
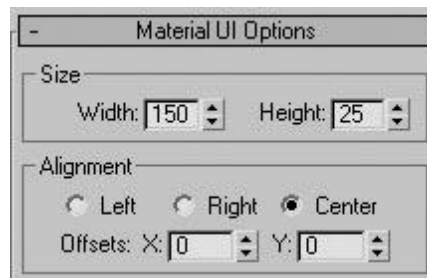
Fig. 5.25: Parameter Editor Option 8

Width: This set the width of the material/map button.

Height: This set the height of the material/map button.

Left/Right/Center: This set t he alignment of the material/map button in the rollout.

Offset X/Y: This Fine-tune the position of the material/map button on the h orizontal and vertical axes.

The String parameter t ype creates a text box that the user can e dit with the keyboard, with optional default text.

Width: This set the width of the material/map button.

Height: This set the height of the material/map button.

Left/Right/Center: This set t he alignment of the text box in the rollout.

Offset X/Y: This Fine-tune the position of the text box on the horizontal and vertical axes.

Fig. 5.26: Parameter Editor Option 9

This rollout displays the U I layout for the custom attribute that you are working on.

![bell icon]	Study Notes
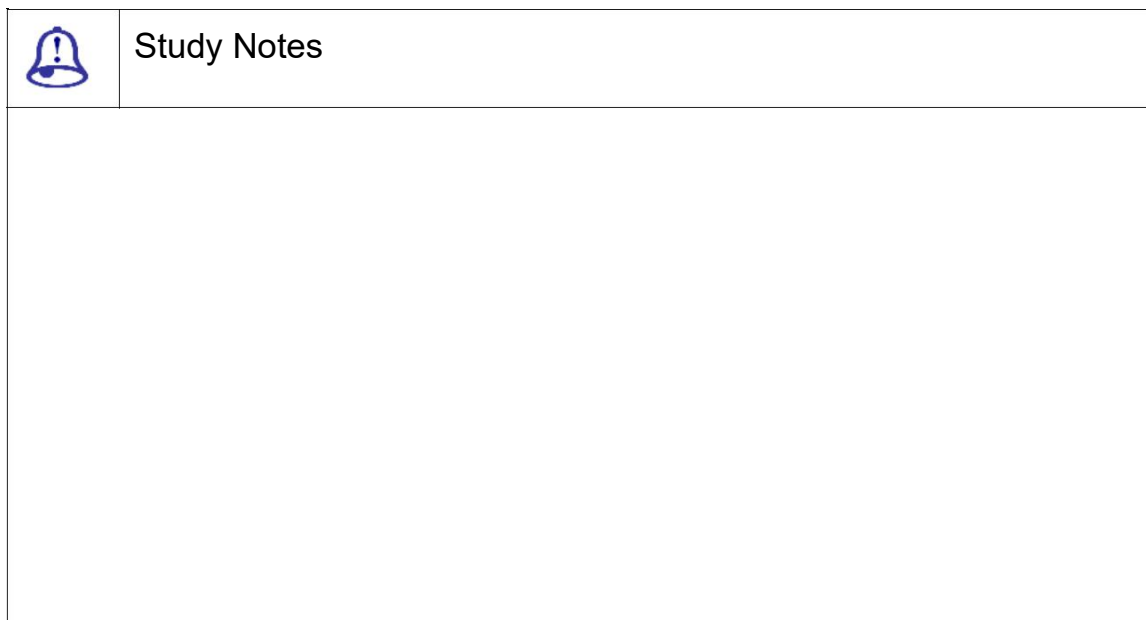
	Assessment
Explain parameter editor and its use.	
Explain the Button Options group.	

	Discussion
Discuss parameter editor and its various uses.	

5.16 Wire Parameter

This enables you to make a connection between the manipulator objects like sliders with the parameters of an object for controlling it with the use of the parameter.
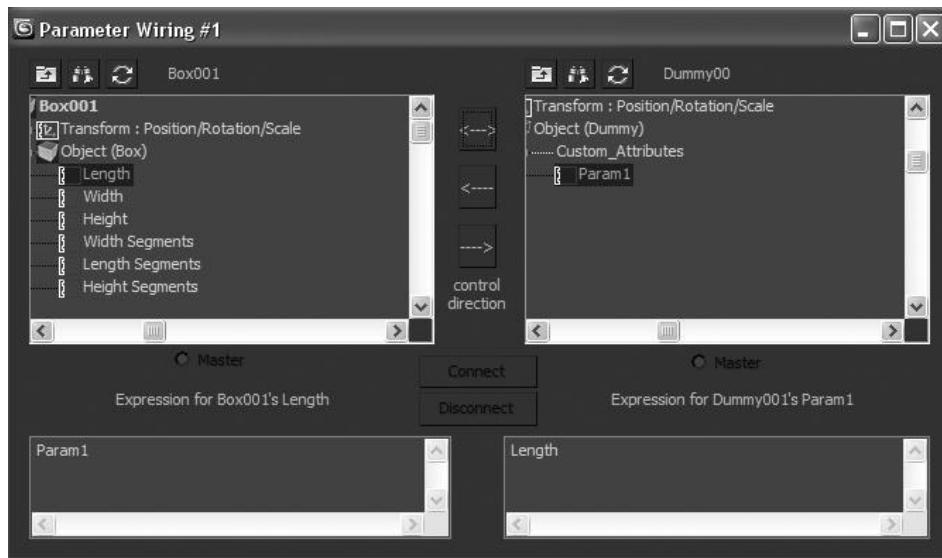
Fig. 5.27: Wire Parameter Window

In this window, you can connect one object's property to another object as well as to the sliders or spinners to control it. You can do two way connection or one side connection for the controls.

These wires parameters can be applied by right click on any object and then select the property or modifier of that object to control its values.

	Study Notes

👁	Assessment
Explain the importance and uses of wire parameters.	

🗣	Discussion
Discuss wire parameters and their various uses.	

5.17 Curve Editor

TRACKVIE W MENU BAR
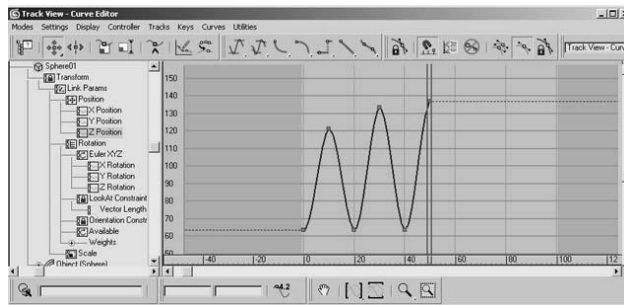
Fig. 5.28: Curve Editor Window

Modes: Lets us choose between Curve Editor and Dope Sheet.

Settings: Controls the behavior (auto: expansion, etc.) of the Hierarchy list window. Also contains controls that improve performance.

Display: Affects curve, icon and tangent display.

Controller: Assigns, copies and pastes controllers and makes them unique. Here we also add looping.

Tracks: Adds Note and Visibility tracks.

Keys: Adds, removes, slides and scales keys. Also includes soft selection, align to cursor and snap frame.

Curves: Applies or removes Ease and Multiplier curves.

Utilities: Randomises or creates out:of:range keys. Also selects keys by time and current value editor.

KEY TOOLS TOOLBAR

Fig. 5.29: Curve Editor Tools

Filter: Use this to determine what is displayed in the Controller window and the Key window.

Move Keys: Moves keys freely both horizontally and vertically on the function curve graph.

Move Keys: Horizontal: Moves keys only horizontally on the function curve graph.

Move Keys: Vertical: Moves keys constrained vertically on the function curve graph.

Slide Keys:Use Slide Keys in the Curve Editor to move a group of keys and slide adjacent keys away as we move.

Scale Keys: Use Scale Keys to compress or expand the amount of time between keyframes.

Scale Values:Proportionally increases or decreases the values of the keys, rather than moving the keys in time.

Add Keys:Creates keys on existing curves on the function curve graph or Dope Sheet.

Draw Curves: Use this to dr aw new curves, or revise existing ones by sketching directly on the function curve graph.

Reduce Keys: Use this to reduce the amount of keys in a track.
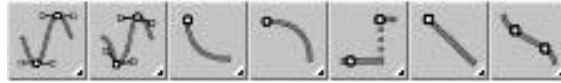
Fig. 5.30: Curve Editor keys

Set Tangents to Auto: Selecting the handles of an Auto tangent changes th em to custom and makes them available for editing.

Set Tangents to Custom:Sets keys to custom tangents. Select the key t hen click this button to make the key hand les available for editing. Set in and out tangen ts individually using the fewer. Use the SHI FT key to break continuity when using handles.

Set Tangents to Fast:Sets key tangency to fast in, fast out, or both in and o ut, depending on our choice from the fewe r.

Set Tangents to Slow:Sets key tangency to slow in, slow out, or both in and out, depending on our choice fro m the fewer.

Set Tangents to Step:Sets key tangency to step in, step out, or both in and out, depending on our choice fr m the 77. Use step to freeze motion from o ne key to the next.

Set Tangents to Linear:Sets key tangency to linear in, linear out, or bot h in and out, depending on our choice fro m the fewer.

Set Tangents to Smooth:Set s key tangency to smooth. Use this to even up discontinuous motion.

CUR VES TOOLBAR

Fig. 5.31: Curve Editor keys toolbar 1

Lock Selection: Locks the key selection..

Snap Frames:Restricts key movement to frames.

Parameter Out:of:Range Curves:Use this to repeat keyframed motio n beyond the range of the keys.

Show Keyable Icons: Displays an icon that defines a track as keyable or not.

Show Tangents:Hides or dis plays tangent handles on the curves.

Show All Tangents:Hides or displays all tangent handles on the curves.

Lock Tangents: Locks the selection of multiple tangent handles, so we can then manipulate several handles at once.

Fig. 5.32: Curve Editor Keys Toolbar 2

☐ Name: Track View lets us na me the Track View.

Fig. 5.33: Curve Editor Selection Toolbar

Track Selection:Track View gives we tools to select tracks by entering the name of an object. Also available in Dope Sheet mode.

Fig. 5.3 4: Curve Editor Navigation Toolbar

Navigation: Track View prov ides tools to pan and zoom the Key window. We can zoom to the extents of the time or the values. Also available in Dope Sheet mode.
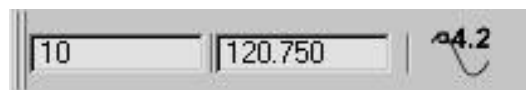
Fig. 5.35: Curve Editor Key Stats Toolbar

Key Stats: Track View provides tools for the display and type:in transform of key values.

3d s Max Part II
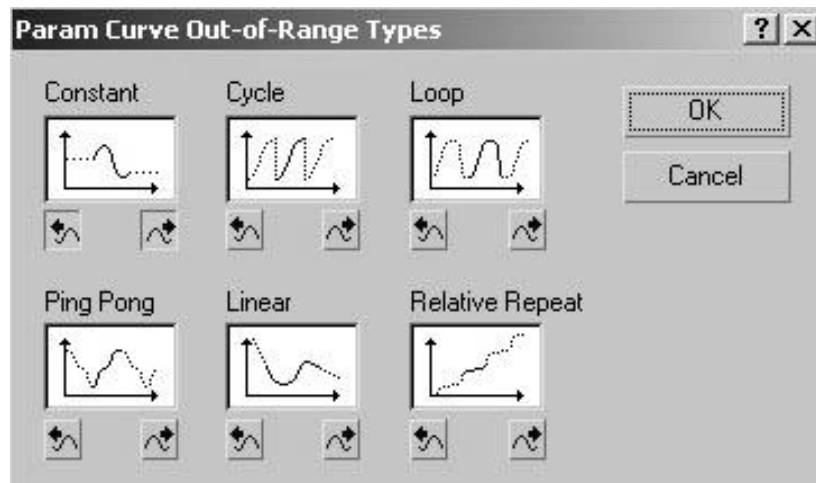
Fig. 5.36: Out-of-Range Types

With Parameter Curve O ut:of:Range Types we can specify how an object is to behave outside the range of the keys we've defined.

Constant: Holds the value of the end key of the range for all frames.

Cycle: Repeats the same ani mation as within the range.

Loop: Repeats the same anim ation as within the range.

Ping Pong: Alternates betwe en a forward and backward repeat of the ani mation within the range.

Linear: Projects the animation value along a line tangent to the function cur ve at the end of the range.

Relative Repeat:Repeats the same animation as within the range but offsets each repetition by the value at the end of the range.
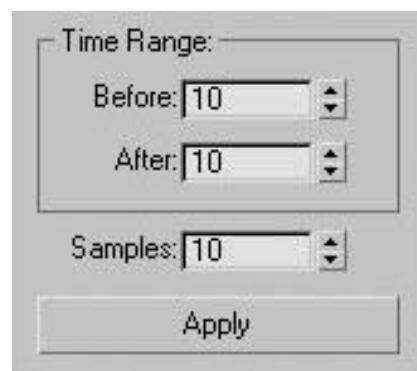
Fig. 5.37: Relative Repeat

Before: Specifies the number of frames before the range for generating keys

After: Specifies the number of frames after the range for generating keys.

Samples: Specifies the number of keys to be generated for both the before and after time range, based on the settings in Before and After.

Apply: Generates the keys.

Explain each curve and the tracks

When you make animation of any object, you get its curves to edit in the curve editor.
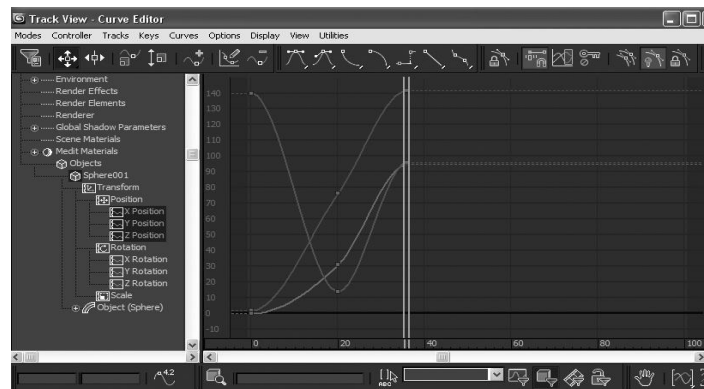
Fig. 5.38: Tracks

Here you can see the curves of X, Y and Z-axis animation of the selected object. Here you can change the animation as well as make the animation too. You can add or delete the keys as well as scale the values of the keys for modification in the animation you have made.

X Curve: This is the curve of animation of the selected object on X-axis. It comes in red color.
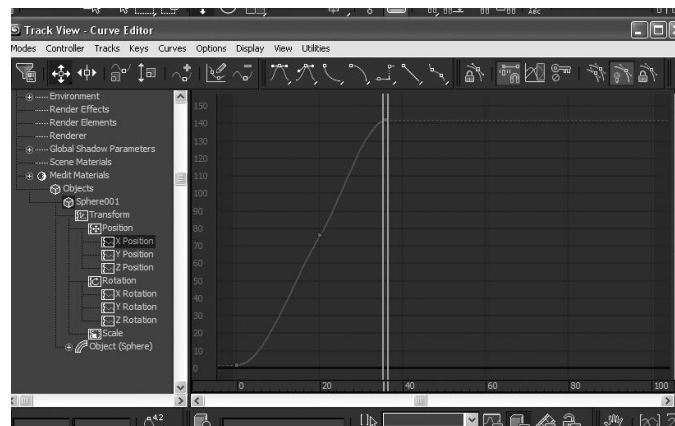
Fig. 5.39: Track of X Curve

Y curve: This is the curve of animation of the selected object on Y axis. It comes in green color.
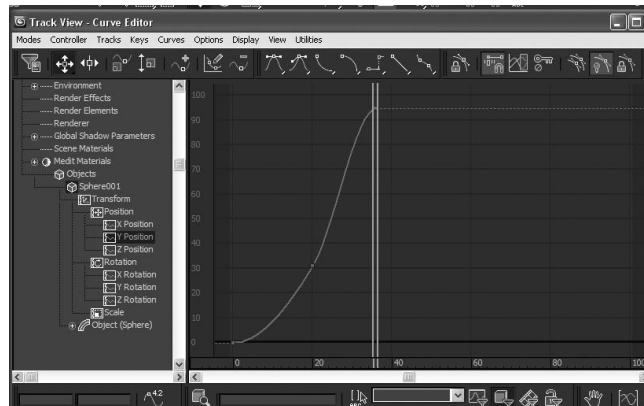
Fig. 5.40: Track of Y Curve

Z curve: This is the curve of animation of the selected object on Z-axis. It comes in blue color.
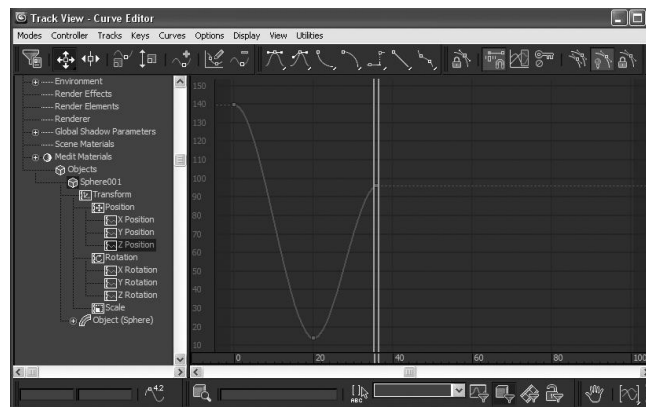
Fig. 5.41: Track of Z Curve

	Study Notes

	Assessment
Write a note on Key tool bar. Write a note on Curve tool bar.	

	Discussion
Discuss and Practice using the Software the various tool bars available and their use.	

5.18 Summary

INTRODUCTION TO MOTION PANEL

As you have learnt in this Unit the Motion Panel, The Motion panel provides tools to adjust the motion of the selected object. Key timing and easing in and out of a key are parameters that you can adjust with tools on the Motion panel, for example. The Motion panel also provides an alternative to Track View for assigning animation controllers.

ATTACHMENT CONSTRAINTS

It keep the cylinders on the surface. The Attachment constraint is a position constraint that attaches an object's position to a face on another object.

SURFACE CONSTRAINTS

It positions the weather symbols on the globe. The Surface constraint positions an object along the surface of another object.

PATH CONSTRAINT

It positions the service platform along the side of the bridge. A path constraint restricts an object's movement along a spline or at an averaged distance between multiple splines.

POSITION CONSTRAINTS

It aligns the elements of the robot assembly. The position constraint causes an object to follow the position of an object or the weighted average position of several objects.

It is used to animate an object linking from one target object to another. The Link constraint causes an object to inherit the position, rotation and scale of its target object.

THE LOOK AT CONSTRAINT

This constraint controls an object's orientation so that it is always looking at another object. It locks an object's rotation so that one of its axes points toward the target object.

ORIENTATION CONSTRAINT

An Orientation constraint causes an object's orientation to follow the orientation of an object or averaged orientation of several objects.

TRANSFORM CONTROLLERS

Here we talked about the Transform Controllers: and their uses.

POSITION CONTROLLERS

The Position controllers Parameters rollout provides tools for creating and deleting keys. PRS stands for the 3 basic transform controllers: Position, Rotation, Scale.

ROTATION CONTROLLERS

In the same way, you get rotation controllers to control and make animation of rotations for any selected object.

SCALE CONTROLLER

In the same way, you get scale controllers to control and make animation of X, Y, Z scale for any selected object.

ATTRIBUTE HOLDER

This modifier is used for making any object ready for attribute editor. This is not essential for any helper objects but for any poly, mesh or other mesh object this is must before applying attribute editor.

PARAMETER COLLECTOR

Parameter Collector takes the form of a dialog with a menu bar, a toolbar and rollouts that you create and modify using the dialog tools.

The Parameter Editor takes the form of a dialog with several rollouts: The first rollout set general options for the attribute; the central rollout set options for the current parameter type; and the third lets you preview the attribute user interface (UI).

This enables you to make a connection between the manipulator objects like sliders with the parameters of an object for controlling it with the use of the parameter.

Here,we talked about each axis animation curve.

5.19 Self-Assessment Test

Broad Questions

What is curve editor?What are the uses of curve editor?

What are the uses of controllers?Explain position controller

What is the use of wire parameters?

Short Notes

Curve Editor

Wire parameters

Motion panel

Rotation Controller

Scale Controller

5.20 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make various animation clips like bouncing ball, bouncing egg, jumping characters etc. and control the animation with the use of curve editor and various animation controllers.

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Unit 3   Interactive Animation Control

Learning Outcome

After going through this unit, you will learn:

List the uses of Helpers > Manipulators

Illustrate how to Create > Helpers > Standard

Explain the uses of Grid, Tape, Protractor, Compass and Point

Give the uses of Animation modifiers – Flex, Melt, etc.

Demonstrate the uses of Patch deform, Patch deform and X-form

Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

Content Map

6.1   Introduction to Animation Control

6.2   Helpers >Manipulators

6.3   Create > Helpers > Standard

6.4   Grid

6.5   Tape

6.1 Introduction to Animation Control

In this Unit, you will learn to control objects by using other objects and their properties as well as using the helper and manipulator objects given in 3DS MAX for support. Here we will also discuss the various uses of the same helper an manipulators.

Youwill also learn to use various modifiers given for animation like path deform, patch deform, flex, etc. for various animations. You will learn to use grid, tape, compass etc. helpers for various purposes.

6.2 Helpers >Manipulators

MANIPULATORS: Manipulators are the helpers with which we can manipulate other objects. They let we add customised controls to our scene that provide visual feedback in view ports.

Let us have a look on the manipulators in brief.
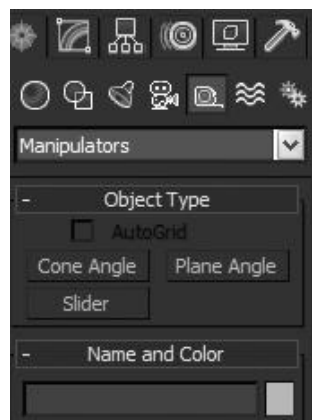
Fig. 6.1: Manipulators

Here you will get three manipulator objects.

Cone Angle: This is used for giving controls on angle-based values.
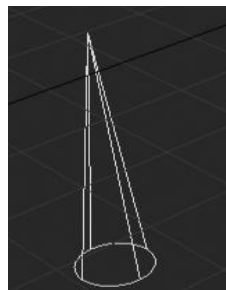
Fig. 6.2: Cone Angle

Plane Angle:This is used for making controls for values.
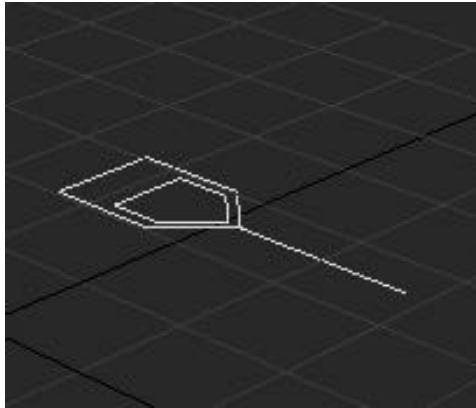
Fig. 6.3: Plane Angle

Slider:This is used for making controls for values of any object's properties.
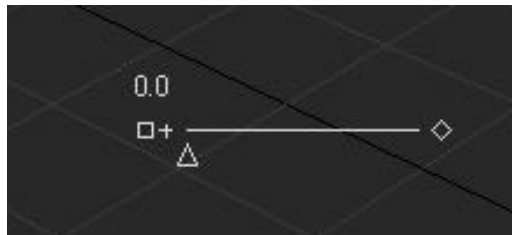
Fig. 6.4: Slider

	Study Notes

	Assessment
Define and explain manipulators and their uses.	

	Discussion
Discuss various uses of manipulators.	

6.3 Create > Helpers > Standard
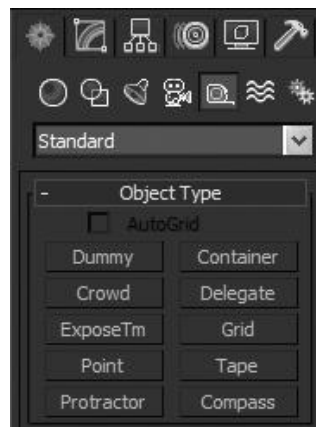
Fig. 6.5: Standard Helpers

Here you will get different helper objects for usage in various conditions. All these are not renderable as they are given as extras.

Dummy-It is a wireframe cube with a pivot point at its geometric center. The dummy has a name but no parameters, you cannot modify it andalso it doesn't render.

Grid- The grid, also called "User Grid" or "Custom Grid", is a 2D parametric object with adjustments for overall size and grid spacing. You can move and orient user grids anywhere in world space.

Point- Point provides a specific location in 3D space that can be used as a reference or by other program functions.

Tape- It is called "tape measure" for determining and setting distances. The tape is composed of two named objects. You can drag a length (the default), or enter a specific

length by turning on Specify Length. It can be snapped or aligned at either end of the tape or link to objects in your scene. Deleting either end deletes the tape.

Protractor- It measures the angle between any two objects in your scene. The names of the two objects appear above their respective buttons and the angle formed at the protractor object between the pivot points of the two objects is displayed in the Angle field. Lines are drawn between the protractor and the two selected objects.

Compass- Compass displays as a non-rendering compass rose, with indicators for North, South, East and West.

![bell icon]	Study Notes

![eye icon]	Assessment
Explain Dummy manipulator.	

![head icon]	Discussion
Discuss the standard manipulators and their uses.	

6.4 Grid

This helper can be used as a grid when activated. This makes the de fault grid de activated and then behaves like a grid for you.
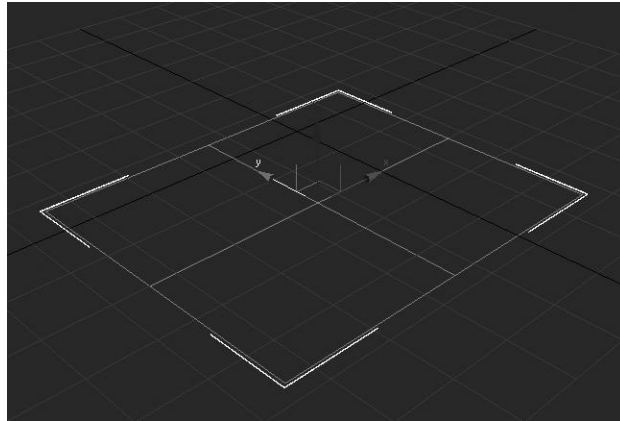
Fig. 6.6: Grid Helpers

The grid is also called as " User Grid" or "Custom Grid". It is a 2D parametric object.

It has adjustments for overall size and grid spacing.
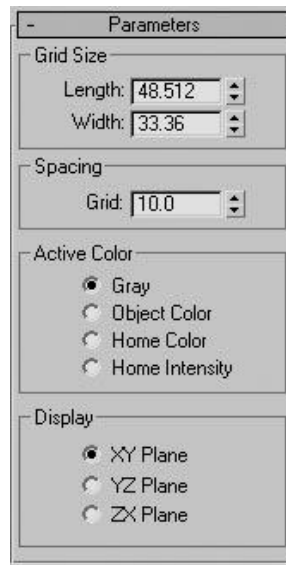
Fig. 6.7: Grid Helper Options

We can move and orient user grids anywhere in world space. We ca n create any number of grid objects in our s cene.We name them when we create them a nd save them with the scene. We can delete th em at any time.

The properties are

Length

Width

Grid: It specifies the size of the smallest square in the visible grid.

We can set Grid Spacing when a grid is selected, but we won't see the grid spacing until the grid is activated.

The other properties are

Object Colour:in here, the main grid lines use the assigned object colour and the secondary lines use a lighter intensity.

Home Colour: The grid object uses the home grid colour.

Home Intensity: The grid object uses the grid intensity settings.

	Study Notes

	Assessment
	Explain grid and its uses for various purposes.
	Explain the parameters for Grid.

	Discussion
Discuss the uses of grid helper.	

6.5 Tape

Tape provides facility for determining and setting distances.
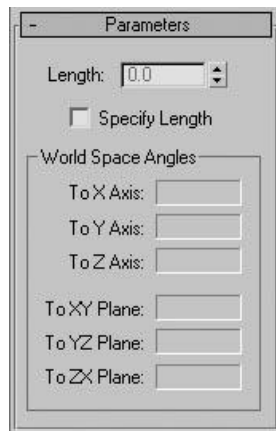
F ig. 6.8: Tape Helper Options

Length

Specify Length

To X/Y/Z Axis: This displays the angle of the tape object relative to each axis in world space.

To XY/YZ/ZX Plane: Used to display the angle of the tape object relative to each of these home planes.

Fig. 6.9: Tape Helper

![bell icon]	Study Notes
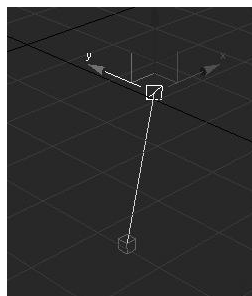
![eye icon]	Assessment
	Explain tape helper object a nd its uses. List down the parameters f or Tape.

![speaking head icon]	Discussion
	Discuss tape helper and its various uses.

6.6 Protractor

This is used for measuring the angle between two objects.
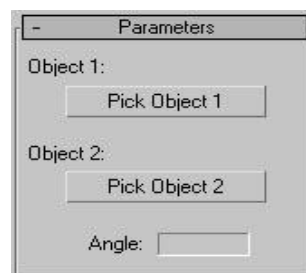
Fig. 6.10: Protractor HelperOptions

Pick Object 1: Used to select the parent object.

Pick Object 2: Used to select the child object.

Angle: Displays the angle.
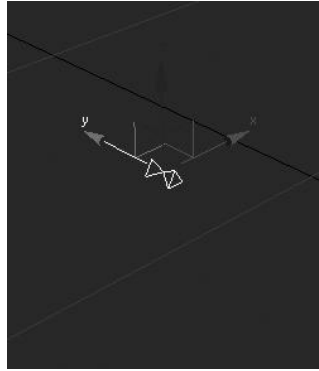
Fig. 6.11: Protractor Helper

![bell icon]	Study Notes

![eye icon]	Assessment
Write down the parameters required for Protractor.	

![head icon]	Discussion
Discuss protractor helper and its uses.	

6.7 Compass

Compass displays indicates for North, South, East and West.
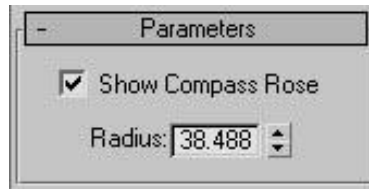
Fig . 6.12: Compass Helper Options

This is very useful for making and developing a complete city scene with proper directions.
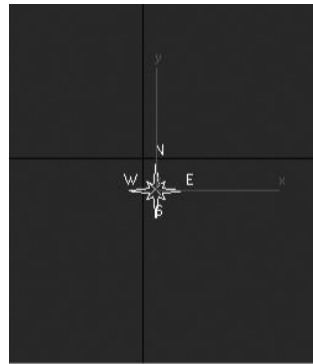
Fig. 6.13: Compass Helper

⚠	Study Notes

	Assessment
Explain compass helper and its uses.	
List the parameters of Comp ass and explain them.	

	Discussion
Discuss compass helper and its uses for various purposes.	

6.8 Point
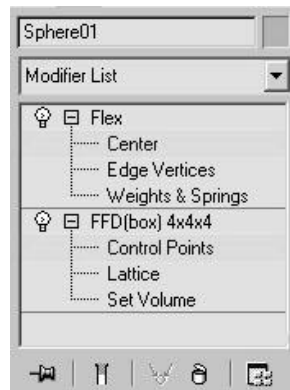
Fig. 6.14: Point Helper Options

Point provides a specific location in 3D space that can be used as a reference or by other program functions.
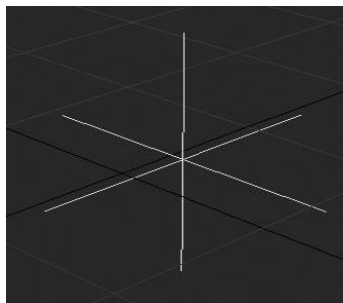
Fig. 6.15: Point Helper

👁	Assessment
Explain point helper and its uses.	
List the parameters of Point helper and explain them.	

🗣	Discussion
Discuss point helper and its various uses.	

6.9   Animation Modifiers – Flex

Here are some of the modifiers, which can be animated so as to create some exotic animations with great accents. Let us have a look on some of the modifiers in brief.

Flex

The Flex modifier simulates soft body dynamics using virtual springs between an object's vertices.
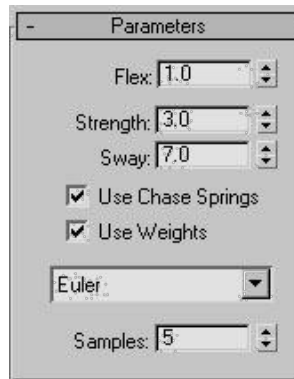
Fig. 6.16: Flex Modifier 1

Center: Move the Transform gizmo in the view ports to set the center of the effect.

Edge Vertices: Select vertices in the view ports to control the falloff and di rection of the flex effect.

Weights & Springs: The weights and painting rollout controls to select and d eselect.

Fig. 6.17: Flex Modifier 2

Flex: Sets the amount of flex and bend.

Strength: Sets the overall spring strength of the chase springs.

Sway: Sets the time for t he object to come to rest for chase springs.

Use Chase Springs: Ena bles chase springs, which force the object to return to its original shape.

Solver Type:Allows us to choose a solver for the simulation from the dr op down list. The three choices

Euler

Midpoint

Runge:Kutta4

Samples: The number of times per frame the Flex simulation is run at equal time intervals.

Fig. 6.18: Flex Modifier 3

Create Simple Soft Bod y: Generates spring settings for the object based on the Stretch and Stiffness settings.

Stretch: Determines how much object edges can elongate.

Stiffness: Determines how rigid the object is.
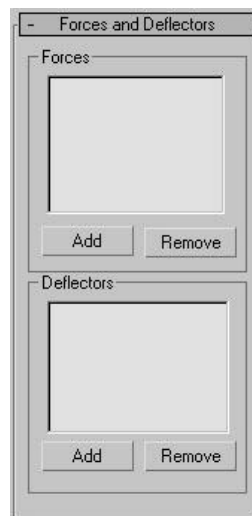
Fig. 6.19: Flex Modifier 4

Paint: Used to paint vertex weights using the current Strength and Feat her settings.

Strength: Sets the amou nt by which painting changes weight values.

Radius: Sets the size of t he brush in world units.

Feather: Sets the falloff in strength from the centre of the brush to its e dge.

Absolute Weight: Turn on to assign absolute weights to the selected ver tices.

Vertex Weight: Assigns w eight to selected vertices.
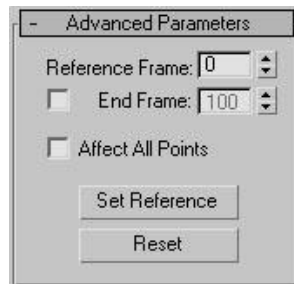
Fig. 6.20: Flex Modifier 5

Use these controls to add space warps in the Forces category to the Flex modifier.

Supported space warps are:

Displace

Drag

Gravity

Motor

PBomb

Push

Vortex

Wind

List Window: Displays particle space warps applied to the Flex modifier.

Add: Click this and then select a particle space warp in the view ports to add the effect to Flex.

Remove: Select a space warp in the list and click Remove to remove the effect from Flex.

Using deflectors with Fle x lets object movement be impeded by surface s. This lets we simulate collisions with soft: bod y objects.

Supported deflectors are:

POmniFlect

SOmniFlect

UOmniFlect

UDeflector

SDeflector

Deflector

List Window: Displays de flectors applied to the Flex modifier.

Add: Click this and then s elect a deflector in the view ports to add the e ffect to Flex.

Remove: Select a deflector in the list and click Remove to remove the effect from Flex.
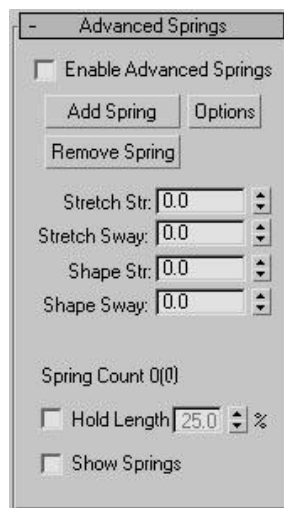
Fig. 6.21: Flex Modifier 6

Reference Frame: Sets th e first frame at which Flex begins its simulation .

End Frame: Sets the last frame at which Flex is to take effect.

Affect All Points: Forces Flex to ignore any sub object selection in the stack and apply itself to the entire object.

Set Reference: Updates t he view ports.

Reset: Resets vertex wei ghting to the defaults.

Enable Advanced Springs: Makes the numeric controls available for editing and disconnects the Strength and Sway settings from the Simple Soft Bodies controls.

Add Spring: Adds one or more springs to the object based on the vertex selection at the Weights & Springs sub: object level and the Spring Option dialog settings.

Options: Opens the Spring Option dialog for determining how springs are added with the Add Spring function.

Remove Spring: Deletes any springs that have both vertices selected at the Weights & Springs sub: object level.

Stretch Str: Determines the strength of the edge springs; the higher the strength, the less the distance between them can vary.

Stretch Sway: Determines the sway of the edge springs; the higher the strength, the less the angle between them can vary.

Shape Str: Determines the strength of the shape springs; the higher the strength, the less the distance between them can vary.

Shape Sway: Determines the sway of the shape springs; the higher the strength, the less the angle between them can vary.

Spring Count: Displays the number of edge springs, followed by the number of shape springs in parentheses.

Hold Length: Maintains the length of edge springs within the specified percentage.

Show Springs: Displays edge springs as blue lines and shape springs as red lines.

Study Notes

⊚	Assessment
List the supported deflectors.	

🗣	Discussion
Discuss flex modifier and its var ious uses.	

6.10 Melt

The Melt modifier lets us apply a realistic melting effect to all typ es of objects, including editable patches and NURBS objects, as well as to sub object selecti ons passed up the stack.
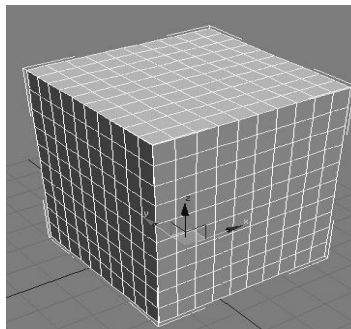
Fig. 6.22: Melt Modifier 1
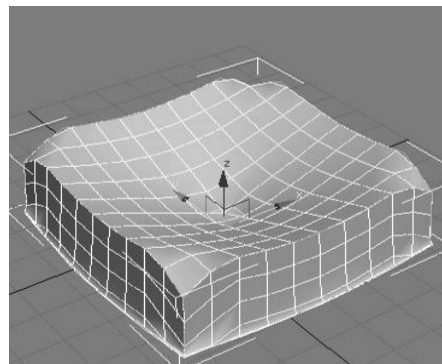
Fig. 6.23: Melt Modifier 2

Fig. 6.24: Melt Modifier 3
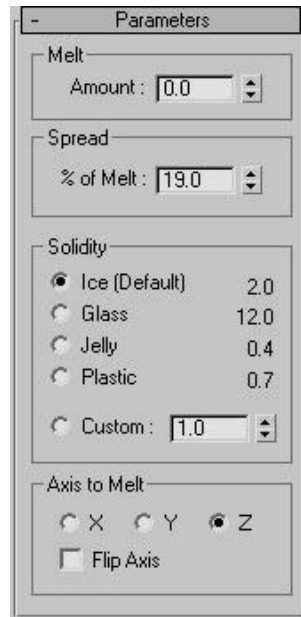
Fig. 6.25: Melt Modifier 4

Gizmo: At this sub object le el, we can transform and animate the gizmo like any other object, altering the effect of the Melt modifier.

Center: At this sub object le vel, we can translate and animate the center, altering the Melt gizmo's shape and thus the shape of the melted object.

Amount: Specifies the extent of the "decay" or melting effect applied to the gizmo, thus affecting the object.

% of Melt: Specifies how m uch the object and melt will spread as the A mount value increases.

Ice: The default Solidity setti ng.

Glass: Uses a high Solidity setting to simulate glass.

Jelly: Causes a significant dro oping effect in the center.

Plastic: Relatively solid, but d roops slightly in the center as it melts.

Custom: Sets any solidity between 0.2 and 30.0.

X/Y/Z: Choose the axis on which the melt will occur.

Flip Axis: Normally, the melt occurs from the positive direction toward the negative along a given axis.

![bell icon]	Study Notes

![eye icon]	Assessment
Explain melt modifier and its uses.	
List the parameters for melt modifier.	

![speaking head icon]	Discussion
Discuss various uses of melt modifier.	

6.11 Patch Deform (WSM) & (OSM)

The Patch Deform world space modifier lets we deform an object based on the contours of a patch object. It works the same as the Path Deform (World Space), but uses a patch instead of a curve. With the exception of the Move to Patch button, its parameters are the same as those in the object space Patch Deform modifier.
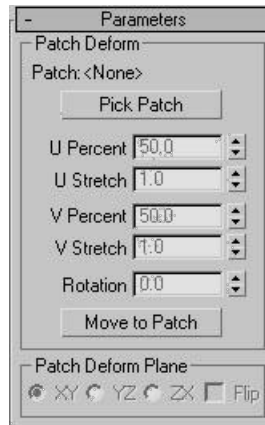
Fig. 6.26: Patch Deform Modifier

Gizmo: The Patch Deform gizmo is a representation of the deforming pat ch object, so transforming it determines w hich part of the patch affects the modified obj ect.

Patch: Displays the name of the selected patch object.

Pick Patch: Click this button and then select the patch object we want to use for the deformation.

U Percent: Moves the object along the U (horizontal) axis of the gizmo patch, based on a percentage of the U distance.

U Stretch: Scales the object a long the U axis of the gizmo patch.

V Percent : Moves the objec t along the V (vertical) axis of the gizmo patc h, based on a percentage of the V distance

V Stretch: Scales the object a long the V axis of the gizmo patch.

Rotation: Rotates the modified object with respect to the gizmo patch.

Move To Patch: Clicking this button moves the object from its original p osition to the patch object we are using for deformation.

XY/YZ/ZX: Choose a two: axis plane of the object to make parallel with the XY plane of the gizmo patch.

Flip: Reverses the gizmo direction.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain patch deform modif ier and its uses.
	List the parameters and exp lain them.

![speaking head icon]	Discussion
	Discuss the various uses of patc h deform.

6.12 PathDeform

The Path Deform modifie r deforms an object using a spline or NURBS cu rve as a path.
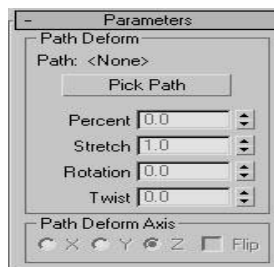
Fig. 6.27: Path Deform Modifier 1

Path: Displays the name of t he selected path object.

Pick Path: Click this button and then select a spline or NURBS curve to use as the path.

Percent: Moves the object along the gizmo path based on a percentage of the path length.

Stretch: Scales the object alo ng the gizmo path, using the object's pivot poi nt as the base of the scale.

Rotation: Rotates the object about the gizmo path.

Twist: Twists the object abou t the path.

X/Y/Z: Choose one to rotat e the gizmo path to align with a specified local axis of the object.

Flip: Reverses the gizmo path 180 degrees about the specified axis.

Path Deform Modifier (WS M)

Since this is a world spac e rather than an object space modifier, the obj ect is affected in world space coordinatesand affected by the relative position of the path to t he object.
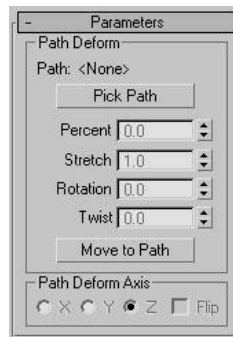
Fig. 6.28: Path Deform Modifier 2

Move to Path: Moves the object from its original position to the start of the path.

![eye icon]	Assessment
	Explain path deform and its various uses.
	Write the parameters required for Path Deformer.

![speaking head icon]	Discussion
	Discuss various uses of path deform.

6.13 X-Form

Fig. 6.29: X-form

This modifier has no parameters, but we can transform the XForm gizmo and the XForm centre. If we switch the selection level to the XForm centre, only the M ove transform is available.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain x-form and its uses. Make a list of parameters for x-form.

![speaking head icon]	Discussion
Discuss various uses of x-form.	

6.14 Summary

INTRODUCTION TO ANIMATION CONTROL

As you have learnt in this Unit the Interactive animation controls, Helper objects play a supporting role, like stagehands or construction assistants. Several categories of helpers are available from the drop-down list on the Create panel.

HELPERS > MANIPULATORS

Manipulators are the helpers with which we can manipulate other objects. They let we add customized controls to our scene that provide visual feedback in view ports.

Here we talked about the helpers available in the standard catagotyliek Dummy, tape, protractor etc.

GRID

This helper can be used as a grid when activated. This makes the default grid de activated and then behaves like a grid for you.

TAPE

The tape is composed of two named objects. You can drag a length (the default), or enter a specific length by turning on Specify Length.

PROTRACTOR

It measures the angle between any two objects in your scene. The names of the two objects appear above their respective buttons and the angle formed at the protractor object between the pivot points of the two objects is displayed in the Angle field.

COMPASS

Compass displays as a non-rendering compass rose, with indicators for North, South, East and West.

POINT

Point provides a specific location in 3D space that can be used as a reference or by other program functions.

ANIMATION MODIFIERS – FLEX

The Flex modifier simulates soft body dynamics using virtual springs between an object's vertices.

MELT

The Melt modifier lets we apply a realistic melting effect to all types of objects, including editable patches and NURBS objects, as well as to sub object selections passed up the stack.

PATCH DEFORM

It works the same as the Path Deform (World Space), but uses a patch instead of a curve.

The Path Deform modifier deforms an object using a spline or NURBS curve as a path.

X-FORM

Here we talked about X-deform and its uses.

6.15 Self-Assessment Test

Broad Questions

What are helper objects?Explain standard helper objects.

Explain manipulators.

Which are the animation modifiers?

Helpers

Manipulators

Animation Modifiers

Melt

Patch Deform

6.16 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a scene of Architecture and use maximum helpers and manipulators for the same.

Make a scene and use various modifiers of animation for various purposes.

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ARCHITECTURE DESIGN 2

BLOCK 3:
CHARACTER ANIMATION

Dr. Babasaheb Ambedkar Open University, Ahmedabad

"

*Education is something
which ought to be
brought within
the reach of every one.* **"**

- Dr. B. R. Ambedkar

Dr. Babasaheb Ambedkar
Open University

BCA(DES)-205
ARCHITECTURE DESIGN 2

Block

3

CHARACTER ANIMATION

UNIT 1 INTERACTIVE ANIMATION CONTROL

UNIT 2RIGGING AND SKINNING,HUMAN ANATOMY

UNIT 3 PARTICLES

UNIT 4 REACTORS AND UTILITIES

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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 cues, 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)

Unit 1   Hierarchies and Kinematics

	## Learning Outcome

After going through this unit, you will learn:

Discuss the uses of IK and FK -Types of bodies - Rigid body, Soft body and deformable body

Give the uses of IK and Fk - Binding objects - IK solvers

List the uses of HI solver, HD solver, IK limb solver,

Describe the uses of Schematic view - Locking the object transforms - Explain schematic view and to navigate complex hierarchy

Explain the uses of Important principles while animating (viz. a character rotates more than it moves), Easing In and Out, Timing, jerks and smoothness

	## Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	## Content Map

7.1   Introduction to Hierarchies and Kinematics

7.2   Understanding IK and FK

7.3   Rigid Body, Soft Body and Deformable Body

7.1   Introduction to Hierarchies and Kinematics

In this unit, we will talk about the hierarchy and kinematics which are helpful for making bones and their controls for animation of deformable body of a character.

In addition, we will talk about how to make various rigs for various types of characters. We will talk about controlling the body with the use of different controllers. Here we will talk about different types of kinematics that allows you to control the rigged character in different way for animation. You will learn about the animation principles and their importance in making realistic animation. We will talk about the schematic view and its uses for managing the hierarchy of linked objects as per requirements.

7.2   Understanding IK and FK

Inverse kinematics calculates the position and orientation of objects in a kinematic chain.This chain is defined as a single branch of the hierarchy that starts with a selected child object and continues up through its parents until the base of the chain is reached.

There are 2 types of kinematics present in 3ds Max:

FK: Forward Kinematics

IK: Inverse Kinematics

Example: Using an arm to move a hand is of forward kinematics. Using the hand to move the arm is an example of inverse kinematics. When we use freeform animation to animate a biped, we can use both kinds of kinematics. To animate an arm using forward kinematics, we rotate the upper arm away from the shoulder and then rotate the forearm, the hand from the wrist and so, on adding rotation keys for each child object.

FORWARD KINEMATICS

In this method, the IK Blend parameter determines how FK and IK are blended to interpolate intermediate positions.

The default method of manipulating a hierarchy uses a technique called "FK". In forward kinematics, when a parent object moves, its children must follow.

The basic principles are:

Hierarchical linking from parent to child

Placement of pivot points to define the connecting joint between linked objects

Inheritance of position, rotation and scale transforms from parent to child

IK is a method of animating that reverses the direction of the chain.Like for example rather than working from the root of the tree, it works from the leaves.

The best way to understand is that to animate the arm using inverse kinematics, we move a goal that positions the wrist. In the case of a leg, for example, the foot is constrained to the floor by the goal. If we move the pelvis, the foot stays put since the goal has not moved and this causes the knees to bend.

Study Notes

Assessment
Explain forward kinematics.
Explain inverse kinematics and their uses.

Discussion
Discuss forward and inverse kinematics and their uses.

7.3 Rigid Body, Soft Body and Deformable Body

The Rigid body tool helps to simulate the real life effects using Reactor. Its used for hard material objects,This applies to the objects which are tough like iron, metals, wood, etc.For example to simulate a falling apple or a book, this type of Rigid body option is used.

This Reactor system includes many Collections of appliers, which can be applied to any objects in the scene.This applies to the objects that have soft body like soft objects. For example Soft body can be used for a hanging rope, Jelly etc.

This type of option can be used to break an object. An object, which can be deformed and transformed when, moved or rotated then that kind of body is called a deformable body. For example: after shooting an apple or glass with a rifle, deformable option can be applied to apple or glass so that it breaks as soon as the bullet touched it.

Study Notes

Assessment
Explain Rigid Body with example.
Explain Deformable body and its use.

	Discussion
Discuss forward and inverse kinematics and their uses.	

7.4   IKSolvers

IK SOLVERS

An IK solver creates an inverse kinematics solution to rotate and position links in a chain. It applies an IK Controller to manage the transforms of the children in a linkage. The IK solution takes place in a plane, known as the solver plane. The angle of the solver plane is controlled by a parameter called the swivel angle.

In here, the transformation includes only the position and the rotational values

At the end of the IK chain is a gizmo, called the goal.

The goal can be repositioned or animated over time in a variety of ways, often using linkage, parameter wiring or constraints.

There are 4 plug-in IK solvers ship with 3ds max:

HI solver

HD solver

IK limb solver

Spline IK solver

Fig. 7.1: Inverse Kinematics

![eye icon]	Assessment

Explain uses of IKsolvers.

List the plug-in IK solvers in 3D max.

![discussion icon]	Discussion

Discuss the various uses of IK and FK solvers.

7.5 Types of Solver

1. HI (HISTORY-INDEPENDENT) SOLVER

The HI Solver is the preferred method for character animation and for any IK animation in long sequences. Multiple chains in a hierarchy can be created using HI Solver
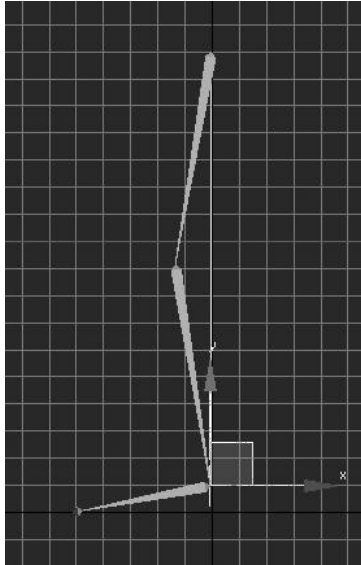
Fig. 7.2: HI Solver

2. HD (HISTORY-DEPENDENT) SOLVER

The HD Solver is a solver well suited to use for animating machines, especially ones with sliding parts that require IK animation.

It is good for animating machines, especially ones with sliding parts. Ideally use it on short animation sequences.
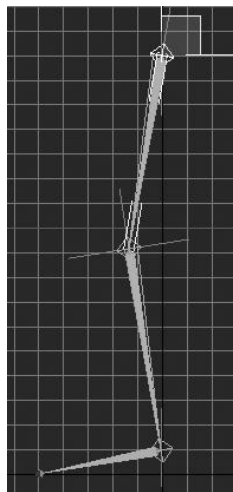
Fig. 7.3: HD Solver

3. IK LIMB SOLVER

The IK Limb solver operates on only two bones in a chain. It can animate the arms and legs of a character.

The IK Limb solver can be used for export to game engines.
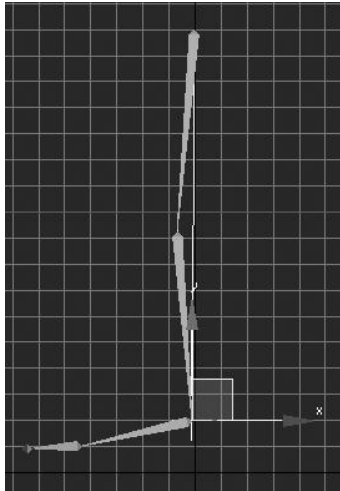
Fig. 7.4: IK Limb Solver

4. SPLINE IK SOLVER

The Spline IK solver uses a spline to determine the curve of a series of bones or other linked objects.

Vertices on a Spline IK spline are called nodes.

Like vertices, the nodes can be moved and animated to change the curvature of the spline. Nodes can be moved anywhere in 3D space.

We adjust IK solver settings in the Motion and Hierarchy panels.
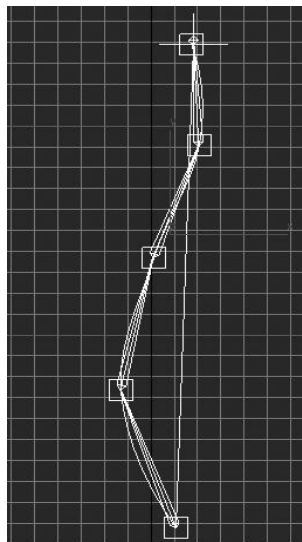
Fig. 7.5: Spline IK Solver

Motion Panel

When the goal of an IK chain is selected, the motion panel displays the rollouts for the individual IK solver.
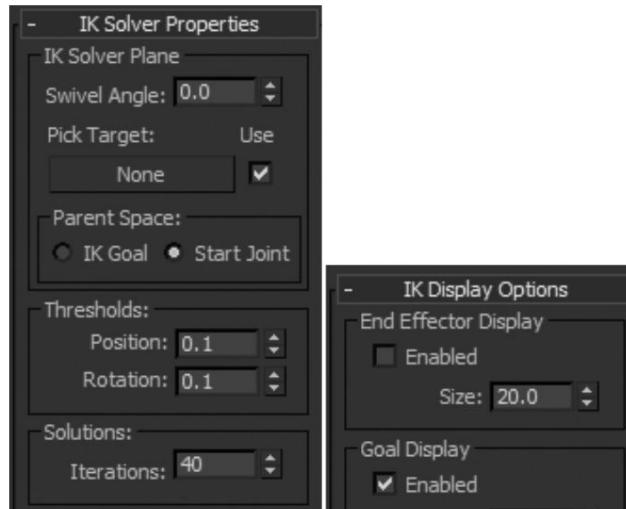
Fig. 7.6: Motion Panel 1

HI Solver / IK Limb Solver: Motion panel parameters adjust the swivel angle of the solver plane.

HD Solver: Motion panel parameters assign, remove and edit the end effector for the currently selected joint.
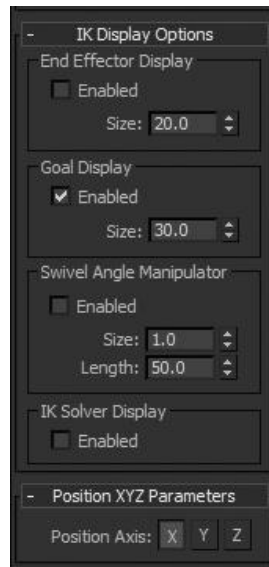
Fig. 7.7: Motion Panel 2

Spline IK Solver: Motion panel parameters allow us to

Activate / Deactivate the solver.

Adjust the bones at the joints.

Adjusts start and end twist angles.

	Study Notes

	Assessment
	Explain inverse kinematics and motion panel and their uses.
	Explain Spline IK Solver.

	Discussion
	Discuss various uses of inverse kinematics and motion panel.

7.6 Schematic View
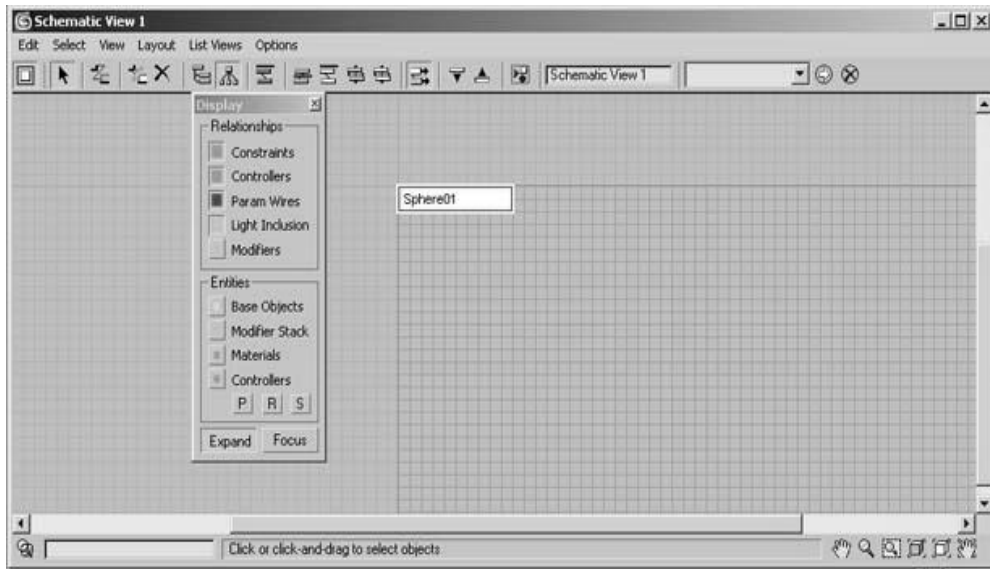
Fig. 7.8: Schematic View 1

Schematic View allows you to rearrange the nodes into any placement you like. You can rearrange them to resembl e the actual objects in the scene. Then it is easy to select what you want at a glance without reading.Schematic View has tools that allow you to hide or show upstream or downstream from the object.

Open the Schematic Vie w by Choosing Customise menu > Preferences.

The Schematic View is a node-based scene graph. This gives us access to:

Object properties

Materials

Controllers

Modifiers

Hierarchy

Wired parameters

Instancing

The following describe the Schematic View user interface:

SV Menus

SV List

SV Preferences

SV Toolbars

SV Display Floater

Connect

Unlink

Delete

Assign Controllers

Wire Parameters

Edit Object Properties

Types of selection tools

Select all

Select none

Select invert

Select children

Deselect children

Select to scene

Select from scene

Sync Selection

PAN TOOL

ZOOM TOOL

Zoom Region

Zoom Extents

Zoom Extents Selected

Show Grid

Show Background

Refresh View

Left

Right

Top

Bottom

Center Horizontal

Center Vertical

![]	Study Notes

![]	Assessment
Explain various uses of schematic view. Write down the tools available in schematic view.

7.7 Important Animation Principles

Well there are 12 principles of Animation, which are accepted globally for animation standardisation. They are as followings:

Squash and stretch:This is one of the most important principles. The purpose of which is to give a sense of weight and flexibility to drawn objects. It can be applied to any simple object, like a bouncing ball or more complex constructions like the musculature of a human face.
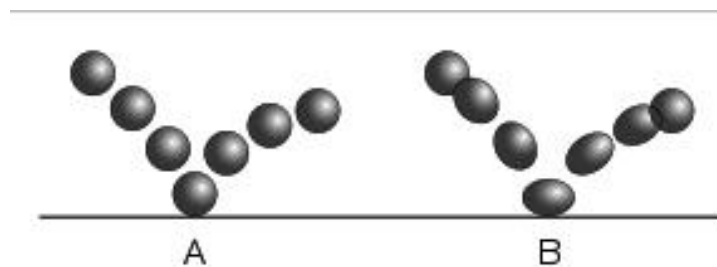
Fig. 7.9: Squash and Stretch

Anticipation:Anticipation is a principle that is used to prepare the audience for an action and to make the action appear more realistic. For an example - A dancer jumping off the floor has to bend his knees first or a golfer making a swing has to swing the club back first.

Fig. 7.10: Anticipation (Courtesy: Wikipedia.com)

Staging:This principle is called as staging, as it is known in theatre and film. Its purpose is to direct the audience's attention and make it clear what is of greatest importance in a scene like - what is happening and what is about to happen.

Straight ahead action and pose to pose:Well, these are two different approaches to the actual drawing process. "Straight ahead action" means drawing out a scene frame by frame from beginning to end, while "pose to pose" involves starting with drawing a few, key frames and then filling in the intervals later.

Follow through and overlapping action:These are the closely related techniques help render movement more realistic and give the impression that characters follow the laws of physics. "Follow through" means that separate parts of a body will continue moving after the character has stopped. "Overlapping action" is the tendency for parts of the body to move at different rates like - an arm will move on different timing of the head and so on.

Slow in and slow out:The movement of the human body and most other objects, needs time to accelerate and slow down. Becouse of this reason, an animation looks more realistic if it has more frames near the beginning and end of a movement and fewer in the middle. This principle applies on the characters moving between two extreme poses, such as sitting down and standing up, but also for inanimate, moving objects, like the bouncing ball in the above illustration.

Arcs:Most of the human and animal actions occur along an arched trajectory and animation should reproduce these movements for greater realism. So, This can apply to a limb moving by rotating a joint or to a thrown object moving along a parabolic trajectory.

Secondary action:Addition of a secondary action to the main action gives a scene more life and can help to support the main action. Like - A person walking can simultaneously swing his arms or keep them in his pockets, he can speak or whistle, or he can express emotions through facial expressions

Timing:The principle of timing refers to the number of drawings or frames for a given action, which translates to the speed of the action on film. On the original physical level, correct timing makes objects appear to abide to the laws of physics; for instance, an object's weight decides how it reacts to an impetus, like a push.

Therefore, as per the principles we talked above, we need to take care of the timing in the animation we are making as well as to remove the jerks from the actions of the animation. In addition, we can maintain more smoothness by taking all the principles in the mind while making the animation.

Exaggeration:The exaggeration is an effect especially useful for animation, as perfect imitation of reality can look static and dull in cartoons. Well, The level of exaggeration depends on whether one seeks realism or a particular style, like a caricature or the style of an artist.

Solid drawing:The principle of solid drawing means taking into account forms in three-dimensional space, giving them volume and weight. Naturally, the animator needs to be a skilled draughtsman and has to understand the basics of three-dimensional shapes, anatomy, weight, balance, light and shadow etc.

Appeal:The appeal in a cartoon character corresponds to what would be called charisma in an actor. Well, A character who is appealing is not necessarily sympathetic — villains or monsters can also be appealing — the important thing is that the viewer feels the character is real and interesting.

🔔	Study Notes

👁	Assessment
	Explain the importance of animation principles in making realistic animation.
	Write note on two of the Animation principles and give example.

🗣	Discussion
Discuss the uses and importance of animation principles.	

7.8 Summary

INTRODUCTION TO HIERARCHIES AND KINEMATICS

As you have learnt in this Unit Hierarchies and Kinematics, One of the most useful tools in producing computer animation is the ability to link objects together to form a chain. By linking one object to another, you create a parent-child relationship. Transforms applied to the parent are also transmitted to child objects. A chain is also referred to as a hierarchy.

UNDERSTANDING IK AND FK

Using inverse kinematics requires that you set parameters for a number of IK components. Brief definitions of these components follow; details are provided in other topics. Note 3ds Max offers a variety of inverse kinematics systems. Four kinds of IK solvers, plus applied IK and interactive IK systems donot use IK solvers. Not all of the following parameters are used by all the systems. The default method of manipulating a hierarchy uses a technique called "FK". In forward kinematics

RIGID BODY, SOFT BODY AND DEFORMABLE BODY

Here the types of bodies we have around us as well as how to divide them in different categories. The Rigid body tool helps to simulate the real life effects using Reactor. Its used for hard material objects,

IK SOLVERS

An IK solver creates an inverse kinematics solution to rotate and position links in a chain. It applies an IK Controller to manage the transforms of the children in a linkage.

TYPES OF SOLVER

Here we talked about the inverse kinematics like - HI Solver, HD Solver, Spline IK Solver and IK Limb Solver.

SCHEMATIC VIEW

The Schematic View is a node-based scene graph that gives you access to object properties, materials, controllers, modifiers, hierarchy and non-visible scene relationships such as wired parameters and instancing. Here, you can view, create and edit relationships between objects. You can create hierarchies; assign controllers, materials, modifiers, or constraints.

There are 12 principles of Animation which are accepted globally for animation standardisation such as Squash, stretch, anticipation, Staging, Straight ahead action and pose to pose, Follow through and overlapping action, Slow in and slow out, Arcs, Secondary action, Timing, Exaggeration, Solid drawing, Appeal.

7.9 Self-Assessment Test

Broad Questions

Explain 12 principles of animation. What is ease in and ease out?

Explain schematic view.How does one control the transformation of an object in schematic view?

What is IK and FK?Explain HI solver and Explain HD Solver.

Short Notes

Schematic view and its uses

IK and FK Solvers and their uses

Squash and stretch

HD Solver

Spline IK Solver

7.10 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make 12 different clips of 15 to 30 seconds duration each, describing 12 principles of animation. Here you can use one or more objects or characters for the same. Also make a human character rig with the use of IK and FK Solvers.

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Unit 2   Rigging and Skinning, Human Anatomy

	Learning Outcome

After going through this unit, you will be able to:

Illustrate the importance of Human anatomy, Bones, Bones and hierarchy

Create bones, Bone tools, Create character

Give the use of Lock, Unlock character, Destroy character, Save character, Rigging, Creating a human rig

Use IK solver with bones, Adjusting bones with character

Adjust the rig in a human character four legged creature, reptile and multi legged creature

Createwalk cycle Using rigging

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	Content Map

8.1   Introduction - Rigging and Skinning

8.2   Human Anatomy

8.3   Bones and Hierarchy

8.1 Introduction- Rigging and Skinning

In this Unit, we will Discuss making rig and skin for characters so that we can animate them as per our requirements. We will talk about how to use bones and make rigs for various characters. We will discuss making human rigs with the sense of human anatomy to make realistic animations at the end.

Here we will talk about using skin modifier and along with that using skin morph, skin wrap and skin wrap patch modifiers for detailed animations.

RIGGING AND SKINNING

The process of making a linked bone structure to control the character is called rigging. Well there are no fixed standards for that as a rig is made as per the requirement of the final animation that is going to be done on the character like walk, jump, run, etc.

Also skinning is there for accomplishment of the control on the character asset as it is the process to bind the character with the structure of bones so that each bone has a specific control on a specific part of the body.Skinning is done with the use of skin modifier in 3DS MAX and that we will discuss later in this Unit.

8.2 Human Anatomy

Human Anatomy has become a key part of visual arts. Basic concepts of how muscles and bones function and deform with movement is key to drawing, painting or animating a human figure. It is very important t to understand anatomy of the character when modelling and during rigging. At the Rigging stage, the position of the bones will crated the direct deformation of the surface or faces of the character or model. In case of a complex or extinct character like Dinosaurs, anatomy has to be imagined and studied using available reference.

In this session, the entire human anatomy i.e. the structure of the human body has to be learnt and understood as for the FK and IK.

Human Proportions:-
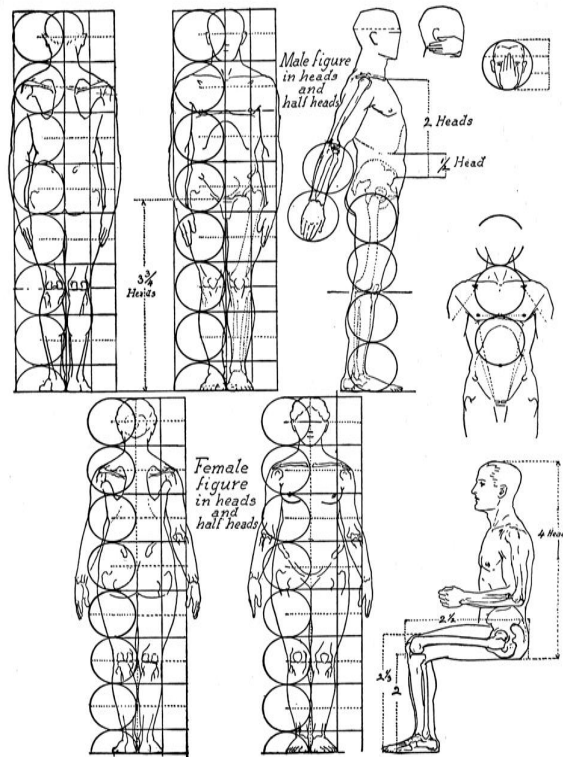
Fig. 8.1: Human Proportions

Male and female body pro portions:-
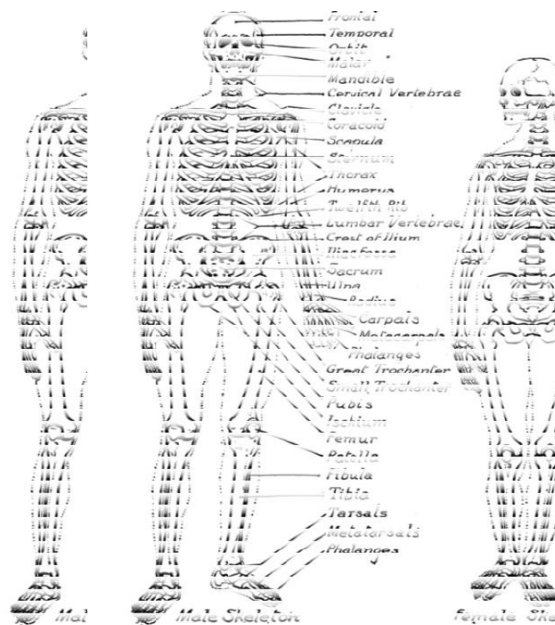
Fig. 8.2: Male and Female Body Proportions

Degree of rotation and pelvis:
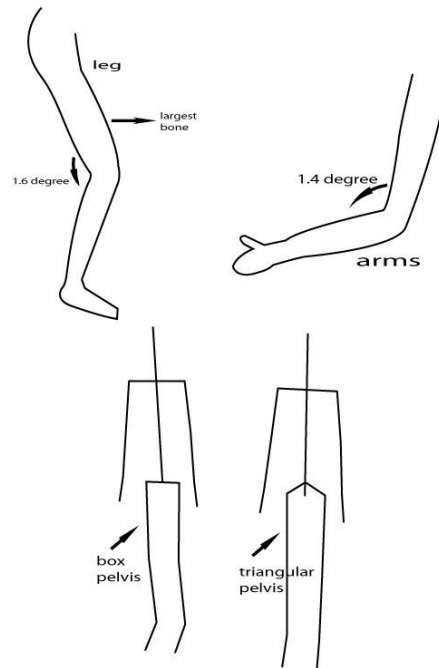
Fig. 8.3: Degree of Rotation and Pelvis

![bell icon]	Study Notes

![eye icon]	Assessment
Explain the uses of human anatomy and its uses for realistic animation.	

	Discussion
	Discuss the human anatomy and it uses.

8.3 Bones and Hierarchy

A Bones system is a joint hierarchical linkage of bone objects that can be used for animating character models that have a continuous skin mesh.
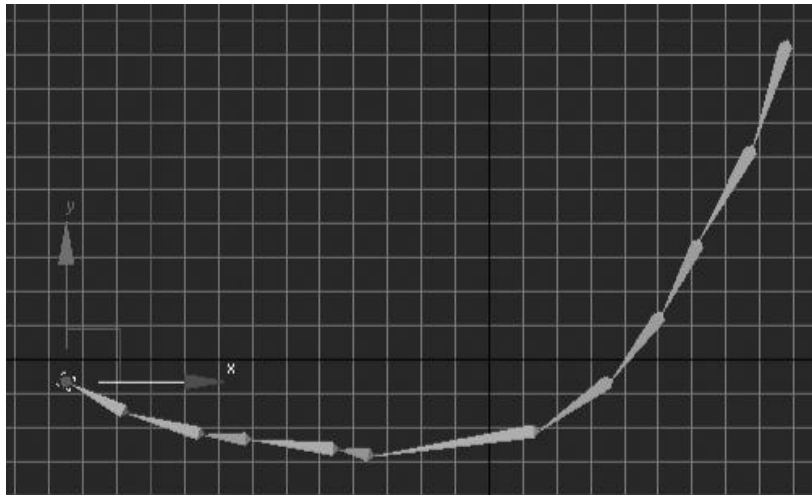
Fig. 8.4: Bones

The bone chain is called a system as it contains more than one bone, which works together for one goal of animation. You can see one bone chain in the above figure.

The link chat of bones is a hierarchy that shows the relation of the linked bones. As for the above bone chain you can get the following hierarchy.
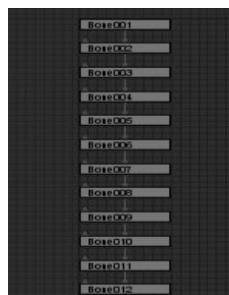
Fig. 8.5: Hierarchy

	Study Notes

	Assessment
Explain the bones and their uses for rigging.	

	Discussion
Discuss bones, hierarchy and their uses.	

8.4   Creating Bones

This command displays functions for working with bones.

Bone Editing Tools

Controls on the Bone Editing and lets us create, modify bone geometry and structure, set bone colour.
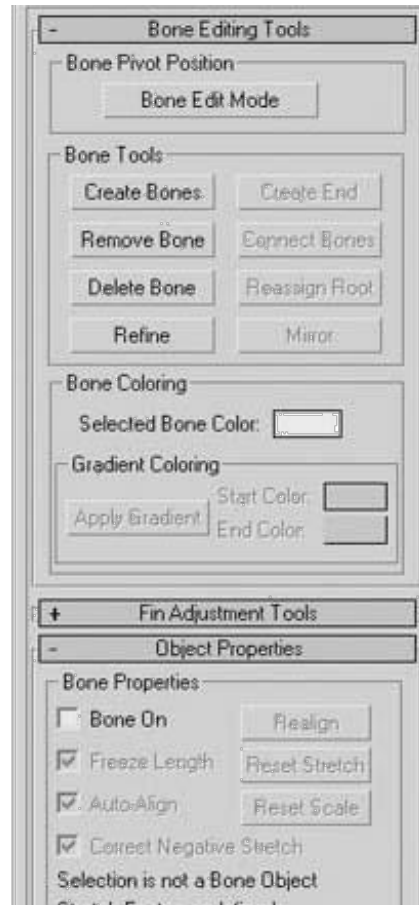
Fig. 8.6: Bone Options

Bone Edit Mode: Lets us change the lengths and the positions relative to one another.

Create Bones: Begins the bone-creation process.

Create End: Creates a cr x bone at the end of the currently selected bo ne.

Remove Bone: Removes the currently selected bone.

Connect Bones: Creates a connecting bone between the currently selected bone.

Delete Bone: Deletes the currently selected bone.

This remove all its paren t:Child associations.

Reassign Root: Makes the currently selected bone the root of the bone structure.

Refine: Splits a bone in t wo.

Mirror: Creates mirror co pies of selected bones.

Mirror Axis: Choose an axis or plane about which the bones will be mirrored.

Bone Axis to Flip: To avoid creating a negative scale.

Offset: Sets the distance between the original bones and the mirrored bones.

Selected Bone Color: Sets the colour for selected bones.

Apply Gradient: Applies a gradient colour across several.

Absolute: Sets the fin parameters as absolute values.

Relative: Sets the fin parameters relative to their current values.

Copy: Copies the bone and fin settings for the currently selected bone.

Paste: Pastes the copied bone and fin settings to the currently selected bone.

Width: Sets the width of the bone.

Height: Sets the height of the bone.

Taper: Adjusts the taper of the bone shape.

FINS

Side Fins: Adds side fins to selected bones.

Front Fin: Adds front fins to selected bones.

Back Fin: Adds a fin to the back of selected bones.

Bone On / Off: The selected bone or object behaves as a bone.

Freeze Length: The bone maintains its length.

Auto-Align: The bone's pivot point does not align to its child object.

Correct Negative Stretch: Any stretching of the bone that results in a negative scale factor will be corrected to a positive number.

Stretch: Determines what kind of stretch takes place when the child bone is transformed.

None

Scale: Lets the bone scale.

Squash: The bone gets fatter as it gets shorter and thinner as it

gets longer. Axis: Determines the axis used for the stretch.

Realign: Causes the bone's X-axis to realign.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain bone tools and their uses.
	Write down the parameters of the bone tool.

![head icon]	Discussion
	Discuss bone tool and bones chain and their various uses.

8.5 Create Character

This command creates a character assembly. Here the character assembly is given the default name of Character01, which can be changed. All members of the assembly are listed in the Character Members rollout.

Fig. 8.7: Character Assembly

To create a character assembly, follow these steps:

Create a linked structure of bones or other objects. The structure can have several chains. You can also use the linked structure with the Skin modifier and/or set up character rigs and controllers as needed.

Select all objects that will become members of the assembly.

Use this method to add the character-assembly commands to the user interface and then choose the Create Character command.

The character-assembly node is created at the bottom of the entire selection, as viewed in the Front viewport.

On the Modify panel, use the character assembly tools to work with the character structure.
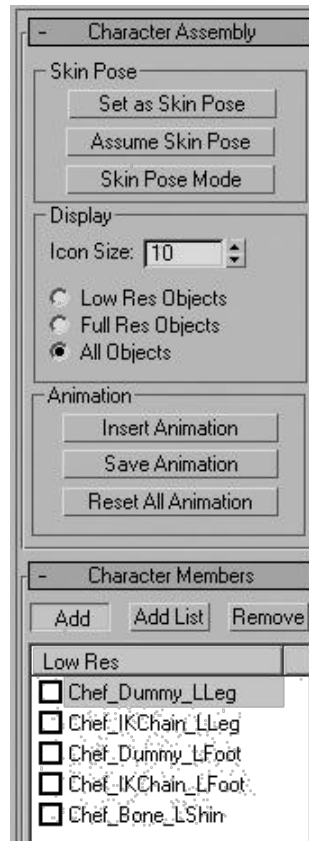
Fig. 8.8: Character Assembly Options

Skin Pose group:

Here the Skin pose is the bone structure pose used by the Skin modifier for associating bones with the mesh. When the Skin modifier is first applied, the current bone structure pose is used as the Skin pose. The Skin pose can sometimes be accidentally altered by animating the bone structure on frame 0. If this occurs, you can use these options to fix the Skin pose.

Here you can use these options both before and after applying the Skin modifier. You can also invoke these options when any member of the character assembly is selected.

Set as Skin Pose: This sets the Skin pose to the current bone structure's pose. The Skin modifier's envelopes and vertex weighting are automatically recalculated to work with the new pose.

Assume Skin Pose: This causes the bone structure to take on the Skin pose. This feature can be useful during the animation phase. For example, if you have animated the character on various keyframes and want the character to animate back to its Skin pose at frame 50, you can turn on Auto Key at frame 50 and click Assume Skin Pose.

Skin Pose Mode: This poses the character in its Skin pose and allows the Skin pose to be refined. Changes to the bone structure when Skin Pose Mode is on will affect only the Skin pose and not the animation. When Skin Pose Mode is turned off, the bone structure returns to its pose at the current frame.

Display group:

Low Res Objects: This displays only the objects checked in the Low Res display in the Character Members rollout.

Full Res Objects: This displays only the objects not checked in the Low Res display in the Character Members rollout.

All Objects: This displays all objects in the character assembly.

Animation group:

Insert Animation: This displays the Merge Animation dialog and prompts for a previously saved animation file.

Save Animation: This saves the character assembly animation in an ANM or XML file. Both file types contain the character assembly and its animation. An ANM file is a proprietary format that can be read and saved only by 3ds Max. An XML file formats the information as XML code and can be edited with a text editor. Well the animation saved as an ANM file loads and saves faster than an XML file. Saving and editing an XML animation file is recommended only for users who are familiar with the XML language and who have a specific need for editing the file.

Reset All Animation: This removes all animation from the character assembly.

![]	Study Notes

 	Assessment
Explain character assembly and is uses. Write note on Animation group.	

 	Discussion
Discuss character assembly and its various uses.	

8.6   Lock, Unlock Character, Destroy Character, Save Character

Lock, Unlock character: Here locking a character assembly prevents the character from being animated. Use these commands when you want to prevent accidental animation of the character, such as when the animation process is complete.

The unlocking of a locked character assembly allows you to animate the character.These commands are available only when a character-assembly node is selected.

Destroy character: Here destroying a character deletes the character assembly node. This command is available only when a character assembly node is selected.

Save character: Here saving a character saves a character assembly at its current location, including its node, all members and any animation on its members. Use this command for storing a character assembly to disk prior to inserting it into another scene.

Well, saving a character with this, command saves the assembly as a CHR file. You can then insert the CHR file into a scene with Insert Character. This option is available only when a character assembly node is selected.

8.7   Creating a Human Rig

Well, making a bone structure for a character is called rigging. Here you will make controllers as well as IK and FK solver also for controlling the rigged structure in a required manner.

For rigging, you can make a proportional structure of bones as shown in the figure or you can take a character model and inside it you can make bones as per the size and proportions of it to skin it after completion of the rig.
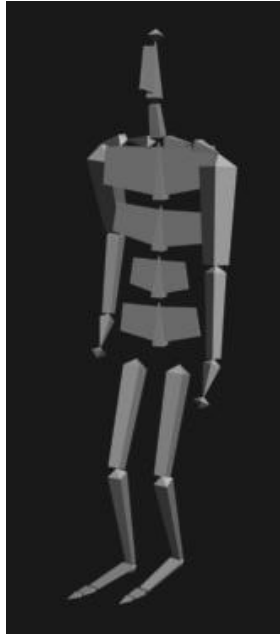
Fig. 8.9: Character Rig

In the above figure, you can see a human rig as per the simple body structure of a normal human being.

Following are the steps to create Bone in Character:

Freeze you character before creating bones cause the "snap" options will b eon

Click on the Control Panel

clicking on the small 'gears' icon at the top of the panel to create Bones

Next, click and drag to creat e bones

After the preferred length of a bone is created, click again to start a new o ne that will be automatically linked to the ti p of the first bone and carry on

Then move-rotate them to conform into the body, the fins on the bones d etermine how faces of the model surface each bone will 'control'

Now, select the character/model, from the modifier menu and select 'skin' modifier.

👁	Assessment
	Explain the use of rigging in various situations.
	What is the procedure of creating a character rig?

🗣	Discussion
Discuss various types of rig characters.	

8.8 Using IK Solver with Bones

An IK solver creates an inverse kinematic solution to rotate and position bones in a chain. The end effector is constrained to the ground plane. For example, in walk cycle the toes you might "pin" as the heels lift. Then the movement of the root of the chain poses the legs up from the toes. It applies an IK Controller to control the transforms of the children in a hierarchy. IK solver can be applied to any hierarchy of objects or part of a hierarchy using commands on the Animation menu.

Following is the process of applying IK:

Select an bone in the hierarchy

Choose an IK solver

Then click another object in the hierarchy to define the end of the IK chain.

This will create an IK handle to move the bones.

When you will apply IK it will loo k like the following figure.
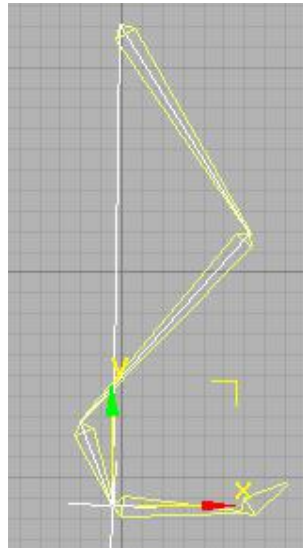
Fig. 8.10: IKController

When you will make rig for a human character with the use of IK and FK it will look like the following figure.
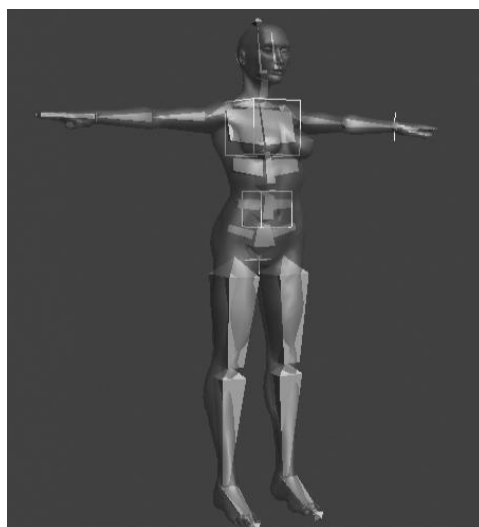
Fig. 8.11: Mesh Character Rig with Controllers

You can modify the height, width and fin adjustments of bones for making them fit in the character for better skinning at the end as you can see in the above figure.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain the uses and importance of solvers and bones for rigging. What is the process of using IK solver with bone?

![discussion icon]	Discussion
	Discuss IK Solvers and create apply it to the model.

8.9   Adjusting the Rig in anOrganic Object

After creating the rig consisting of bones for the Organic model, they need to be adjusted. This is an important step coz, the position of the bones will determine the amount of influence it has on the surface or faces of the model of a character.

Following are the few steps for adjusting the Rig in an Organic object:

First it is important to freeze the character coz Sapping tool will be used for setting or arranging the bones.

The bones can then be moved-rotated to conform into the body, the fins on the bones will determine the influence on the surface.

You can make rig for various types of characters as shown in following figures.
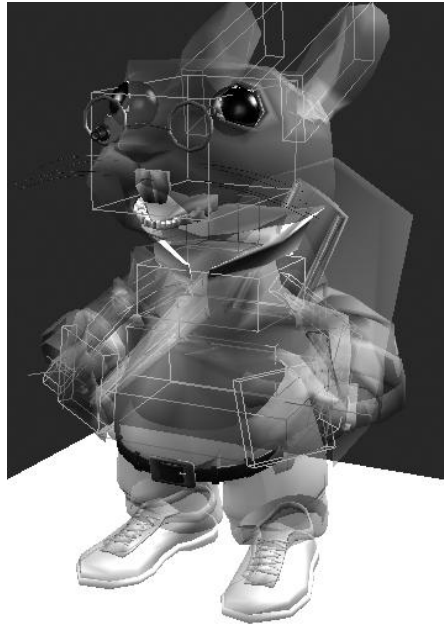
Fig. 8.12: Mesh Character Rig with Controllers 1

In the following figure you can see a four legged character rigged.
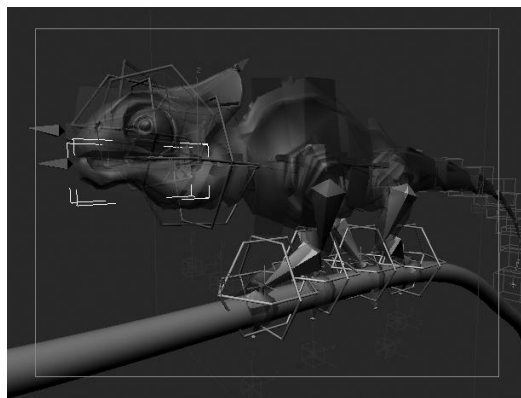
Fig. 8.13: Mesh Character Rig with Controllers 2

Later, after adjusting the rig, controllers can be set up for easily controlling the bones. Also in the following figure you can see one more character rigged for animation with various controllers.
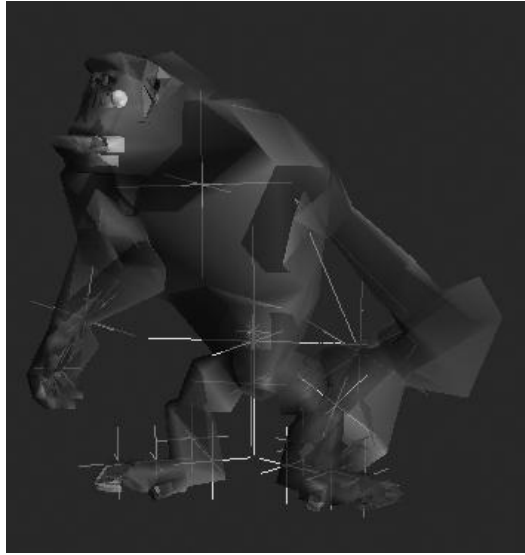
Fig. 8.14: Mesh Character Rig with Controllers 3

![bell icon]	Study Notes

8.10 Adjusting the Rig in anInorganic Object

Rigging can be done with non-organic objects too, like – chair, table, car, scooter, etc. As you can see normally in games or movies like- transformers, etc.

The purpose of rigging an object is to make it more controllable and flexible for animation, just like you see objects more deformable and flexible for animation in games or movies.
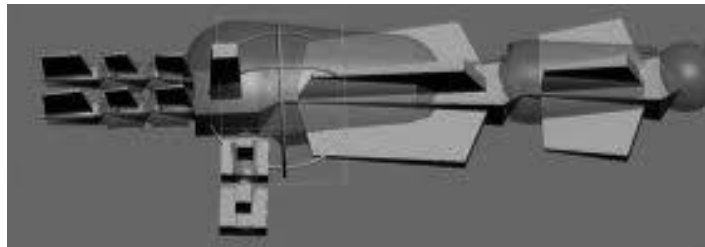
Fig. 8.15: Non-organic Model Rig 1

For more realistic animation, machines are also rigged sometimes.
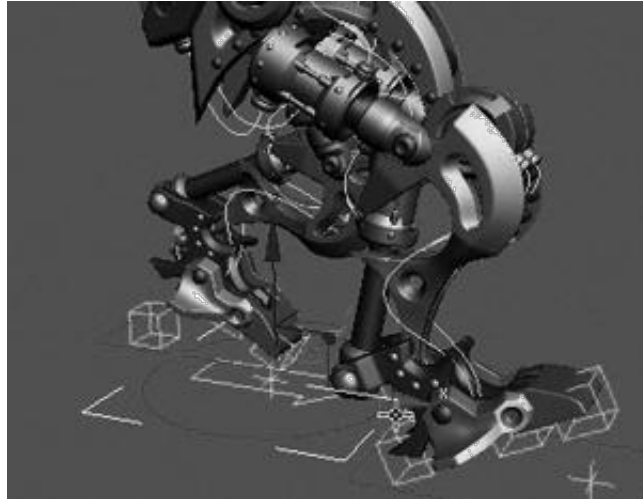
Fig. 8.16: Non-organic Model Rig 2

In the above figure, you can see the robot that is rigged.

⚠	Study Notes

👁	Assessment
	Explain the uses of rig in controlling inorganic models and their animation.
	Give examples of an inorganic rig.

	Discussion
Discuss the various objects that can be rigged for animation.	

8.11 Creating Walk Cycle

A walk cycle is a cycle of several keys of animation that makes the character walk smoothly and that animation you can loop for repeated steps of walk. So first, you must know the basic keys poses of a walk cycle of a human. For that, you can read the book animator's survival kit by Richards Williams.

Following are the steps for a walk cycle:

Key poses are first set to begin with a walk cycle.

Click on frame 1 in the timeline

Select right foot controller and slide the foot backwards on the Z-axis.

Select the Ball Roll attribute name in the channel box and raise the heel by increasing the value above 0.

Select left foot controller and translate foot forwards on the Z-axis.

Select the Heel Roll attribute of the left foot and raise the toes of the left foot.

After the foot is positioned, it is necessary to always position the center body to move along.

The traditional animators (i.e. pencil and paper) have used this process for creating animated through centuries, known as "pose-to-pose". This defines extremes in movementwith keyframes, the breakdowns are placed between keyframes. Similarly, 3 steps should be followed:

Step1: Inserting keyframes at key poses,

Step 2: Adding breakdown poses,

Step 3 lastly adding inbetween poses.

Finally, clean-up process is carried.
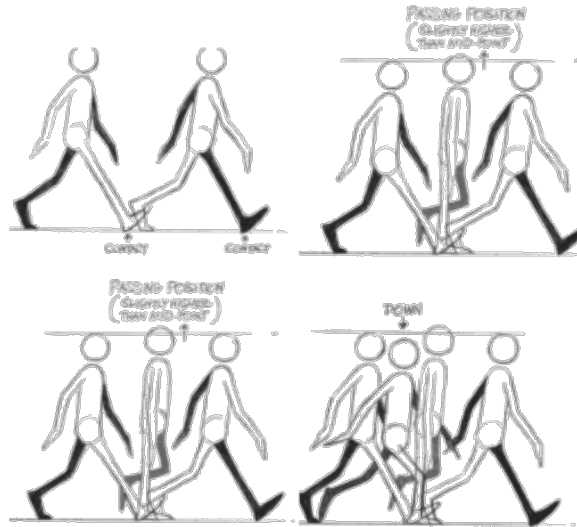
Fig. 8.17: Walk Cycle Poses

As you will rig and make a walk cycle of a character, it will have the steps like the following figures show.
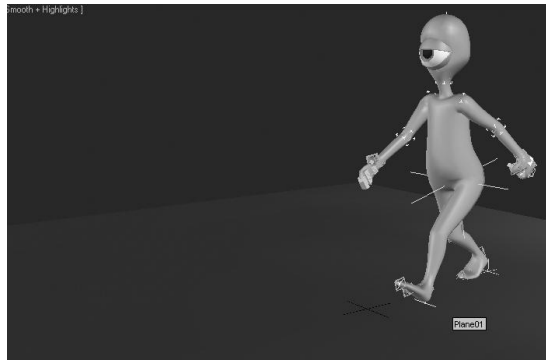
Fig. 8.18: Walk Cycle Poses 1
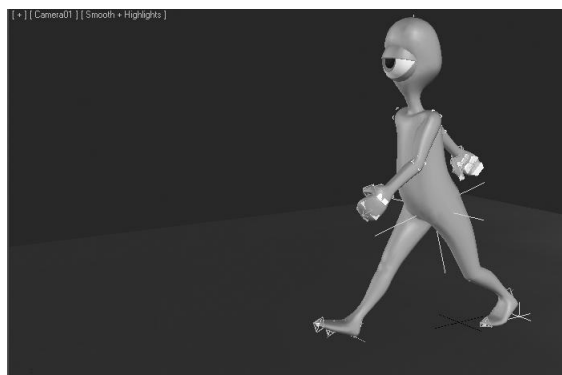
Fig. 8.19: Walk Cycle Poses 2
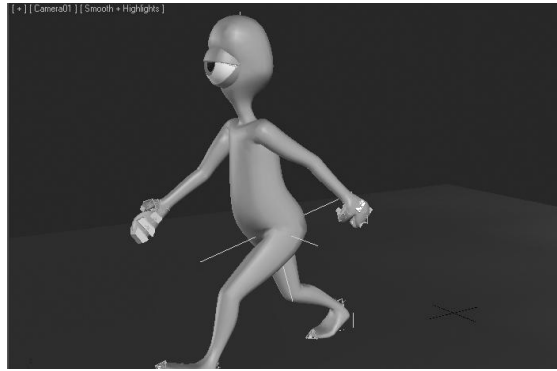
Fig. 8.20: Walk Cycle Poses 3

👁	Assessment
Explain walk cycle poses for a character.	

🗣	Discussion
Discuss various moods for walk cycle animations.	

8.12 Skinning

Skinning works on the principle of moving one or more vertices of a mesh object in a weighted manner like "deformer" gizmos to cause it to deform locally. It is common to have multiple deformer objects assigned to a single vertex, each with a share of the overall deforming "strength", but all which add up to a strength of 1.0.

The traditional character animation system uses a single skin mesh object examplea human body. The skeleton is defined simply as a hierarchy of NULL nodes that are visualised as bones havinglocation and direction. The skeleton acts as the deformer to the mesh.

Skinning is the process of binding a skeleton hierarchy to a single mesh object, when the skeleton bones are bound to the mesh.

For skinning, you can use the skin modifier. Following is the procedure:

To add Skin modifier, select the model.

Then, in the Parameters rollout, click on "Add Bone"

In the Selection window, click on the "All" button,

Then click Select.

Fig. 8.21: Skin 1

The options and parameters of skin are as you can see in the following figure.
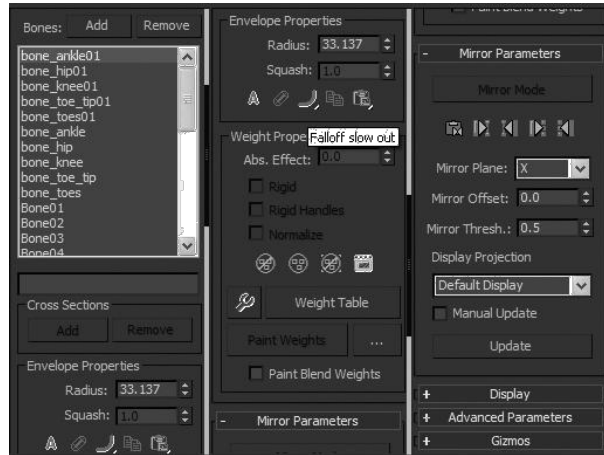
Fig. 8.22: Skin 2

Here you can select the bones for skinning and set their envelop with the range of effect on the mesh.

You can set the weight with the use of weight table for each vertex and bone.

Fig. 8.23: Weight Table

For more precise deformations in the character, you can use the gizmos.

Fig. 8.24: Gizmo

![bell icon]	Study Notes

![eye icon]	Assessment
Explain skin and gizmo.	
What is the procedure for applying Skinning?	

![discussion icon]	Discussion
Discuss skinning of characters.	

8.13 Skin Morph, Skin Wrap, Skin Wrap Patch

Skin Morph:
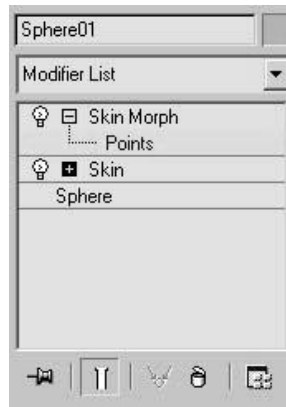
Fig. 8.25: Skin Morph

The Skin Morph modifier allows us to use a bone's rotation to create a morph. It is a deformation of the object mes h. Skin Morph is used for a Skin or Physique modifier. The morph is created at the frame in which the effect should be greatest.

This fine-tunes the mes h deformation at any frame. This uses a bone to drive the morph that is at a problem area . When animating a character with bones nor mally we have to create extra bones. This handles problem areas. The Skin Morph helps us to create simple animations without using extra bones. In here, the transformation of vertice s allows us to get the exact shape we want.

This allows us to easily cr eate muscle bulges. Points sub-object level: The vertices can be viewed and selected on the skin mesh.

Fig. 8.26: Skin Morph 1

Add Bone: Adds one or m ore bones.

Pick Bone: Adds bones b y clicking them in a scene.

Remove Bone: Removes a bone from the list.
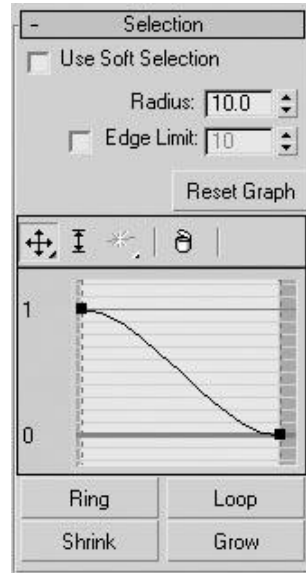
Fig. 8.27: Skin Morph 2

Use Soft Selection: Enables soft selection for editing vertices.

Radius: Specifies the exte nt of the soft-selection.

This depends upon the system units.

Edge Limit: Determines the extent of the soft-selection area.

Reset Graph: Sets the default value for the soft-selection graph.

Graph: A fully functioned curve graph for editing soft-selection characteristics globally is available.

Ring: Selects all the edges that are parallel to the selected edges. This e xpands vertex selection.

Here the new edge selection is s et back to a vertex selection.

Loop: In here, a vertex selection is converted to an edge selection, selecting all aligned edges.

Later the new edge selection is converted back to a vertex selection.

Shrink: Reduces the vert ex selection area.

Grow: Expands the vertex selection area.

This is done in all available directions.

Fig 8.28: Skin Morph 3

Create Morph: Sets a morph at the current frame.

This is done for the highlighted bone

Delete Morph: Deletes the highlighted morph.

Edit: Allows us shape the current morph.

This is done by transforming vertices.

Clear Vertices: Resets the values to zero.

Reset Orientation: The morph orientation is set to current orientation of the bone.

Remove Vertices: Removes selected vertices from the morph.

Enabled: Sets the morph active

Morph Name: Displays as well as allows us to edit the name of the current morph.

Influence Angle: Specifies the angle around the bone's current orientation.

This happens within which the morph takes place.

Falloff: Determines the rate of change of the morph.

Joint Type: Determines the tracking done by the modifier in the angular motion of the bone.

This is a per-bone setting and not per-morph.

Types of joints:

Ball Joint: Tracks all rotation of the bone. This is mostly used.

Planar Joint: Tracks rotation of the bone only in the plane of its parent bone.

External Mesh: Allows us to use a different mesh as a morph target. Reload

Target: Updates the Skin Morph object with edited vertex.

Reload only selected vertices: This option copies only the positions of vertices that are selected.

Paste Mirror: Pastes the copied morph on the other side of the mirror gizmo.

Show Mirror Plane: Displays the mirror plane.

This is usually red rectangle gizmo seen in the view ports.

Preview Bone: Highlights the target bone in the view ports.

Preview Vertices: Displays the morphing-qualified vertices in red in the view ports as well as in any animation.

Mirror Plane: Specifies the axis for the mirror plane.

Mirror Offset: Specifies the position for the mirror.

Mirror Threshold: Determines the radius.

This is done in system units.

Beginner Mode: Use the Create Morph button to create a morph.

Show Driver Bone Matrix: Displays the matrix tripod of the current bone.

Show Morph Bone Matrix: Displays the tripod of the orientation of the active morph.

Show Current Angle: D epicts the angles between the driver bone m atrix and the morph bone matrix.

Show Edges: Highlights the edges.

Matrix Size: Specifies the size of each tripod.

Bone Size: Specifies the s ize of the bone display.

Fig. 8.29: Skin Wrap 1

The Skin Wrap modifier allows one or more objects to deform another. Skin Wrap is adaptable enough for animating a high-resolution object. It can be a low-resolution character mesh.

Control Object: A co ntrol object means a low-resolution objec t doing the deformation.

Base Object: The high-resolution object that is affecting is called the basse object.

A base object can be any type of deformable object. The structure and topology of the high-resolution can be determined object after setting up the animation.

Control Vertices sub-object level: Allows us to view and select vertices on the control object as well as set local parameters for any selected vertices.

Add: Adds control objects to the list.

Remove: Removes control objects from the list.

Deformation Engine: Determines which engine drives the deformation.

Distance Influence: Determines the distance of influence.

Face Limit: Determines the extent of influence.

Local Strength: Determines the power and direction for the strength.

Local Scale Multiplier: Scales each selected control-object vertex's volume of influence. This is done uniformly.

Local X/Y/Z: Scales each selected control-object vertex's volume of influence along the indicated axis.

Reset: Resets all control-object vertices local values to 1.

Threshold: Determines the distance in system units.

Weight All Points: Forces all base-object points to have weights.

Convert To Skin: Applies a new Skin modifier to the base object.

Show Mirror Data: Displays mirror plane gizmo and a circle showing the projected location.

Mirror Plane: Selects the axis for mirroring.

Mirror Offset: Moves the mirrored plane and vertices.

Mirror Threshold: Sets the distance in system units.

Mirror Selected: Copies the local settings from each selected control vertex to any control vertices within the threshold distance.

Bake Control Vertices: Stores the following

Local Strength / Scale

Global Falloff

Distance Influence

Face Limit

Display Loops: Displays volumes of influence for selected control v ertices as red loops.

Display Axis: Displays th e axis tripods for selected control vertices.

Display Face Limit: Displays all base-object points that the selected con trol vertex or vertices can affect.

Display Unassigned Poi nts: Draws a red circle around each base-obj ect point that was not found a closest face.

Display Control Vertices : Toggles display of all control vertices.

SKIN WRAP PATCH

```
┌─────────────────────────┐
│  –       Parameters      │
│                          │
│        Pick Patch        │
│   ┌──────────────────┐   │
│   │       None        │   │
│   └──────────────────┘   │
│                          │
│   Sample Rate: │100│  ▲▼  │
│                          │
│   ┌──────────────────┐   │
│   │     Resample      │   │
│   └──────────────────┘   │
│                          │
└─────────────────────────┘
```
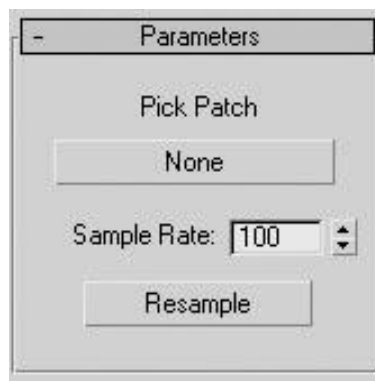
Fig. 8.30: Skin Wrap Patch

Pick Patch: Selects a patc h object to deform the mesh object.

Sample Rate: Determin es the accuracy with which the modifier samp les the patch object.

Resample: The data is resampled.

🔔	Study Notes

	Assessment
Explain the uses of skin morph, skin wrap and skin wrap patch.	

	Discussion
Discuss skin morph, skin wrap, s kin wrap patch.	

8.14 Reaction Manager

Reaction Manager is a to ol that simplifies complex process of animating in 3ds max. Reaction Manager works on the concept of Master and Slave, A Master can be any object or helper that controls the Slave.

Interface:
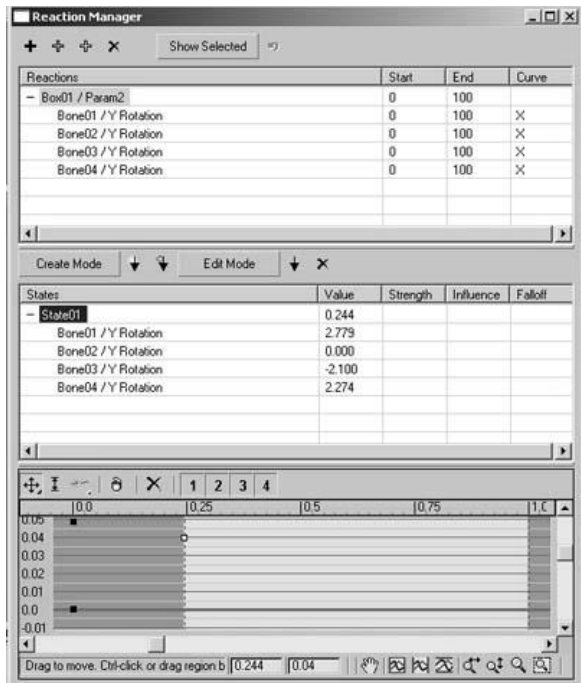
Fig. 8.31: Reaction Manager 1
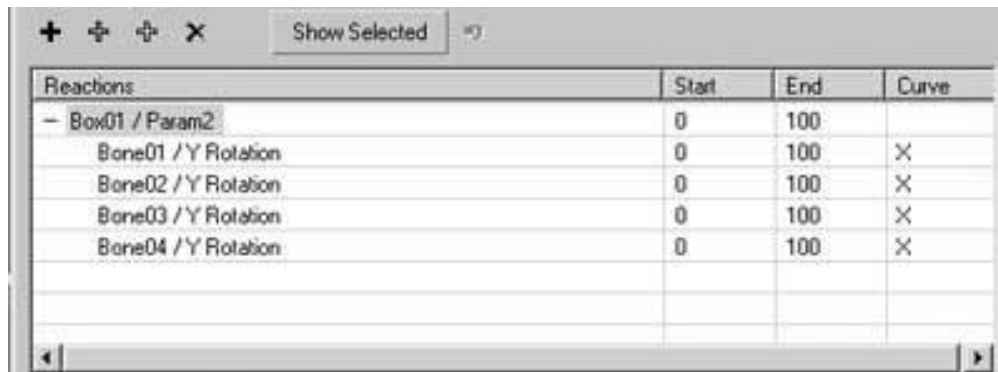
The interface is divided into 3 parts:

Reaction List

State List

Graph

Reaction List

F ig. 8.32: Reaction Manager 2

Add Master: Click the sli der manipulator in the Perspective view port.

Add Slave: On the uppe r toolbar click the box in the Perspective view port to add a slave.
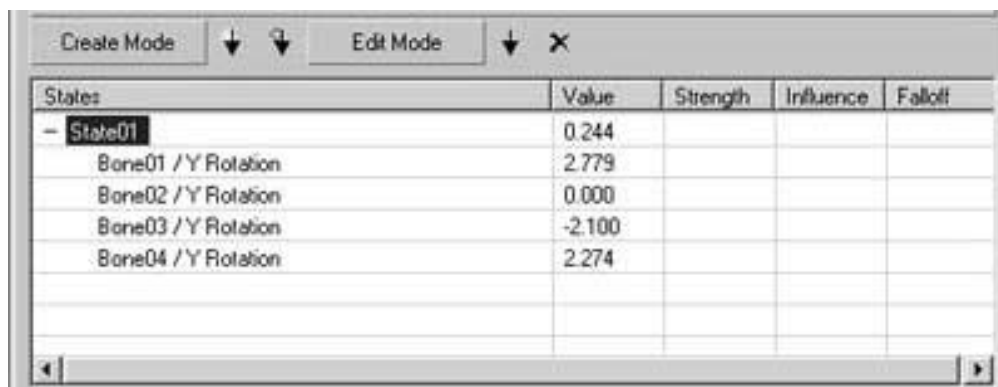
Add Selected: Click to add the selected objects.

Delete Selected: Deletes the highlighted items highlighted.

Show Selected: Displays data in the Reactions list.

Update Selection: Updates the contents in the list based on the current selection.

States List:-

F ig. 8.33: Reaction Manager 3

Create Mode: Creates new states interactively at the primary level.

Create State: In here, the current values are used for the master and sl aves and adds a new state to the "States list" fo r the current reaction.

Append Selected: Adds a slave or slaves to a state in which their particip ation is null.

Set State: Updates the highlighted / selected state to its current value.

Delete State: Deletes the items highlighted.

Strength: This is a biasin g factor that affects a state's influence when one or more states overlap.

Influence: The maximum extent of its range of influence.

Falloff: The rate of change in the slave's speed.

Graph:-
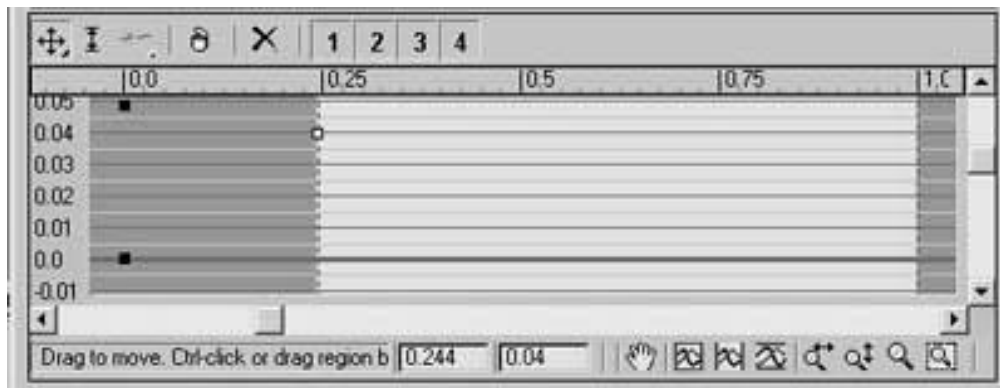
Fig. 8.34: Reaction Manager 4

Add Master: Adds the selected object in "Add Master" mode.

Replace Master: Replaces the current master.

Add Slave: Adds a slave to the current master.

Add Selected: Adds selected objects as slaves to the current master.

Delete Selected: Deletes the items highlighted.

Create States Mode: Cre ates states by manipulating objects in the view ports.

Create State: Adds a new state to the States list.

Append Selected: Adds a slave to a state.

Set State: Updates the highlighted state to its current value.

Delete State: Deletes any highlighted items in the States list.

Edit Slave State Mode: Slaves can be changed.

Show in Track View: The "Track View" displays the reaction tracks for the slaves and masters that are highlighted and masters.

Show in Schematic View: The "Schematic View" displays the reaction tracks for the slaves and masters that are highlighted and masters.

Show controlling bones with the help of reaction manager.

Volume Fog provides a fog effect in which the fog density is not constant through 3D space.

⚠	Study Notes

👁	Assessment
Explain reaction manager and its uses.	
List down the parameters required for Reaction Manager.	

🗣	Discussion
Discuss reaction manager and its uses.	

8.15 Summary

INTRODUCTION TO RIGGING AND SKINNING

As you have learnt in this Rigging and Skinning, A Bones system is a jointed, hierarchical linkage of bone objects that can be used to animate other objects or hierarchies. Bones are especially useful for animating character models that have a continuous skin mesh. You can animate bones with forward or inverse kinematics. For inverse kinematics, bones can use any of the available IK solvers, or through Interactive or applied IK.

HUMAN ANATOMY

It is very important t to understand anatomy of the character when modelling and during rigging. At the Rigging stage, the position of the bones will crated the direct deformation of the surface or faces of the character or model. In case of a complex or extinct character like Dinosaurs, anatomy has to be imagined and studied using available reference.

BONES AND HIERARCHY

A Bones system is a joint hierarchical linkage of bone objects that can be used for animating character models that have a continuous skin mesh.

CREATING BONES, BONE TOOLS

Bones are created in 3DS MAX and using the tools.

CREATE CHARACTER

This command creates a character assembly. Here the character assembly is given the default name of Character01, which can be changed. All members of the assembly are listed in the Character Members rollout.

LOCK, UNLOCK CHARACTER, DESTROY CHARACTER, SAVE CHARACTER

Locking a character assembly prevents the character from being animated. The unlocking of a locked character assembly allows you to animate the character. Well, These commands are available only when a character-assembly node is selected. Here destroying a character deletes the character assembly node, saving a character saves a character assembly at its current location.

Making a bone structure for a character is called rigging. Here you will make controllers as well as ik and fk solver also for controlling the rigged structure in a required manner.

USING IK SOLVER WITH BONES

An IK solver creates an inverse kinematic solution to rotate and position bones in a chain. The end effectors is constrained to the ground plane. IK solver can be applied to any hierarchy of objects or part of a hierarchy using commands on the Animation menu.

ADJUSTING THE RIG IN ANORGANIC OBJECT

After creating the rig consisting of bones for the Organic model, they need to be adjusted. This is an important step coz, the position of the bones will determine the amount of influence it has on the surface or faces of the model of a character.

ADJUSTING OF THE BONES IN ANINORGANIC OBJECT

Rigging can be done with non-organic objects too, like – chair, table, car, scooter, etc.
As you can see normally in games or movies like- transformers, etc.

CREATING WALK CYCLE

A walk cycle is a cycle of several keys of animation that makes the character walk smoothly and that animation you can loop for repeated steps of walk. So first you must know the basic keys poses of a walk cycle of a human.

SKINNING

Skinning works on the principle of moving one or more vertices of a mesh object in a weighted manner like "deformer" gizmos to cause it to deform locally.

SKIN MORPH, SKIN WRAP, SKIN WRAP PATCH

Here we talked about the skin morph, skin wrap and skin wrap patch modifiers and their uses.

REACTION MANAGER

Reaction Manager is a tool that simplifies complex process of animating in 3ds max. Reaction Manager works on the concept of Master and Slave, A Master can be any object or helper that controls the Slave.

8.16 Self-Assessment Test

Broad Questions

Explain rigging process. What is the difference between rigging and skinning process?

What is reaction manager?Which type of animations can be done with reaction manager?

What is create character? What is the use of destroy character?

Character assembly

Rigging and skinning

Reaction manager

Importance of skinning

Lock and un lock character

8.17 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Select three different types of character and then rig and skin them. After that, make their walk cycle animation. Use reaction manager also in their rigging and animation.

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Unit 3   Particles

	Learning Outcome

After going through this unit, you will be able to:

Explain concept of Particle generation, Stages of particles

Discuss types of particles

Workwith Types of particles, Standard particles and Meta particles

Work with Forces

Work with Deflectors

Work with Pf source

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	Content Map

9.1   Introduction to Particle

9.2   Concept of Particle Generation

9.3   Stage of Particle

9.4   Properties of Particle

9.1 Introductionto Particle

Particles are very useful for animated movies. In this Unit, you will learn to work with particles and their supportive elements like deflectors and forces for more precise and realistic outputs. In this unit, we will Discuss how you can use various particle systems of3DS MAX for making of different types of effects. We will talk about the dynamic features of particles and their performance for animation. We will discuss each option of particle and how to use it for animation in a unique way.

9.2 Concept of Particle Generation

Particles are non-editable fragments of objects. They are used for making dynamic effects like dust, vortex, volcano, rain, fountains, etc.Particle systems are useful for a variety of animation. They are employed when animating a large number of small objects using procedural methods.

There are 2 types of particles:

Non -Event driven

Event driven

Particle systems are subjected to any number of complex calculations. Let us have a look over some of concepts of the particles –

Particle Generation:Items on this rollout control when and how quickly particles form, how particles move and the size of the particles over time.

Study Notes

	Assessment

Define and explain particles and their uses.

Which are the two types of particle?

	Discussion

Discuss use of particles.

9.3   Stage of Particle

There are different stages of particle that decide the life and death of a particle, for example the fountain containing particle emitting from an emitter should last only till they hit the ground, so setting their life or age of a particle will create a desirable effect.

Following are the particle stage:

LIFE: The stage of particle from birth till death is called life.

AGE: The stage of particle between life and action is called age.

ACTION: The motion and the behavior of the particle is called the action.

DEATH: The stage of particle where the particle's life is finished or emission is stopped is called the death.

GROW FOR: The number of frames over which the particle grows from being very small to the Size value

FADE FOR: The number of frames over which the particle will shrink to 1/10th its Size setting prior to its death

	Study Notes

👁	Assessment
Explain the stages of particle and their uses.	

🗣	Discussion
Discuss and practice to create a fountain or water from tap using the Particle.	

9.4   Properties of Particle
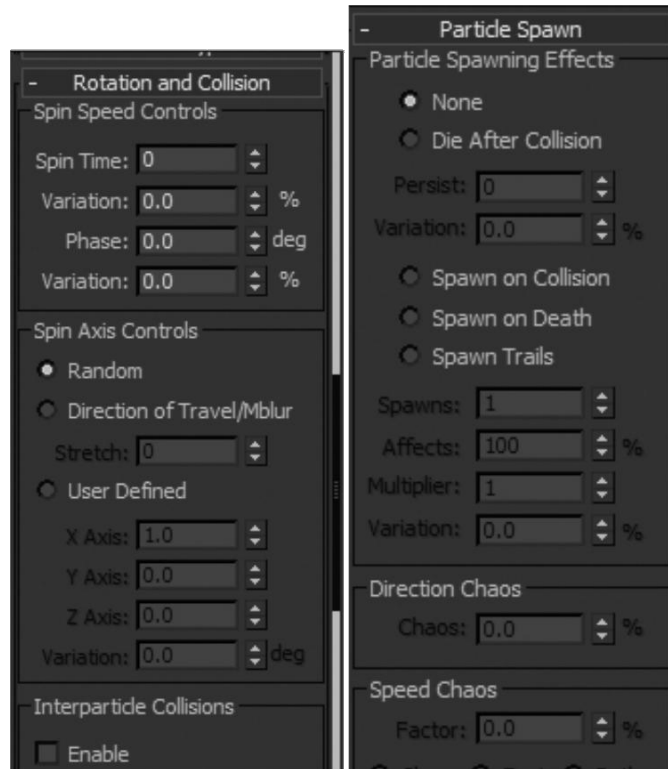
Fig9.1: Particle Property

ROTATING: The Rotation operator lets us set and animate particle orientation during an event, with optional random variation.

COLLIDING: Collision tests the particles that collide with one or more specified Deflector space warps.

SPAWNING: In spawn, particles are new particles that are generated from existing particles in a process called spawning.

Motion Inheritance: This is to affect the object motion.
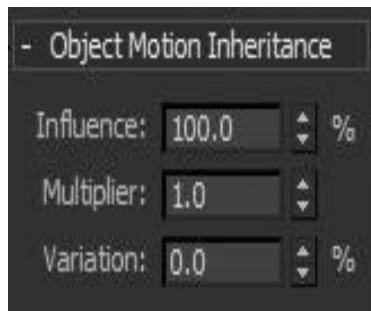
Fig9.2: Particle Property 2

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain the use of Rotating, Colliding with example.
	Explain Spawning, Motion inheritance in particles with example.

![speaking head icon]	Discussion
	Discuss the use of Rotating, Colliding, Spawning, Motion inheritance in particles.

9.5   Types of Particles

There are various types of particle available in 3D Max. The different particle can be used in a different way as per the requirement of the project for example a crowd scene can be created using or a fire cracker can be created.

Standard Particles

It uses one of several standard particle types, such as triangle, cube, tetra and so on.
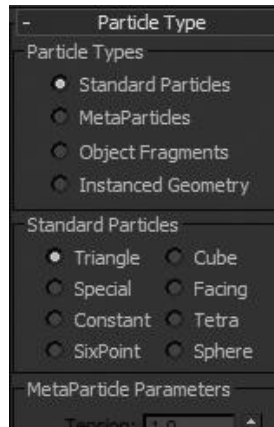
Fig. 9.3: Standard Particles

Meta Particles:

It uses Metaball particles . These are particle systems in which the indiv idual particles blendin blobs or streams.

Object Fragments:

It creates particles out of fragments of an object.
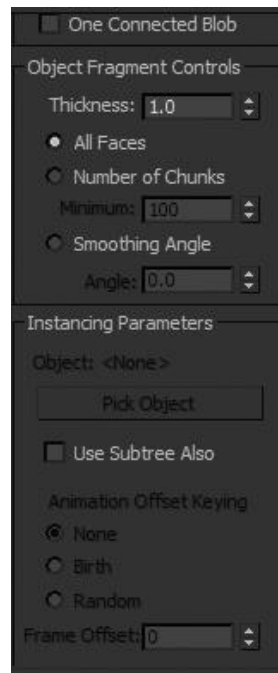
Fig. 9.4: Meta Particles

Instanced Geometry:

It generates particles that are instances of either an object, a linked hierarchy of objects, or a group.
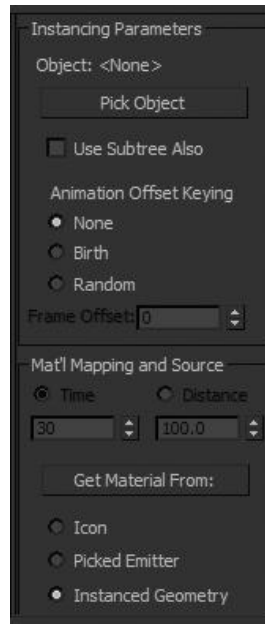
Fig. 9.5: Instanced Geometry

🔔	Study Notes

👁	Assessment
	Explain Standard particles.
	Write note on Instanced geometry.

  Discussion
Discuss Types of particles, Standard particles, Meta particles, Instanced geometry, Object fragments.

9.6   Non-Event Driven Particle

Non-event-driven particle systems provide simple, straightforward methods for generating particle sub-objects for the simulating snow, rain, snow etc. Now let us have a look over Non – event driven particles in brief.

Non-event-driven particle systems provide relatively simple, straightforward methods for generating particle sub-objects over time.

There are six non-event-driven particle systems:

Spray Particle System

Snow Particle System

Super Spray Particle System

Blizzard Particle System

PArray Particle System

PCloud Particle System

1. SPRAY PARTICLE SYSTEM:

Spray simulates water drops such as rain, a fountain, the spray from a garden hose and so on.
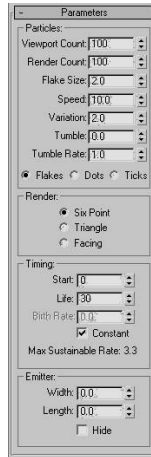
Fig. 9.6: Spray Particle System

View port Count: Maximum number of particles displayed in view ports .

Render Count: Maximum number of particles that can appear in a single .

Drop Size: Size of a partic le in the current selected units.

Speed: (Initial) Velocity of each particle as it leaves the emitter.

Variation: Applies variation to the initial speed and direction of particles.

Drops / Dots / Ticks: Chooses how particles are to be displayed in view ports.

Tetrahedron: Particles are rendered as tetrahedron.

The particles are generated with the length we specify in the Drop Size paramet er.

Facing: Particles are rendered as square faces.

Facing particles are tho se, whose width and height equals the Drop Size. Facing particles always face the camera.

Start: Number of the first frame where particles appear.

Life: The lifetime of each particle, in number of frames.

Birth Rate: The number o f new particles born per frame.

Constant: The birth rate is unavailable and the birth rate used equals t he maximum sustainable rate.

Width and Length: We implicitly set the initial value of these paramet ers when we drag in a view port to create the emitter.

Hide: Hides the emitter in view ports.

2. SNOW PARTICLE SYSTEM

Snow simulates falling snow or confetti. The snow system is similar to Spray, but it has additional parameters to generate tumbling snowflakes and its rendering options are different.

View port Count: Maximum number of particles displayed in view ports at any given frame.

Render Count: Maximum number of particles that can appear in a single frame when we render it.

Flake Size: Size of a particle in the current units.

Speed: Initial velocity of each particle as it leaves the emitter.

Variation: Applies the variation to the initial speed and direction of particles.

Tumble: Sets the amount of random rotation for snowflake particles.

Tumble Rate: Calculates the speed at which snowflakes rotate.

Six Point: Each particle is rendered as a six-pointed star.

Triangle: Each particle is rendered as a triangle.

Start: Number of the first frame where particles appear.

Constant: Sets the birth rate is unavailable and the birth rate used equals the maximum sustainable rate.

Width and Length: We implicitly set the initial value of these parameters when we drag in a view port to create the emitter.

Hide: Turn on to hide the emitter in view ports. When off, the emitter is displayed in view ports

3. SUPER SPRAY PARTICLE SYSTEM

The other Super Spray rollouts and their contents are identical with those in Particle Array, except that Object Fragments and associated settings are not available on the Particle Type rollout
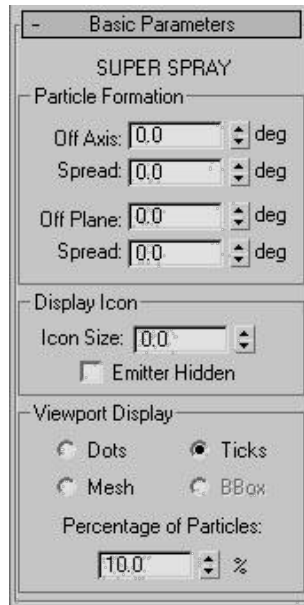
Fig. 9.7: Super Spray Particle System

Off Axis: Affects the angle of the particle stream off the Z.

Spread: Affects the spread of the particles away from the emission vect or.

Off Plane: Affects the an gle of emission about the Z axis.

Spread: Affects the spread of the particles about the Off Plane axis.

Speed: The speed of the particle at birth, in units per frame.

Variation: Applies a pe rcentage of variation to the speed of emiss ion for each particle.
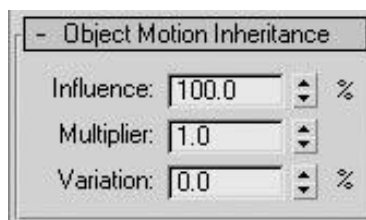
Fig. 9.8: Super Spray Particle System Options

Influence: The percent of particles that inherit the motion of the object-based emitter at the moment of particle formation.

Multiplier: Modifies the amount by which the emitter motion affect s the particle motion.

Variation: Provides a percentage of variation of the Multiplier value.

4. BLIZZARD PARTICLE SYSTEM

It is an advanced version of the original Snow particle system. The Blizzard particle system consist an emitter that specifies the location where particles are generated in the scene. It has a geometry you can display in viewports, but it isn't renderable. The emitter is displayed as a rectangle with a vector pointing out of one side. The vector shows the direction in which the system emits particles.

You set emitter parameters on the particle system's Basic Parameters rollout, in the Display Icon group:

Width and Length:

You implicitly set the initial value of these parameters when you drag in a viewport to create the emitter.

Emitter Hidden:

Hides the emitter in viewports.
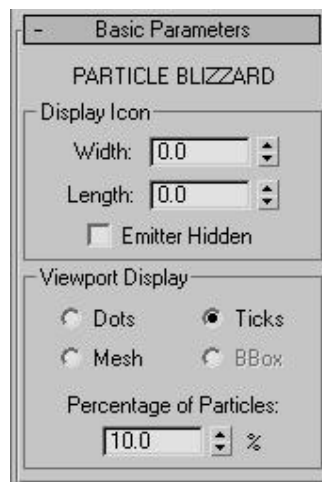
Fig. 9.9: Blizzard Particle System

5. PARRAY PARTICLE SYSTEM
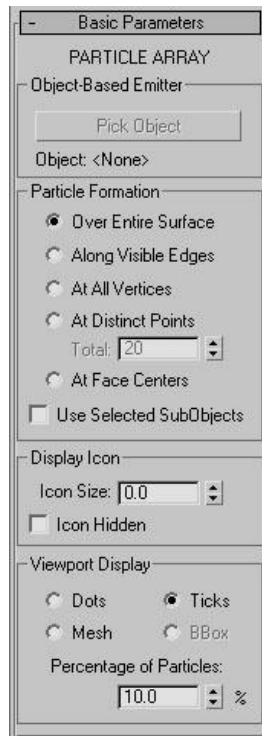
Fig . 9.10: PARRAY Particle System

Pick Object: Selects an object in our scene. The selected object becom es the object-based emitter.

Object text field: Displays the name of the picked object.

Over Entire Surface: Em its particles randomly over the entire surface of the object-based emitter.

Along Visible Edges: Emi ts particles randomly from the visible edges of t he object.

At All Vertices: Emits particles from the vertices of the object.

At Distinct Points: Places a specified number of emitter points randomly over the surface of the object.

Total: Specifies the numb er of emitter points used when At Distinct Poin ts is chosen.

At Face Centres: Emits p articles from the centre of each triangular face.

Use Selected Sub Objects: With mesh-based emitters and to a limite d extent with patch-based emitters, limits the source of the particle stream to the sub-object selection passed up the modifier stack in the object-based emitter.

Over Entire Surface: Faces

Along Visible Edges: Edges

At All Vertices: Vertices

At Distinct Points: Faces

At Face Centres: Faces

Icon Size: Sets the overall size of the icon, in units.

Icon Hidden: When on, the PArray icon is hidden in the view ports. Note that the icon does not render, in any cas e.

6. PCLOUD PARTICLE SYSTEM

The Particle Cloud partic le system is used when we want a "cloud" of particles that fill a specific volume.

Let us have a look on the param eters in brief:
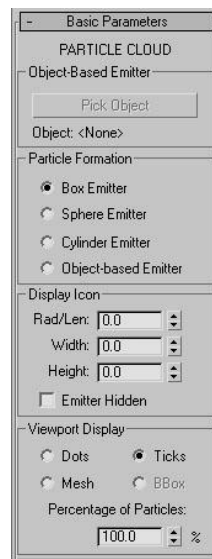
Fig. 9.11: PCLOUD Particle System

Pick Object: Click this an d select a render able mesh object to be use d as a custom emitter.

Object: It displays the name of the picked object.

Box Emitter: It chooses a box-shaped emitter.

Sphere Emitter: It choos es a sphere-shaped emitter.

Cylinder Emitter: It chooses a cylindrical emitter.

Object-Based Emitter: It chooses the object selected in the Object-B ased Emitter group.

Radius / Length: It adjusts the radius of a spherical or cylindrical icon and the length of a box icon.

Width: It sets the width o f a box emitter.

Height: It sets the height of a box or cylindrical emitter.

Emitter Hidden: It hides the emitter.
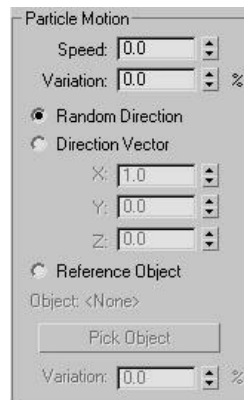
Fig: 9.12: PCLOUD Particle System Options 1

Speed: The speed of the particle at birth along the normal, in units per f rame.

Variation: It applies a percentage of variation to the speed of emis sion for each particle.

Random Direction: One of three options that affect the direction of the particles.

Direction Vector: It spec fies the direction of the particles by a vector defined by the three X, Y and Z spinners.

X/Y/Z: Displays the partic le direction vectors.

Reference Object: It emits particles in the direction of the local Z axis of a specified object.

Object: It displays the na me of the picked object.

Pick Object: Click this an d then select an object in the scene to use as a reference object.

Variation: It applies a per centage of variation to the direction when we choose either the Direction Vector or Reference Object option.
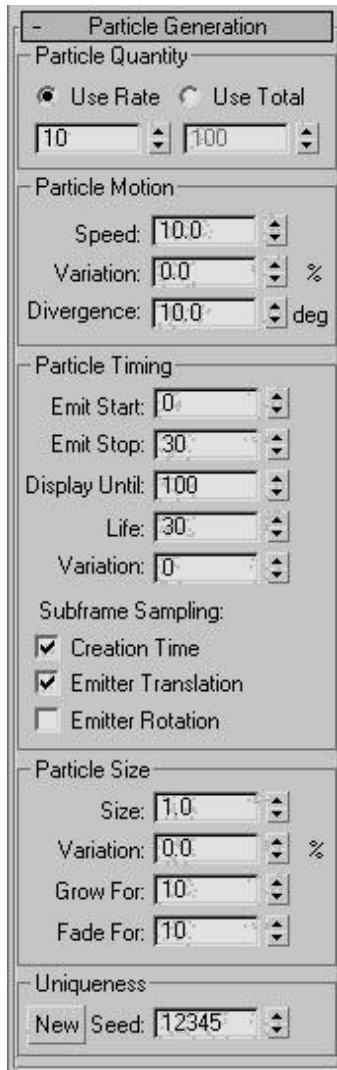
Fig. 9.1 :PCLOUD Particle System Options 2

Use Rate: It specifies a fi xed number of particles emitted per frame. Us e the spinner to set the number of particles formed per frame.

Use Total: It specifies a t otal number of particles formed over the life of the system. Use the spinner to set the number of particles formed per frame.

Speed: The velocity of t he particle at birth, along the normal, in units travelled per frame.

Variation: Applies a percentage of variation to the speed of emis sion for each particle.

Divergence: Applies an a ngular degree of variation by which each part icle's velocity can vary from the emitter norm al.

Emit Start: It sets the frame at which particles begin to exist in the scene.

Emit Stop: Sets the last frame at which particles are emitted.

Display Until: Specifies the frame at which all particles will disappear, regardless of other settings.

Life: It sets the lifespan in number of frames of each particle from the frame of creation.

Variation: Specifies the number of frames by which the life of each particle can vary from the norm.

Sub frame Sampling: Avoids particle puffing by sampling particles at a much higher sub frame resolution, instead of the relatively coarse frame resolution.

Creation Time: Enables the addition of a time offset to the equations of motion that prevents puffing in time.

Emitter Translation: If the object-based emitter is moving in space, particles are created at integral times at positions along the geometry's path between renderable positions.

Emitter Rotation: If the emitter is rotating, turn this on to avoid puffing and produce smooth spiral effects.

Size: This animatable parameter specifies the target size for all particles in the system, depending on the type of particle:

Standard Particles: The major dimension of the particle.

Constant: The dimension, in rendered pixels, of a Constant type of particle.

Object Fragments: No effect.

Variation: The percentage by which the size of each particle may vary from the norm.

Grow For: The number of frames over which the particle grows from being very small to the Size value.

Fade For: The number of frames over which the particle will shrink to 1/10th its Size setting prior to its death.

New: Randomly generates a new seed value.

Seed: Sets a specific seed value.
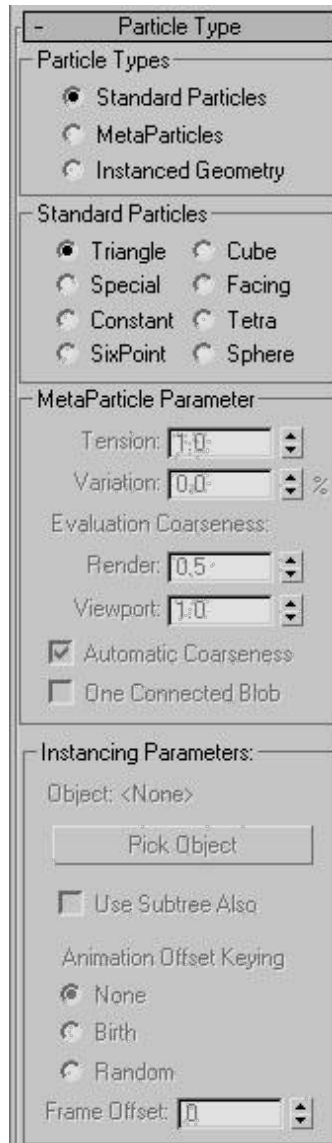
Fig. 9.1 :PCLOUD Particle System Options 3

Cube: Renders each particle as a cube.

Special: Each particle co sists of three intersecting 2D squares.

Facing: Renders each pa rticle as a square that always faces the view. Use with an appropriate opacity map for bub bles or snowflakes.

Constant: Provides a particle that remains the same size, in pixels, sp ecified in the Size spinner.

Tetra: Renders each pa rticle as a mapped tetrahedron. Use Tetra particles for raindrops or sparks.

Six Point: Renders each particle as a six-pointed, two-dimensional star.

Sphere: Renders each particle as a sphere.

Tension: Determines the tightness of the particles, with regard to their tendency to blend with other particles.

Variation: Specifies the percent of variation of the Tension effect.

Evaluation Coarseness: Specifies how accurately the meta particle solution is calculated.

Render: Sets the coarseness for meta particles in the rendered scene.

View port: Sets the coarseness for the view port display. This option is unavailable when Automatic Coarseness is on.

Automatic Coarseness: A general rule is to set the Coarseness value between 1/4 and 1/2 the size of the particles.

One Connected Blob: All particles are calculated; when on, a shortcut algorithm is used that calculates and displays only those particles that are adjoining or contiguous to each other.

Thickness: Sets the thickness of the fragments. At 0, the fragments are single-sided with no thickness.

All Faces: Each face of the object becomes a particle. This results in triangular particles.

Number of Chunks: The object breaks into irregular fragments.

Minimum: Determines a number of "seed" faces in the geometry.

Smoothing Angle: The fragments are broken based on the angles between face normals, as specified in the Angle spinner.

Angle: Sets the amount of smoothing angle.
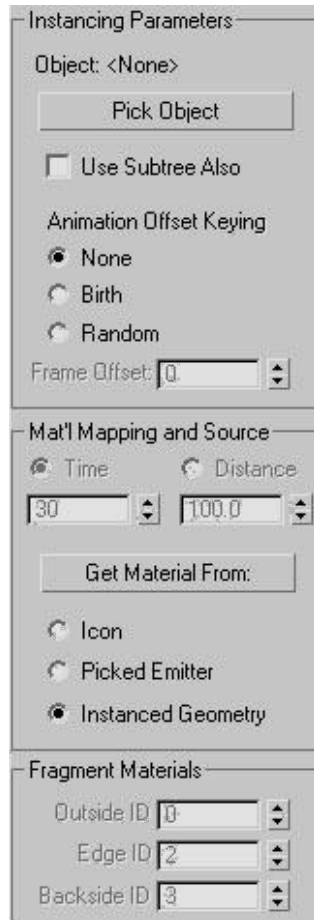
Fig. 9.1 :PCLOUD Particle System Options 4

Object: Displays the name of the picked object.

Pick Object: Click this an d select an object in the view port to be used ass a particle.

Use Sub tree Also: Turn this on when we want to include the linked children of the picked object in the particle.

Animation Offset Keyin g: Because the instanced objects can be animated, the options here let us specify the timing of the animations for the particles.

None: Each particle du plicates the timing of the original object. As a result, the animation of all particles will be identically timed.

Birth: The firstborn part icle is an instance of the current animation of the source object at the moment of that particle's birth.

Random: This option is t he same as None when Frame Offset is set to 0.

Frame Offset: It specifies an offset value from the current timing of the source object.

Time: It specifies the number of frames from the birth of the particle that it takes to complete one mapping of the particle.

Distance: It specifies the distance, in units, from the birth of the particle that it takes to complete one mapping of the particle.

Get Material From: It updates the material carried by the particle system, using the source specified by the option buttons below this button.

Icon: The particles use the material currently assigned to the particle system icon.

Picked Emitter: The particles use the material assigned to the distribution object.

Instanced Geometry: The particles use the material assigned to the instanced geometry.

Outside ID: It specifies which face ID number is assigned to the outside faces of the fragments.

Edge ID: It specifies which submaterial ID number is assigned to the edges of the fragments.

Backside ID: It specifies which submaterial ID number is assigned to the backsides of the fragments.

🔔	Study Notes

	Assessment
Explain the uses of particles systems Parray.	
Explain the uses of particles systems Pcloud.	

🗣	Discussion
Discuss various types of particle systems.	

9.7 Space Wrap

Fig. 9.16: Forces

These are forces like in nature we see wind, vortex, motor, etc. they are used for making the effects similar to their names.

1. MOTOR SPACE WARP:

The Motor space warp works like Push, but applies rotational torque to the affected particles or objects rather than a directional force. Both the position and orientation of the Motor icon affect particles, which swirl around the Motor icon.
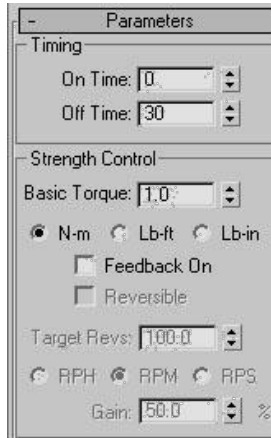
Fig. 9.17: Motor Space Warp

2. PUSH SPACE WARP

The Push space warp applies a force to either particle or dynamics systems.
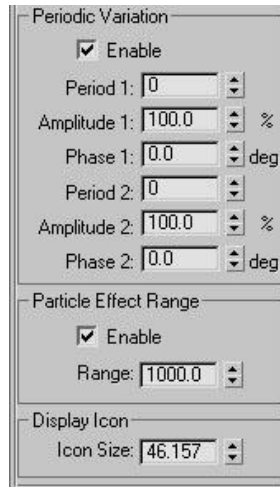
Fig. 9.18Push Space Warp

3. VORTEX SPACE WARP

The Vortex space warp a pplies a force to particle systems, spinning th em through a whirling vortex. It moves them down a long, thin spout or vortex well.
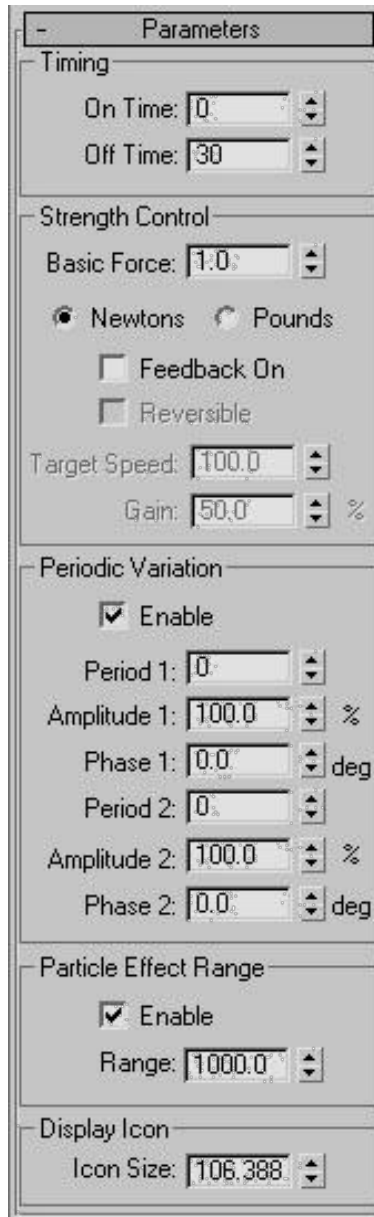
Fig. 9.19: Vortex Space Warp

4. DRAG SPACE WARP

The Drag space warp is a particle motion damper that reduces particle velocity by a specified amount within a specified range. The damping can be applied linearly, spherically, or cylindrically.

Time On/Time Off: The f rame numbers at which the space warp becom es active and becomes inactive.

Unlimited Range: When on, Drag exerts full damping strength over an unlimited range. When off, the Range and Falloff settings for the current damping type take effect

Linear Damping: Motion for each particle is separated into vectors for the space warp's local X, Y and Z axes.

X Axis/Y Axis/Z Axis: Specifies the percentage of particle motion along the local Drag space warp axis that is affected by the damping.

Range: Sets the thickness of the "range plane," or the infinite plane perpendicular to the specified axis.

Falloff: Specifies the distance beyond the X, Y, or Z Range within which Linear Damping is applied

Damping controls the percentage of particle motion toward or away from the center.

Spherical Damping: When Drag operates in Spherical Damping mode, its icon is a sphere within a sphere.

Radial / Tangential: Radial specifies the percentage of particle motion toward or away from the center of the Drag icon that is affected by the damping.

Range: Specifies the distance from the center of the Drag icon, in system units, within which damping is in full effect.

Falloff: Specifies the distance beyond the Radial / Tangential Range within which Linear

Cylindrical Damping: When Drag operates in Spherical Cylindrical mode, its icon is a cylinder within a cylinder.

Radial or Tangential or Axial: Damping is controlled the percentage of particle motion toward or away from the center of the circular portion of the icon .

Range: Specifies the distance from the center of the Drag icon.

Falloff: Specifies the distance beyond the Radial/Tangential/Axial Range within which Linear Damping is applied.

Icon Size: Specifies the size of the icon.

5. Path Follow Space Warp

Particles following a spiral path. The Path Follow space warp forces particles to follow a spline path.
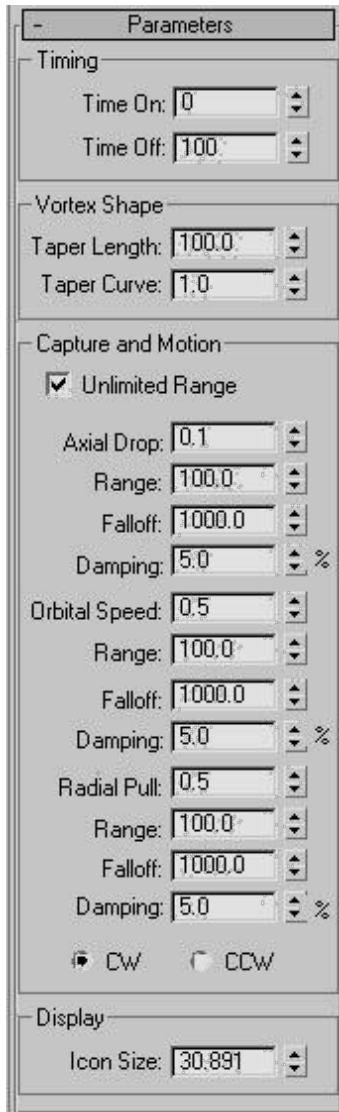
Fig. 9.20: Path Follow Space Warp

6. DISPLACE SPACE WARP

The Displace space war p acts as a force field to push and reshape an object's geometry. Displace affects both geometry objects and particle systems.
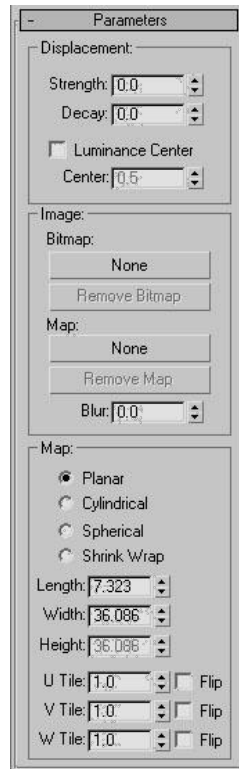
Fig. 9.21: Displace Space Warp

Strength: Displaces obje ct geometry or particles away from the position of the displace space warp object.

Decay: Decay causes disp lacement strength to reduce as distance incre ases from the position of the warp object.

Luminance Center: Disp laces the space warp's centers the lumina nce by using medium gray as the zero displac ement value.

Bitmap: Allows us to choose the bitmap for the displacement.

Remove Bitmap: Remov s the bitmap or map assigned.

Blur: Softens the effect of the bitmapped displacement.

Planar: Projects the map from a single plane.

Cylindrical: Projects the   map as if it were wrapped around the cylinder.

Spherical: Projects the map from a sphere where the bitmap edges meet at the sphere's poles.

Shrink Wrap: Truncates the corners of the map and joins them all at a single pole.

Length, Width, Height: Specify the dimensions of the bounding box of the space warp gizmo.

U / V / W Tile: The number of times the bitmap repeats along the specified dimension.

Flip: Reverses the orient ation of the map along the corresponding U, V, or W axis.

7. GRAVITY SPACE WARP

The Gravity space warp s imulates the effect of natural gravity on particles generated by a particle system.

The properties of gravity :

Gravity is directional.

Particles moving in the direc tion of the gravity arrow accelerate and movi ng against the arrow decelerate.
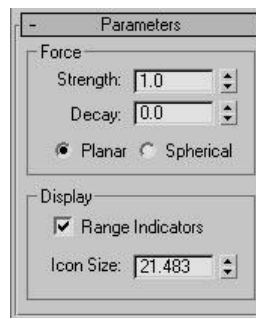
F ig. 9.22: Gravity Space Warp

Strength: Used to set the strength of gravity.

Decay: Sets the gravity s pace warp has the same strength throughout world space.

Planar: Gravity effect i s perpendicular to the plane of the Gravity warp object throughout the scene.

Spherical: Gravity effect is spherical, centered on the Gravity warp obje ct.

Range Indicators: This i ndicates the range at which the force of gravity is half the maximum value

Icon Size: Size of the Gravity warp object icon, in active units.

8. WIND SPACE WARP

Wind changing the direction of the spray of a fountain. The Wind space warp simulates the effect of wind blowing particles generated by a particle sys tem. Wind is directional.
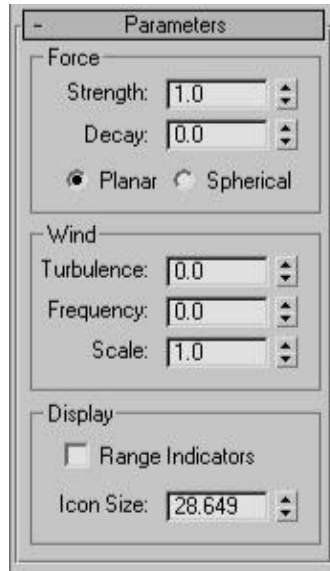
Fig. 9.23: Wind Space Warp

Strength: Increases the wind effect.

Decay: Sets the same strengt h throughout world space.

Planar: Wind effect is perpen dicular to the plane.

Spherical: Wind effect is sph erical.

Turbulence: Causes particles to change path randomly as the wind.

Frequency: This sets the variation in the turbulence sometimes over time..

Scale: Scales the disorder(tur bulence) effect.

Range Indicators: Represents the range at which the force of wind is half t he maximum value.

Icon Size: Size of the Wind warp object icon, in active units.

👁	Assessment
Explain various space wraps and their uses. Explain various gravity force and their uses.	

🗣	Discussion
Discuss various space wraps and forces.	

9.8 Deflectors

1. DEFLECTOR SPACE WARP

The Deflector space warp acts as a planar shield to repel the particles generated by a particle system.

2. PDYNAFLECT SPACE WARP

Planar Dynamics Deflector is a planar version of the dynaflector. This lets particles affect objects in a full of life situation.

Time On/Off: Specifies the frame at which the deflection begins.

Reflects: Specifies the percentage of particles to be reflected.

Bounce: Specifies how much of the initial speed of the particle after collision.

Variation: Specifies the variation in bounce applied to the range of particles.

Chaos: Applies a random variation to the bounce angle.

Friction: Specifies the amount by which particles are slowed, as they move along the deflector surface.

Inherit Velocity: Determines how much of a moving particle's speed is applied to reflected or refracted particles. This is also called velocity inheritance.

Mass: Specifies the mass. It depends upon the chosen unit.

The mass is defined in 3 different forms:

Gram

Kg

Lbm

Width/Height: Specify the width and height of the PDynaFlect icon. This is for display purposes only and does not influence the deflector effect.

3. UDYNAFLECT SPACE WARP

The UDynaFlect space warp is a universal dynamics deflector that lets we use the surface of any object as both the particles deflector and the surface that reacts dynamically to the particle impact.

4. SDYNAFLECT SPACE WARP

The SDynaFlect space warp is a spherical dynamics deflector. It is like the PDynaFlect warp, except that it's spherical and its Display Icon spinner specifies the icon's Radius value.

5. POMNIFLECT SPACE WARP

PomniFlect is a planar version of the omniflector type of space warp

Reflects: Specifies the percentage of particles to be reflected.

Bounce: Specifies the initial speed of the particle.

Variation: Specifies the variation of bounce applied to the range of particles.

Chaos: Applies a random variation to the bounce angle.

Refracts: Specifies the percentage of particles to be refracted.

Pass Velocity: Specifies how much of a particle's initial speed is maintained after passing through the deflector.

Variation: Specifies the variation of Pass Velocity.

Distortion: Controls the angle of refraction.

Variation: Specifies a range of variation of the Distortion effect.

Diffusion: Applies a transmission effect to the.

Variation: Specifies a range of variation of the diffusion value.

Friction: The amount by which particles are slowed as they move along the deflector surface.

Spawns: Specifies the percentage of particles that can use spawn effects.

Width/Height: Specify the width and height of the deflector's icon.

6. UOMNIFLECT SPACE WARP

UOmniFlect, the universal omniflector, provides more options than the original UDeflector. This space warp lets we use any other geometric object as a particle deflector. The deflections are face accurate, so the geometry can be static, animated, or even morphing or otherwise deforming over time.

7. SOMNIFLECT SPACE WARP

SOmniFlect is the spherical version of the omniflector type of space warp. It provides more options than the original SDeflector. Most settings are the same as those in POmniFlect.

The difference is that this space warp provides a spherical deflection surface rather than the planar surface. The only settings that are different are in the Display Icon area, in which we set the Radius, instead of the Width and Height.

8. SDEFLECTOR SPACE WARP

The SDeflector space warp acts as a spherical deflector of particles.

Bounce: Specifies the speed with which particles bounce off the deflector.

Variation: Specifies the variation in the bounce.

Chaos: Sets the amount of variation from the perfect angle of reflection.

Friction: The amount by which particles are slowed as they move along the deflector surface.

Diameter: Specifies the diameter of the SDeflector icon.

9. UDEFLECTOR SPACE WARP

Particles scatter when they strike a UDeflector object.

The UDeflector is a universal deflector that lets us use any object as a particle deflector.

Item: Displays the name of the selected object.

Pick Object: Click this and then click any renderable mesh object to be used as a deflector.

	Study Notes

	Assessment
	Explain various Udynaflect Space Warp deflectors and their uses.
	Explain various Somniflect Space Warpdeflectors and their uses.

	Discussion
Discussvarious deflectors and their uses.	

9.9 Particle FlowSource

Particle View is used for the Particle Flow systems. It is used for building and modifying PF systems. There are several events in PF systems, like. The Particle Flow source is the view port. It appears as a rectangle with a central logo, by default. Its shape and appearance can be changed.

The PF source icon is roughly alike to the matching global event in P View. Even if they have same name, selecting one does not select the other. If we delete a PF source icon from the scene, the global event is converted to an isolated local event in P View. This retains its operators along with their settings.

If we delete a global event then any local event used is also removed that is used completely by that system. To retain the local events, first delete the wire from the global event and then delete the global event.

The Clone Options dialog offers the Copy option only. The Clone Options dialog also allows us to create instances of the cloned operators and tests. Crating the instances of global and local events is not possible. The global events cloned in P View are not automatically wired to the original birth event.

1. GLOBAL EVENT

    This event affects all the particles in the system.

    The name is same as the PF icon.

    It has single render operator.

The globally used operator should not be used locally to avoid possible complications.

    It also provides the Particle View representation.

    New system can be created by duplicating this event.

2. BIRTH EVENT

    It must contain a Birth operator.

    This operator should be at the top of the event and nowhere else.

    This event also contains a number of operators that act locally.

    This specifies the properties of particles in that event.

The particle view is divided into 5 parts:

Event display

Particle diagram

Global event

Birth event

Depot

Particle Flow provides a number of tools. These tools determine where the particles reside currently in the system.

This also includes the ability to change particle colour and shape.

The actions and events can be easily enabled as well as disabled.

We can cache particle motion in memory.

3. MODIFIER STACK

In the modifier stack there is a hierarchy. Expanding the hierarchy of a PF source object provides access to 2 sub-object levels like:

Particle

Event

Enable Particle Emission: Turns the particle system ON and OFF.

Particle View: Opens the P View dialog box.

Logo Size: Sets the logo size of the Particle Flow.

Icon Type: Chooses the basic geometry of the icon, like

Rectangle

Box

Circle

Sphere

Length/Diameter: It allows to set the length of the icon when it is Rectangle or Box types. It helps in setting the diameter of the icon when it is either Sphere or Circle type.

Width: It sets the width of the icon when it is either Rectangle or Box.

Height: It sets the height of the Box icon type.

Show Logo/Icon: It toggles the display of the logo and icon ON and OFF.

View port: It sets the percentage of the number of particles produced in the view ports.

Render: It sets the percentage of the particles produced at render time.

Particle: It selects the particles by either clicking them or dragging a region.

Event: It allows us to select particles by event.

ID: Use this to set the ID number of the particle that we want to select.

Add: Click Add to add to the selection, after setting the ID number of a particle.

Remove: Click Remove to remove it from the selection.

Clear Selection: Clears the selection of the particle so as to deselect it.

Get From Event Level: Converts an event-level selection to the particle level.

Select By Event: This displays all events in P Flow.

Particles Selected: Shows the number of selected particles.

Upper Limit: Displays the maximum number of particles in the system.

View port: Sets the combination step for playback of animations (in the view ports).

Render: Set the blending of steps at render time.

Enable Script: Causes a script in memory to be executed at each addition step.

Edit: Opens a text-editor window with the current script.

Use Script File: We can load a script file.

Enable Script: Turns ON to cause a script in memory to be executed after the final incorporation step.

Use Script File: When on, we can load a script file by clicking the button below.

4. OPERATORS

The operator is the basic element of the particle system. We combine operators into events. This specifies the particles' characteristics over a given period of time.

Operators allow us to describe the speed, direction, shape, appearance, etc. of the particle. The operators exist in 2 groups. These groups are present in the Particle View depot. Each group appears in alphabetical order.

Primary Operators in Particle Flow are:

1. BIRTH OPERATOR

   Emit Start: Specifies the frame number at which the operator emits particles.

   Emit Stop: Specifies the frame number at which the operator stops emitting particles.

   Amount: Specifies the total number of particles emitted by the operator.

   Rate: Specifies the number of particles emitted per second.

   Total: Calculates the total number of particles emitted by the operator.

   Sub frame Sampling: This helps in avoiding the particle puffing.

2. BIRTH SCRIPT OPERATOR

   Edit Script: Opens the current script in a MAX Script Editor window.

   Seed: Specifies a randomisation value.

   New: Calculates a new seed.

3. DELETE OPERATOR

   All Particles: Deletes all particles in the event.

   Selected Particles Only:Deletes particles that are selected.

   By Particle Age: Deletes particles in the event after they have existed for a specific length of time.

This makes the Life Span and Variation settings available.

   Life Span: Specifies the number of frames of life allowed to the particles.

   Variation: Specifies the maximum amount by which Life Span may vary.

   New: Helps in calculating a new seed using a randomisation formula.

4. FORCE OPERATOR

   The Force operator lets us set the influence particle motion with one or more SPACE WARPS from the Forces category. We can use this operator along with different forces to simulate the effects of

   Wind

   Gravity etc.

The following Space Warps work with the Force operator:

Displace

Drag

Gravity

Motor

P Bomb

Push

Vortex

Wind

Add: Adds a force space warp in the scene.

By List: Adds one or more space warps to the list.

The space warps must already exist in the scene.

Remove: Removes the space warp from the list.

Force Field Overlapping: Specifies how multiple forces occupies the same volume of space affect the particles.

Influence: Specifies the strength of the force or forces that are applied to the particles.

The strength is defined in the form of a percentage.

Sync By: Chooses the period for applying animated parameters. There are 3 types of synchronisation, like

Absolute Time: Any keys set for parameters are applied at the actual frames for which they are set.

Particle Age: Any keys set for parameters are applied at the corresponding frames of each particle's existence.

Event Duration: Any keys set for parameters are applied to each particle starting when it first enters the event.

Not Used: Particle Flow uses the Influence setting specified in the Parameters rollout.

Influence: Particle Flow applies the script to the Influence setting.

5. KEEP APART OPERATOR

Keep Apart Operator: It allows us apply forces to particles which separates them. This prevents or reduces collisions among particles. It is a member of the Speed operator family.

Force: Specifies the amount of force applied to the particles.

Acceleration Limit: Sets a maximum quickening value to be applied to particles motion.

Speed Limit: Sets a maximum speed value that can be applied to particle's motion.

Absolute Size: Sets the centre radius and falloff zone as absolute distances

This is set in system units.

Core Radius: Sets the distance from each particle's pivot point.

Falloff Zone: Sets the distance beyond the centre radius.

Relative to Particle Size: Sets the centre radius and falloff zone as percentages.

Core %: The distance from each particle.

Falloff %: The distance beyond the core radius.

Variation %: Sets the amount by which range values can vary randomly.

Current Event: Specifies the particles in the current event but away from each other.

Selected Events: Specifies the particles in the current event away from all particles in the events highlighted.

Selected Particle Systems: Specifies the particles in the current event away from all particles in the flows highlighted.

Use Script Vector As:ChooseS one of the following.

Choosing Absolute Size Range or Relative Size Range makes the Range settings on the Parameters rollout unavailable.

Not Used: Particle Flow uses the Range settings specified in the Parameters rollout.

Absolute Size Range: Particle Flow applies the script particle Vector values to the Absolute Size Range values.

Relative Size Range: Particle Flow applies the script particle Vector values to the Relative Size Range values.

9.10 Mapping and Material Dynamics

1. MAPPING OPERATOR

The Mapping operator lets us assign a constant UVW mapping to the entire surface of the particles.

UVW: Sets the coordinates on the map from which the particle colour is taken.

Sync By: Choose the time frame for applying animated parameters.

Absolute Time

Particle Age

Event Duration

Map Channel: The mapping is applied to the specified map channel.

Vertex colour Channel: The mapping is applied to the particles' vertex colour channel.

Show Map In View port: The map colouring is visible in the view ports.

2. MATERIAL DYNAMIC OPERATOR

The Material Dynamic operator lets us give particles material IDs that can vary during the event. It also lets us assign a different material to each particle based on its material ID.

Assign Material: The operator assigns the specified material to the particles.

Assign Material ID: The operator defines a material ID number for each particle.

Show In View port: Displays the material, applied to the particles in the view ports when the particles are displayed as geometry.

Same As Particle ID: Assigns the same material ID to a particle as its particle ID.

Reset Particle Age: Sets each particle's age to zero when it enters the event.

Randomise Age Offset: Varies the difference between the particle age and the starting material ID at random.

Max Offset: Displays the maximum number of frames by which the software can randomly vary particle age.

Material ID: Assigns the same material ID to all particles.

Cycle: Assigns each particle a material ID.

Random: Assigns each particle a random material ID in the range.

Rate Per Second: Sets the number of times per second to see that the assigned material ID is incremented.

Loop: The software loops back first ID and continues the cycle.

Sync By: Chooses the time frame for applying animated parameters. The available options are

Absolute Time

Particle Age

Event Duration

Rand Offset: Varies the difference between the particle age and the assigned material ID, randomly.

3. MATERIAL FREQUENCY OPERATOR

The Material Frequency operator lets us assign a material to an event and specify the relative frequency with which each sub-material appears on the particles.

Assign Material: The operator assigns a material to the particles.

Assign Material ID: The operator defines a material ID.

Show In View port: Displays the material in the view port applied to the particles.

Sub-Materials: Displays the number of sub-materials in the assigned material.

Material ID 1–10: Specifies the relative chances of particles to be assigned the corresponding material ID.

4. MATERIAL STATIC OPERATOR

The Material Static operator lets we give particles material IDs that remain constant throughout the event. It also lets we assign a material to each particle based on its material ID.

Material ID: Assigns the same material ID to all particles.

Cycle: Assigns each particle a material ID in the range.

Random: Assigns each particle a random material ID in the range.

Per Second: Sets the number of times per second that the assigned material ID is incremented.

Per Particle: Sets the number of particles that must appear before material ID assignment changes.

5. POSITION ICON OPERATOR

This topic uses the term emitter to refer to this icon.

The Position Icon operator to control the initial placement of particles on the emitter

Lock On Emitter: All the particles remain at their initial positions on the emitter.

Inherit Emitter Movement: Sets each particle's rate and direction of motion, to that of the emitter at the time of birth.

Multiplier: Defines the extent to which particles inherit the emitter's motion.

Pivot: Emits particles from the center of the icon.

Vertices: Emits particles from the corners of the icon, for the Box and Rectangle icon types.

Edges: Emits particles from random points along the edges of the icon.

Surface: Emits particles from random points on the surface of the icon.

Volume: Emits particles from random points within the volume of the icon.

Distinct Points Only: Limits emission to a specific number of points on the specified Location type.

Total: Sets the number of emission points.

6. POSITION OBJECT OPERATOR

The Position Object controls the original placement of particles on the emitter. The emitter can be set to emit particles from its surface, volume, edges, vertices, or pivot, or from a sub-object selection. We can also control particle emission with a material applied to the object.

Add: Adds an object to the list.

By List: Adds multiple objects to the list.

Remove: Removes an object from the list.

Animated Shape: Allows particles to emit from the surface of an object whose form is animated. The animation is mostly done by morphing or with modifiers.

Pivot: Emits particles from the emitter object's pivot.

Vertices: Emits particles from randomly selected vertices.

Edges: Emits particles from random points along the edge.

Surface: Emits particles from random points on the surface of the icon.

Volume: Emits particles from random points within the volume of the icon.

Selected Vertices: Emits particles from the current vertex sub-object selection.

Selected Edges: Emits particles from the current edge sub-object selection.

Selected Faces: Emits particles from the current face or polygon sub-object selection.

Surface Offset: Specifies a range of distance from the object surface for particle placement.

Min/Max: These lets us specify the range of offset distances from the object surface.

Density by Material: Sets the variation in the emission over the emitter surface based on properties of the material applied to the emitter.

Separation: The particles are set apart by the amount specified in distance.

Distance: Specifies the distance in system units.

Distinct Points Only: Limits emission to a specific number of points.

Total: Sets the number of emission points.

Delete Particles: Deletes the particle.

Attempts Max: Specifies the maximum number of times P Flow will try to set particle positions that maintain the distance.

This is done when the separation option is ON

7. ROTATION OPERATOR

The Rotation operator lets we set and animate particle orientation during an event, with optional random variation.

Random 3D: Gives each particle an arbitrary, random 3D orientation.

Random Horizontal: Gives each particle a random 3D orientation.

This is done about the Z axis only.

World Space: Orientation is specified in the world co-ordinate space.

Speed Space: The speed depends upon the particles' direction.

Speed Space Follow: The coordinate space, for particle orientation is determined continually while the particles are in the event.

X/Y/Z: Set the basic orientation about the particles' local axes.

Divergence: Defines the range of variation for particle orientation.

Restrict Divergence To Axis: Restricts the divergence axis controls to set the axis to which departure will be applied.

Divergence Axis: Use the X/Y/Z settings to set the axis to which divergence will be applied.

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain various options of about the uses and importance of particle flow source.
	What is Position Object Operator?

![speaking head icon]	Discussion
	Discuss various applications that can be made with various options of about the uses and importance of particle flow source.

9.11 Shape Operators Part 1

1. SPIN OPERATOR

The Spin operator gives an angular velocity to particles in an event, with optional random variation.

Spin Rate: The rate of revolution in degrees per second.

Variation: Sets the maximum amount in degrees per second, by which the spin rate can vary.

2. SCRIPT OPERATOR

The Script operator enables control of particles within the Particle Flow system using a MAX Script script. The script can use any program functionality available to MAX Script.

Edit Script: Click this button to open the current script in a MAX Script Editor window.

Shape is the default operator for defining the geometry used in the particle system. We can use it to specify particles in the shape of pyramids, cubes, spheres, or vertices, as well as particle size.

Seed:The sped setting is used to specify a randomisation value.

New:This setting is used to calculate a new seed using a randomisation formula. SHAPE FACING OPERATOR

Name: The name of the object appears which is selected as a "Look at object".

Pick Camera or Object: Selects a camera or object in the scene to use as the Look At object.

Use Parallel Direction: All particles continuously rotate to stay facing toward the "Look At object", when off

In World Space: Sets the size in system units using the World coordinate system.

Units: Sets the particle size in system units.

In Local Space: Sets particle size relative in local space.

Inherited %: Sets the facing particles' size as a percentage of the existing size.

In Screen Space: Sets the facing particles' size as a percentage of the screen width.

Proportion %: Sets the particle size as a percentage of the screen width.

Pivot At: Specifies the part of the particle around which rotation is performed.

W / H Ratio: Defines the aspect ratio of the rectangle.

Align to Horizon: Keeps the top edge aligned with the horizon.

Align to Speed Follow:Sets the right side of each particle as the leading edge.

Random: Orients the top edge at random.

Allow Spinning: Spins the particles.

3. SHAPE INSTANCE OPERATOR

Shape Instance lets us use any reference object in the scene as particles.

Group Members: Group members are treated as separate particles.

Object and Children: Linked objects are treated as separate particles.

Object Elements: Element sub-objects of a single mesh object are treated as separate particles.

Vertices / Faces: Show the number of vertices and triangles per particle.

Number of Shapes: Shows number of different particle shapes.

Acquire Mapping: All the map from the reference object is transferred to particles.

Acquire Material: Material data from the reference object is transferred to particles.

Multi-Shape Random Order: Assigns shapes to particles in random order.

Animated Shape: Particles use any animation in the reference object.

This includes cyclic animation applied with the Parameter Curve Out-of-Range Types controls.

Sync By: Lets we choose how to synchronise reference-object animation with the particles.

Absolute Time

Particle Age

Event Duration

Rand Offset: When on, randomly varies the start of each particle's animation..

Update Particle Shape: Refreshes instanced particle shapes from the reference object.

4. SHAPE MARK OPERATOR

Use the Shape Mark operator to replace each particle with either a rectangle or a box cut out from the particle geometry with an image mapped onto it.

Align to Surface Animation: Shape Mark takes into account surface changes due to vertex animation of the contact object.

Align To: Shape Mark creates either a rectangle or a box cutout on the contact geometry.

The alignment choices are as follows:

Speed

Particle X/Y/Z

Random

Impact Angle Distortion: Increases the length value of the mark according to the particle's angle of approach.

Distortion Max in percentage: Sets the maximum percentage to stretch the mark.

These settings let us specify the mark-making object as a rectangle or a box.

Rectangle: The mark shape is a two-faced rectangle.

Box Intersection: This creates a box for each particle that the mark shape derives a shape from a Boolean Intersection between the contact object and the box.

Box Height: Sets the height of the box.

Allow Multiple Elements: Leaves marks on all parts of contact objects that contain multiple elements.

Continuous Update: The shape of the mark is recalculated at each frame.

Generate Mapping Co-ordinate: Sets the correct application of the shape mark when using a mapped material.

The different types of offsets are as stated below :

Pivot Offset in percentage

Surface Offset

Offset Variation

Vertex Jitter

5. SPEED OPERATOR

This is the default Speed operator. It provides basic controls over particle speed and direction.

Speed: The particle speed in system units per second.

Variation: The amount by which particle speed can vary, in system units per second.

Along Icon Arrow: Particles move parallel to the icon arrow.

Icon Center Out: Each particle moves along an imaginary line.

This line is drawn between the particle's location and the icon center.

Icon Arrow Out: Each particle moves along an imaginary line.

This line is drawn between the particle's location and the icon arrow.

Random 3D: Particles move in all directions.

Random Horizontal: Each particle moves in a random horizontal direction.

Inherit Previous: Uses the current direction of motion.

Reverse: The direction is reversed.

Divergence: Spreads out the particle stream.

6. SPEED BY ICON OPERATOR

The Speed By Icon operator lets us use a special parameters as below:

The icon is non-rendering. The icon allows to control particle speed and direction.

Acceleration Limit: The amount of acceleration.

Influence: Determines the mix of the speed with the speed of the operator icon.

Speed Variation: Applies random variation of the speed.

Use Icon Orientation: Applies animation of the icon's orientation.

Steer Towards Trajectory: Particles away from the icon are moved directly toward the icon.

In here the value is calculated in terms of the distance value.

Distance: The distance between the particles and the operator.

7. SPEED BY SURFACE OPERATOR

The Speed By Surface operator allows us to control the speed of the particle and direction.

The speed is referred with any object or objects in the scene Set

Speed Once: The speed for the each particle is set only once.

Control Speed Continuously: The speed of the particle is set throughout the event.

Speed: The particle's speed is set in system units per second.

Add: Allows to add an object to the list.

By List: Allows to add multiple objects to the list.

Remove: Removes an object from the list.

Animated Shape: Allows particles to follow the surface of an animated object.

The animation could have been done by morphing or by any other modifiers.

Sub frame Sampling: This operator acquires animation of the geometry shape.

The animation is acquired on the basis of ticks i.e. ¼,800th of a second. It is not done on the frame basis.

Speed by Material: The particles' existing speed and direction is based on properties of the material that is applied to the geometry.

The options related to the Speed by Material are as follows:

Grayscale Multiplier

The speed is controlled by the material's luminance.

Here the darker areas producing slower particles and lighter areas producing faster ones.

Signed Grayscale

This is exactly like the grayscale multiplier.

When the multiplier can be negative so as to cause reversal of motion

RGB as World XYZ Multiplier

This uses the intensity of the material's RGB channels to affect the speed of the particle on the world X, Y andZ-axes.

RGB as Local XYZ Multiplier

This uses the object's local co-ordinates.

Use Sub-Material: Uses a sub-material from the Multi/Sub-Object material.

Material ID: Specifies the material ID of the sub-material.

Surface Normals: In here, each particle moves along a perpendicular line to the nearest face.

Out Of Surface: Particles move away from the closest face.

Parallel To Surface: Each particle travels parallel to the nearest face.

Divergence: Spreads out the particle stream.

Acceleration Limit: Sets the maximum acceleration.

Range: The maximum distance.

Falloff Zone: The distance beyond the range value which exerts partial control over particles.

Absolute Time: Parameters are applied at the actual frames for which they are set.

Particle Age: Parameters are applied at the corresponding frames.

Event Duration: Parameters are applied to each particle when it first enters the event.

⚠	Study Notes

👁	Assessment
Explain Shape Mark Operator and its parameters. Explain Shape Instance Operator and its parameters.	

🗣	Discussion
Discuss various events of about the uses and importance of shape operators.	

9.12 Shape Operators Part 2

1. Cache Operator:

The Cache operator records and stores particle states to memory.

Use At: Caches particle motion when playing back in the view ports or at render time, or both.

Update: This setting determines whether P Flow should update the cache automatically.

There are 2 ways

Always

Manually

Complete

Active Segment

Custom

Start/End Time: The first and last frames of the range considered for caching when

Sampling: Determines how often the operator samples and caches the animation.

Every Frame

Integration Step

Every Nth Frame

N: Determines the frame interval for caching, set to Every Nth Frame.

Cache Test Results: This allows to cache the results of test actions as well.

Save Cache with File: Saves the time of recalculating the particle motion upon reloading the file.

Save Cache with Hold: Saves cached data in the file, which is hold.

Update: Replaces any existing cached data and stores it in the cache.

Clear: Deletes any cached data.

Range: Sets the frame range.

Complete: The operator clears the cache for entire animation.

Active Segment: The software updates the cache only for frames in the active segment.

Custom: Updates the cache only for frames in the custom range.

Limit: The maximum amount of system memory used to cache particle data.

The memory is stored in kilobytes (KB).

Total: The amount of memory currently used by the cached data.

Current Frame: The amount of memory used by the data cached for the current frame.

2. Display Operator:

The Display operator lets us specify how particles appear in the view ports. The default display mode is Ticks, which is the simplest and thus the fastest to display. It's useful for animations that use a large number of particles. At the opposite end of the complexity spectrum is the Geometry option, which lets the software depict particles as their actual shapes.

Type: Choose how particles appear in the view ports.

None: Particles invisible in the view ports.

Dots: Particle appear as a single pixel.

Ticks: Particle appear as a + sign.

Circles: Particle appear as a small circle.

Lines: Particle appear as a line.

The lines are one pixel deep.

Bounding Boxes: Particle appear as a bounding box.

Geometry: Particle appear as its actual geometry.

Diamonds: Particle appear as a diamond.

Boxes: Particle appear as a small square.

Asterisks: Particle appear as an asterisk.

Triangles: Particle appear as a small triangle.

Visible in percentage: Determines the percentage of particles visible in the view ports.

Show Particle IDs: Particle's index number is visible in the view ports.

Color swatch: Displays the colour for particles.

Selected: Determines how selected particles appear in the view ports.

3. NOTES OPERATOR

The Notes operator lets us add a textual comment to any event.

4. RENDER OPERATOR

The Render operator provides controls related to rendering particles.

Type: Allows us to render particles as bounding boxes or geometry.

Types of rendered result:

Single Mesh: One mesh object comprises all particles in the system.

Multiple Meshes: Each mesh contains the specified number of particles.

Mesh Count: Calculates the maximum number of mesh objects that P Flow will send to the renderer.

Particles p / Mesh: The number of particles that each mesh object will comprise.

Mesh Per Particle: Sends the renderer a separate mesh for each particle.

5. FLOWS

There are 2 operators for creating initial particle system setups in "Flow".

Empty Flow

Standard Flow

Let us have a look over them in brief.

Empty Flow:

Empty Flow provides a preliminary point for a particle system. In here the particle system should be consisting of a single global event as well as a render operator.

Standard Flow:

This is same as Empty Flow operator. The global events in here are wired to a

Birth event

Position operator

Speed operator

Rotation operator

Shape operator

Display operator

In here all the parameters are set to default values.

👁	Assessment
Explain Shape Cache Operator and its parameters. Explain Shape Render Operator and its parameters.	

🗣	Discussion
Discuss Note and render operator.	

9.13 Types of Tests

Tests:

The test checks if the particles satisfy one or more conditions and then sends them to another event.

1. AGE TEST:

Age Test lets the particle system check how long a particle has existed as well as how long a particle has been in the current event. In here the particles existing in the branch is also checked.

The age test is differentiated into

Absolute Age: Tests the current frame number.

Particle Age: Tests the current age of each particle.

This particle age and the Event age are checked in frames.

Event Age: Tests the current duration of the current event.

Test True if Particle Value: Specifies if the test passes particles to the next event if the age test succeeds or fails.

This is done after having a look over whether the age test has succeeded or failed.

2. COLLISION TEST:

Collision tests the collision of the particles that collide with deflector space warps.

The Collision test supports the deflector space warps like:

POmniFlect

SOmniFlect

UOmniFlect

SDeflector

UDeflector

Deflector

This does not support the DynaFlect deflector.

List: Displays the deflectors in the view port / scene that can be applied to this operator.

Add: Adds a Deflector space warp.

By List: Selects deflector from the list.

Remove: Removes the selected deflector.

Collides: Specifies how particle speed should be affected by the collision

Speed: Sets the speed. For this we can choose one of the following.

Bounce: In here the speed and direction are defined after the collision.

Continue: In here the speed and the direction of the particle are not affected by the collision.

Stop: Particle speed is set to NIL after the collision.

Random: The bounce of the particles happens in the random directions.

Is Slow After Collision: After the collision particle's speed is less.

Speed Min: Particles travelling at less than this speed become eligible for moving to the next event.

Is Fast After Collision:after the collision, the particle speed is greater

Speed Max: Particles travelling faster than this speed become eligible for moving to the next event.

Collided Multiple Times: Comes into action after the particle collides a specific number of times.

Times: Specifies the number of times a particle must collide.

Speed: Determines speed and direction.

3. COLLISION SPAWN TEST

Collision Spawn creates new particles from existing ones that collide with one or more Deflector space warps.

Each spawned particle is born at the same location, orientation and shape as its parent. Same as "Collision Test", the "Collision Spawn" test supports all deflector space warps except the DynaFlect deflectors

The spawned particles can have a different speed and scaling factor.

Parent Particles: In here, the parent particles qualify for redirection when the test conditions are met.

Spawn Particles: The spawned particles are set for redirection when the test conditions are met.

Spawn On First Collision: The particles spawn only the first time they collide with a deflector.

Delete Parent: Deletes the original particle from which a new one is spawned.

Spawn On Each Collision: Particles spawn on each collisions.

Spawnable: Determines the percentage of particles in the current event that will spawn into new particles.

Offspring: Determines the number of new particles created from each parent particle.

Sync By: Sets the time frame to use when animating Offspring and Variation. It is done in 3 ways

Absolute Time

Particle Age

Event Duration

Restart Particle Age: Sets the age of each newly spawned particle at 0.

Parent: Specifies the parent's behaviour.

Bounce: Determines the speed and direction after collision.

Continue: in here, the particle speed and direction are unaffected by the collision. This is available only when Delete Parent is switched Off.

Offspring: Specifies the behaviour of the newly spawned particles. In here too they are determined by 2 properties

Bounce

Continue

Inherited: Choose this to specify each spawned particle's speed as a percentage of its parent's speed.

4. FIND TARGET TEST

Find Target sends particles to a specified target.

Control By: Specifies if to send particles to a target by specifying the speed and acceleration.

There are 3 ways to control the speed :

Control By Speed.

Control By Time

No Control

Target Pivot: Aims the distance between the particle and the target pivot.

Target Point: Aims the distance between the particle and the target point.

Ease In %age: Controls the rate by which particles slow down.

Timing: Determines the timing. This is defined by the time and variation values.

The options available are:

Absolute Time

Particle Age

Event Duration

5. TARGETS

Icon

Mesh Objects

Animated Shape: Specifies the particles to the target's surface whose form is animated.

The animation could have been done by scaling, by morphing, or with modifiers.

Follow Target Animation: Allows particles to follow a moving target.

Point: Specifies where a particle should land on the target. The options in here are

Random

Closest Surface

By Script Vector

Object: Specifies the option so as to allow us to choose the target out of multiple mesh targets. The options available for this are

Random

Closest Pivot

Closest Surface

Least Deviation

By Script Integer

Lock On Target Object: Locks the particle over the target.

Docking: Let us we specify from which direction particles should approach targets. There are different types of docking methods

None Specified

Along Icon Arrow

Icon Spherical

Icon Cylindrical

Surface Normals

Distance: Specifies the distance from the target at which particles begin docking behavior.

Color Coordinated: The Find Target icon uses the colour of the event.

It contains the test as defined by its local Display operator, if one exists.

6. SCALE TEST

Scale Test checks the particle scaling or particle size. This is done before or after scaling.

Type: Selects the type of measurement.

The type is mentioned in 3 ways :

Pre Scale Size

Post Scale Size

Scale

Axis: Selects the axis to measure.

The available options are :

Average

Minimum

Median

Maximum

X/Y/Z

SIZE

Test Value: The specific size to test for.

Variation: Specifies the amount by which the tested value for the particle can vary randomly.

SCALE

Test Value: This is the specific scaling factor to test.

Variation: The amount by which the value is tested.

Sync By: Choose the time frame to use when animating Test Value and Variation.

The available options are :

Absolute Time

Particle Age

Event Duration

7. SPAWN TEST

Spawn creates new particles from existing ones. The spawned particles have same size and the orientation as the parent particle.

Once: Particles spawns one time only.

Delete Parent: Deletes each original particle.

Per Second: Specifies a number of particles to spawn every second.

Rate: Determines the number of particles to spawn per second.

By Travel Distance: Spawns new particles at regular intervals.

Step Size: The system spawns a new particle every time the parent moves this distance, in system units.

Offspring: Specifies the number of new particles the created from each parent particle.

Restart Particle Age: Sets the age of each newly spawned particle at the zero level.

In Units: Selects the unit to specify the speed.

Inherited: Specifies each spawned particle's speed.

The speed is set as a percentage of its parent's speed.

Divergence: Spreads out the stream of spawned particles.

Scale Factor: Determines the amount of uniform.

8. SPEED TEST

Speed Test checks particle speed, speed or the rate of circular travel.

Velocity Magnitude: Tests the particle velocity, in system units per second In here the direction is not considered.

Velocity X/Y/Z: Tests the particle velocity on the specified axis.

Acceleration Magnitude: Tests the particle acceleration.

Acceleration X/Y/Z: Tests the particle acceleration on the specified axis.

Steering Rate: Tests the circular component of particle.

In here the rotation and spinning is not considered.

True When Accelerates: Returns a True value when the particle velocity is increasing in value.

True When Decelerates: Returns a True value when the particle velocity is decreasing in value.

8. SPLIT AMOUNT TEST

The Split Amount test lets us send a specific number of particles to the next event. This keeps all remaining particles in the current event.

Fraction Of Particles: Splits the particle stream on basis of percentage.

Ratio: Specify the percentage of particles that will test True.

9. SPLIT SELECTED TEST

   The Split Selected test lets us split the particle stream based on particles' selection status.

10. SPLIT SOURCE TEST

   The Split Source test lets us split the particle stream based on particles' origin.

⚠	Study Notes

👁	Assessment
	Explain Split source test and its requirement.
	Explain Sample Test and its importance.

🗣	Discussion
	Discuss the types of test available in 3D Max.

9.14 Summary

In this Unit, we will Discuss how you can use various particle systems of3DS MAX for making of different types of effects. Particles are very useful for animated movies.

Particles are non-editable fragments of objects. They are used for making dynamic effects like dust, vortex, volcano, rain, fountains, etc.

There are different stages of particle that decide the life and death of a particle, for example the fountain containing particle emitting from an emitter should last only till they hit the ground, so setting their life or age of a particle will create a desirable effect.

Rotating, Colliding, Spawning, Motion inheritance arethe various options of particles.

There are various types of particle available in 3D Max. The different particle can be used in a different way as per the requirement of the project for example a crowd scene can be created using or a fire cracker can be created such as Standard particles, Meta particles, Instanced geometry, Object fragments.

Non-event-driven particle systems provide simple, straightforward methods for generating particle sub-objects for the simulating snow, rain, snow etc. Now let us have a look over Non – event driven particles in brief

These are forces like in nature we see wind, vortex, motor, etc. they are used for making the effects similar to their names.

PdynaFlect, UdynaFlect, SdynaFlect, PomniFlect, UomniFlect, sOmniFlect, S Deflector,U deflector,Deflector are the various deflectors available in Max

Particle View is used for the Particle Flow systems. It is used for building and modifying PF systems. There are several events in PF systems, like. The Particle Flow source is the view port. It appears as a rectangle with a central logo, by default. Its shape and appearance can be changed.

<div align="right">

MAPPING AND MATERIAL DYNAMICS

</div>

The Mapping operator lets us assign a constant UVW mapping to the entire surface of the particles. The Material Dynamic operator lets us give particles material IDs that can vary during the event. It also lets we assign a different material to each particle based on its material ID.

<div align="right">

SHAPE OPERATOR

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Here we talked about various features of shape operator like Script, Spin, Shape mark, Speed, Render, Cache, Display, Age test, Collision, Collision spawn, Find Target, Scale, Spawn, Split amount etc.

<div align="right">

TYPES OF TEST

</div>

The test checks if the particles satisfy one or more conditions and then sends them to another event such as Find target, Collision, Collision spawn.

9.15 Self-Assessment Test

Broad Questions

What is particle?Which particle systems are available in 3DS MAX?

What is PF source?What is the difference between other particle systems and particle flow (PF)source?

What is the use of PF source?Which are the special features of particle flow (PF)source?

Short Notes

Age test

Particles in 3DS MAX

Speed by surface operator.

Rotation operator

Primary operator in particle

9.16 Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make a scene with different types of particle systems in 3DS MAX. Try to make more particle systems with various effects in the scene.

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Unit 4   Reactors and Utilities

	Learning Outcome

After going through this unit, you will learn:

Use Reactors, Dynamics, Mass, Elasticity, Friction

Use Un-yielding, Phantom, Concave and convex mesh, Simulation
geometry Use Showing the use of reactors - Rigid body collection

Use Cloth collection, Soft body collection

Use Property editor, Preview animation, Create animation

Use Rope collection, Wind, Toy Car, Fracture, Water

Use Utilities - Asset browser, Polygon counter, Level of detail, Motion capture

	Time Required to Complete the unit

The time required to study this Unit is broken as follows:

1st Reading: It will need 2 Hrs for reading

2nd Reading with understanding: It will need 3 Hrs for reading and understanding

Self-Assessment: It will need 3 Hrs for reading and understanding

Assignment: It will need 4 Hrs for completing an assignment

Revision and Further Reading: It is a continuous process

	Content Map

10.1   Introduction to Reactor

10.2   Understanding Reactor

10.3   Physical Property

10.1 Introduction to Reactor

In this Unit, you will learn about the uses of reactors, dynamics and utilities. Here we will discuss the uses of all these things in order to produce a variety of applications and effects in a 3D scene.

We will also see several examples related to all of them. We will talk about the various types of rectors available in 3DS MAX as well as the utilities available in the software for more flexible work.

10.2 Understanding Reactor

The reactors controls and simulates complex physical scenes.Reactor supports fully built-in rigid and soft body dynamics, cloth and fluid simulation.

Characteristics of the reactors:

Reproduce constraints and joints for bodies that has expressions.

The physical behaviors such as wind and motors.

Rich dynamic environments can be created by these dynamics.

Use of the reactors:

Saves time

Frees manual stress of animation

Helps us to reduce the key frame

Reactor Toolbar:

The reactor toolbar is a useful way to access much of reactor. It has enables us quickly create constraints and helpers.

Dynamics:

Dynamics is a system that creates keys to make animation that simulates real-world.

Preview and Animation:

Runs and has a preview over the reactor simulation.

Frames / Key: Defines the number of frames for each key frame.

Sub steps / Key: The amount of simulation.

Time Scale: Maps the time between simulation and scene.

Create Animation: Creates physical simulation.

Update View ports: Updates the scene in the view ports.

Create List / Layer: Displays a list of controller.

Preview Animation: Helps to have a preview of the simulated scene.

The simulations are depended on:

Gravity

World Scale

Collision Tolerance

Add Deactivator

Deactivator Short/Long Frequency

Add Drag Action

Do Not Simulate Friction

Fracture Penetrations

Collisions rollout: This lets us to accumulate collision details from the scene and lets we enable and disable collision detection for specified pairs of objects

Display rollout: This specifies the display options for previewing the simulation.

This includes the cameras and lighting.

The options for the camera are:

Pick Camera

Camera Clipping Planes

Pick Lights

Texture Quality

Mouse Spring

Stiffness

Damping

Rest Length

DirectX

Utilities rollout: This analyses and optimises the simulation.

Properties rollout: These properties allow us to assign physical properties to a rigid body or a RBC.

The friction values for both objects are shared to produce a coefficient for the contact.

Elasticity: This value governs the bounciness of object.

Inactive: This will start the simulation in an "Inactive state".

Reactor proxies one object for another. This is done in 2 ways

Geometry proxies

Display proxies

⚠	Study Notes

👁	Assessment
	Define and explain reactors and their uses.
	Write note on Friction.

 	Discussion
Discuss reactors and their uses.	

10.3 Physical Property

TYPES OF BODIES:

1. Rigid Body:

    Rigid bodies are the building blocks of reactor simulations.

2. Deformable Body:

    This can be used for the shapes that do not change over time. It allows the objects to bend, flex, or stretch in the world simulation.

    The physical properties, simulation geometry can be assigned to a rigid body using the Rigid Body Properties rollout or dialog.

MASS

A rigid body's mass controls the object interaction with other objects. When the mass is set to 0.0 the object remains fixed in space during the simulation, although other objects will be able to collide with it.

FRICTION

The coefficient of friction for the object's surface. This affects how smoothly the rigid body moves relative to surfaces it is in contact with.

ELASTICITY

This value governs the effect collisions have on the velocities of the rigid body

INACTIVE

The rigid body starts the simulation in an inactive state. This means it requires interaction with another object or system, or the mouse, before it becomes active in the simulation.

This is used for the objects for which you want to make key frame animation and that animation gives preview in the havoc player too with the reactors.
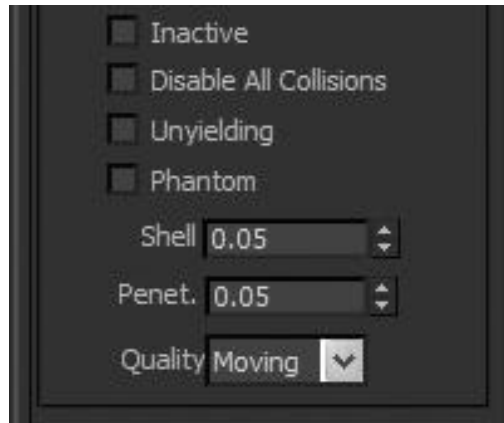

Fig. 10.1: Physical Property

Simulation Geometry:

Here you will define which type of geometry will be of the object at the time it will respond to another object and how it's surface and geometry will be counted like- box, sphere or anything else.
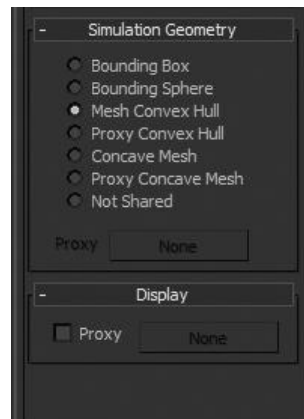

Fig. 10.2: Simulation Geometry

👁	Assessment
	Explain simulation geometry and their uses.
	Write a note on the Physical property of Rigid Body.

🗣	Discussion
	Discuss various types of simulation geometry and their uses.

10.4 Reactor Helper Object Part 1

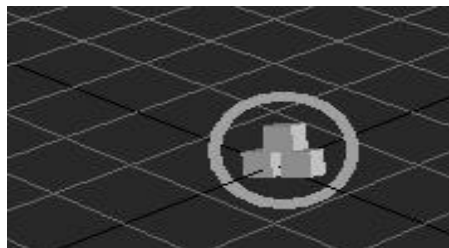Rigid Body Collection:This specifies the objects as the building blocks of physical scenes.

Fig. 10.3: Rigid Body Collection

Cloth Collection:This collection is a helper object that acts as a container for cloth objects.
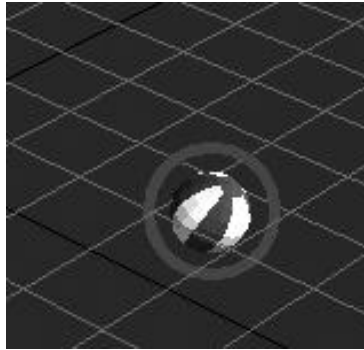
Fig. 10.4: Soft Body Collection

Soft Bodies: This modifies meshes. The soft bodies have a concept of shape.

Soft Body Modifier:The soft body modifier lets us to turn a rigid body into a deformable mesh. It turns the object into 3D closed triangular mesh.

Soft Body Collection:The soft body Collection is an object that acts for soft bodies.

Cloth objects in reactor are two-dimensional deformable bodies.

Cloth Modifier:The cloth modifier us to turn any geometry into a deformable mesh.

Fig. 10.5: Cloth Body Collection

🔔	Study Notes

⊙	Assessment
Explain uses of soft body collector.	
What is cloth collector?	

🗣	Discussion
Discuss uses of soft, rigid and cloth body.	

10.5 Reactor Helper Object Part 2
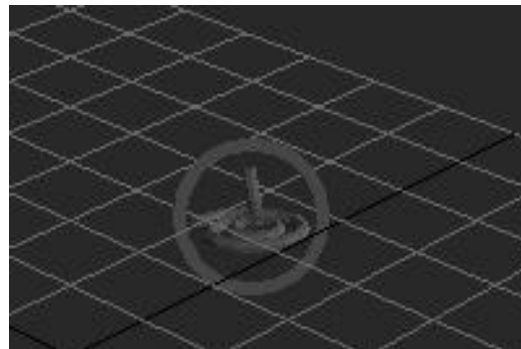
Fig. 10.6: Rope Body Collection

The Rope Collection:

It is a reactor helper object that serves as a container for ropes. Once the Rope Collectionis add in the scene, many ropes can be added in the scene to the collection. The rope collection icon is added to the sceneand in two ways rigid bodies can be added to the collection: by picking or by using a selection list.

Rope are 1-dimensional deformable bodies. This converts any spline object into reactor

Wind Collection:

The Wind helper allows us to add wind effects to the scenes.

Fig: 10.7: ROPE BODY COLLECTION FINAL

Toy Car Collection:The reactor toy car is a quick way to simulate a simple car.

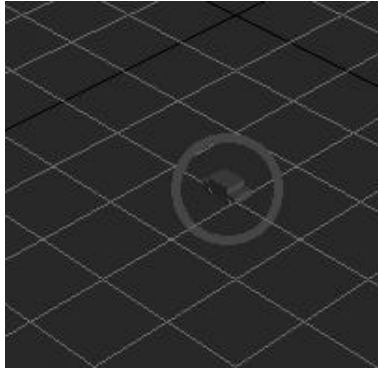Fig. 10.8: Toy Car Collection

Fracture Collection:This is used to make a brewaking collection of object chunks like bricks, stone fragments, etc.
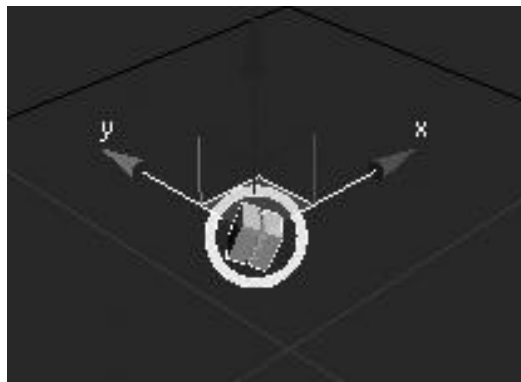
Fig. 10.9: Fracture Reactor

Water Collection:This is used for making water simulation with any object colliding with it.
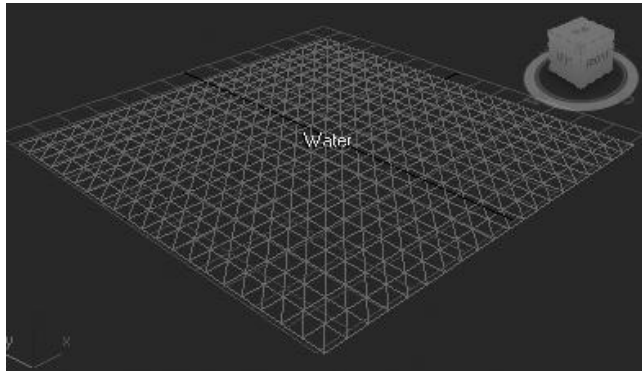
Fig. 10.10: Water Reactor

![bell icon]	Study Notes

![eye icon]	Assessment
	Explain the toy car collector and their use.
	Explain fracture and water reactors and their uses.

![head icon]	Discussion
	Discuss the rope, toy car, fracture and water reactors and their uses.

10.6 Preview Animation
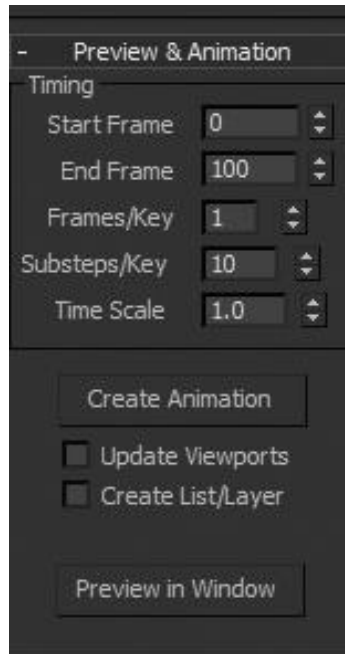
Fig. 10.11: Preview Animation

Here you can see the preview of the animation in havoc player. Remember if you directly press the button of create animation then the operation will be not able to undo afterwards. Therefore, if the final animation is ready then only press create animation button.

Here default frames for preview are 100 so if you need preview of more than 100 frames then go and change the frame number of the same in utilities > reactors> preview and animation

![bell]	Study Notes

👁	**Assessment**

Explain uses of Preview animation window.

🗣	**Discussion**

Discuss uses of Preview animation.

10.7 Utilities Panel

The Utilities panel gives you access to a variety of utility programs. 3ds Max utilities are provided as plug-ins. Some utilities are available from third-party developers

1. ASSET BROWSER:
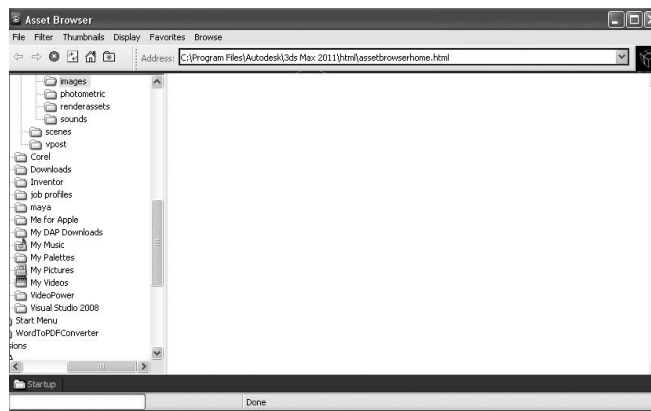
Fig. 10.12: Asset Browser

The "Asset Browser" allow us to generate the files from your machine to the Internet. In here the textures with the below stated formats:

BMP

JPG

TIF

GIF

TGA

AutoCAD DWG Files

IGES Files

AVI Animation File

BMP Image File

Kodak Cineon

AutoDesk FLIC Animation File

GIF Image File

IFL Image File

JPEG File

PNG Image File

Adobe PSD File Reader

MOV QuickTime File

SGI's Image File Format

RLA Image File

RPF Image File

Targa Image File

TIF Image File

YUV Image File

Name

Type

Size

Date

2. POLYGON COUNTER

Calculates the number of polygon in geometry
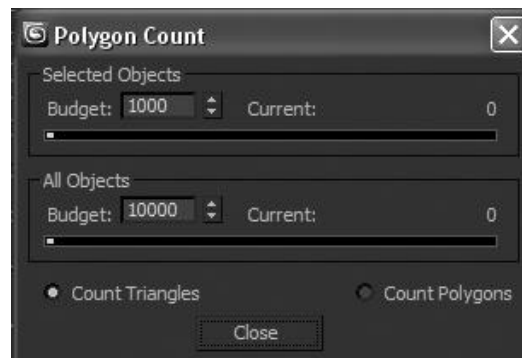
Fig 10.13: Polygon Counter

3. LEVEL OF DETAIL

The "LOD" utility creates an object that warns its geometric complexity. It is based on the size of the rendered image.

Create New Set: Creates a new LOD set based on a selected group object.

Add To Set: Adds an object to the new set.

Remove from Set: Removes the highlighted object.

Width / Height: Sets the width and height as per the current rendering output dimensions.

Reset to Current: Resets the values to the current rendering output dimensions.

List window: Displays all of the objects in the group.

Display in View ports: Displays the highlighted object in the view port.

Fig. 10.14: Level of detail

4. MOTION CAPTURE

Digitally capturing the data and transferring them to the computer for the further analysis the data for animation is called "Motion capturing".

In here the position, rotation and other related parameters can be controlled with the external device like mouse keyboard, joystick or through any selected MIDI file.

This uses Euler rotations with the X, Y and Z-axis.

Types of capturing the data are stated below:

Optical sensing technology

Electro-magnetic sensing technology

Prosthetic sensing technology
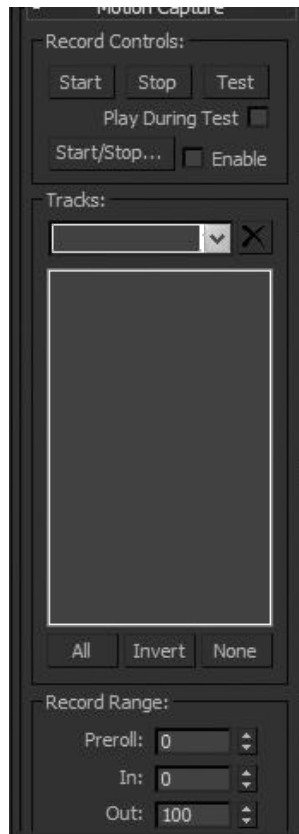
Acoustic sensing technology

Fig. 10.15: Motion Capture

	Study Notes

	Assessment
Explain the use of utilities like motion captureand their uses. Explain polygon counter and their uses	

	Discussion
Discuss the use of utilities like motion capture, polygon counter etc. and their uses.	

10.8 Summary

INTRODUCTION TO REACTOR

In this unit you will learn about the uses of reactors, dynamics and utilities. Here we wilDiscuss the uses of all these things in order to produce a variety of applications and effects in a 3D scene.

UNDERSTANDING REACTOR

The reactors controls and simulates complex physical scenes.Reactor supports fully built-in rigid and soft body dynamics, cloth and fluid simulation such as Reactors, Dynamics, Mass, Elasticity, Friction

PHYSICAL PROPERTY

A rigid body's mass controls the object interaction with other objects. Mass. Friction, elasticity, Un-yielding, Phantom, are some of the physical property.

REACTOR HELPER OBJECT PART 1

Rigid body collectionCloth collection, Soft body collection are explained in this section.

REACTOR HELPER OBJECT PART 2

Here Rope collection, Wind, Toy Car, Fracture, Water are explained in this section.

Here you can see the preview of the animation in havoc player. Remember if you directly press the button of create animation then the operation will be not able to undo afterwards.

The Utilities panel gives you access to a variety of utility programs. 3ds Max utilities are provided as plug-ins. Some utilities are available from third-party developers. Utilities includes - Asset browser, Polygon counter, Level of detail, Motion capture

10.9 Self-Assessment Test

Broad Questions

What are reactors? What is the use of rope collection?

What is the use of utilities?What is polygon counter?

What is the use of toy car?What is the method of using fracture?

Short Notes

Reactors

Utilities

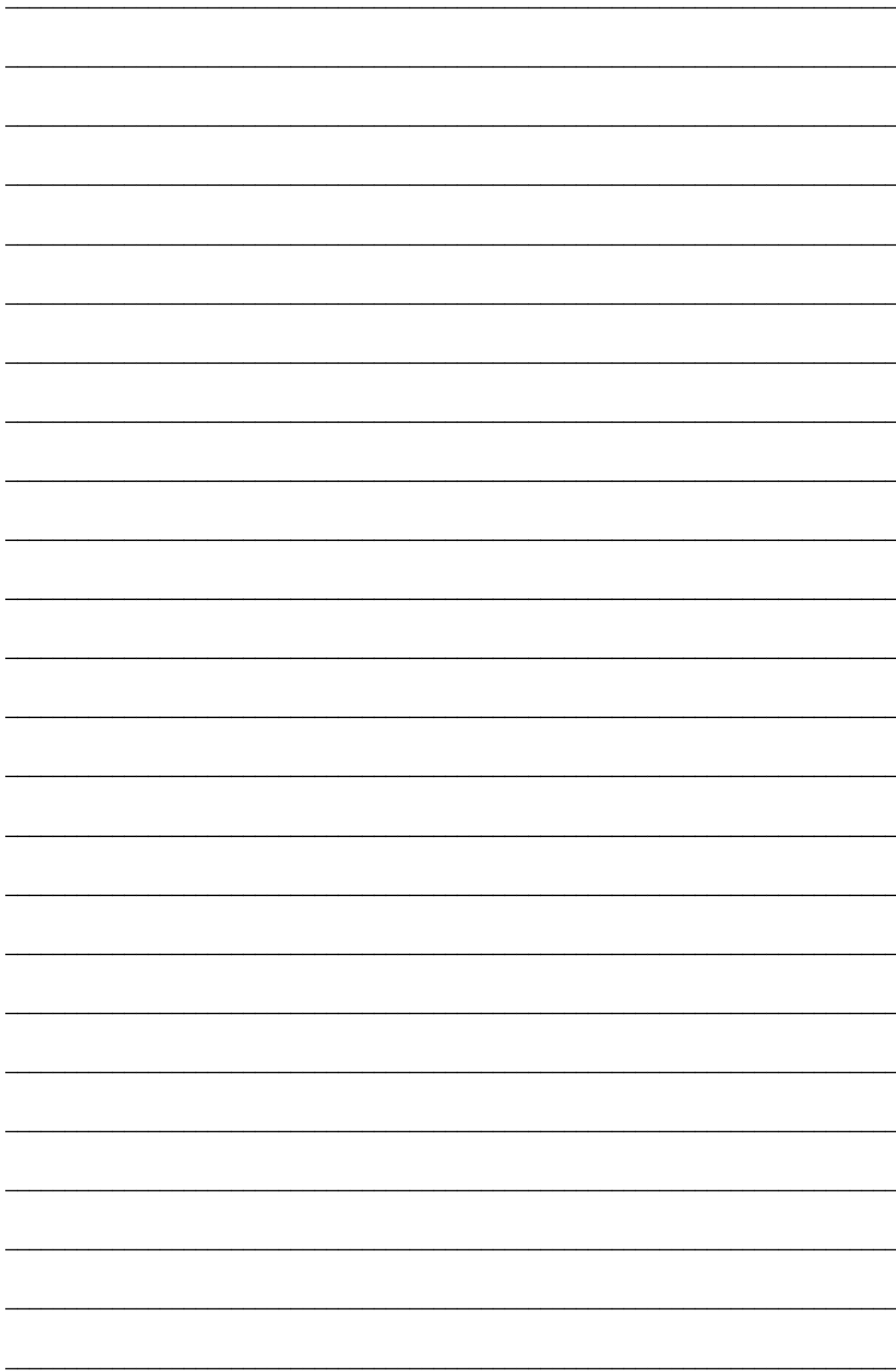Soft body collection

Asset browser

Toy car reactor

10.10Further Reading

1. 3ds Max 2011 Bible, Kelly L. Murdock

Assignment

Make an animation of water simulation, car race, rope or cloth falling with the use of reactors.

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Glossary

Ambient	This is the lightness of a color.
Bump	This is the roughness of any object's surface.
Camera	This is an equipment that is used for shooting a movie
Light	This is an energy that is made of photons.
Map	This are ready made materials given in 3dsm ax that cna be modified further.
Material	It is the texture of object's surface
Raytrace	This is the calculation of photons bounced or reflected by an object.
Refletion	This is the bounced back light from an object that makes an impression.
Reactors	These are plug in given with presets in 3ds max for animation of certain objects with respected properties.
Environment	The environment is the surrounding of any scene in 3D.
Photometric Lights	Photometric lights are based on photometric values, which are the values of light energy.
Sky Light	The Skylight light models daylight. It is meant for use with the Light Tracer.
Light Tracer	Light tracer is used for calculating realistic light and shadows with sky lights as well as other lights in open environment scenes.
Indirect Illumination	This is the calculation of light and its photons which are bounced by one object and get on to another in the environment.
Caustics	Caustics are the effects of light cast onto an object via reflection off or refraction through another object
Global Illumination	Here we talked about the global illumination that includes direct and indirect illumination for a realistic result of lights in a 3D scene.

Final Gather	It 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.
Depth of Field	Here the main object that is taken at the target distance remains clear to the vision of the camera or vice versa.
RAM Player	This is a player given along with 3DS Max which can be used for opening and checking any image or avi file after rendering it.
Position Controllers	The Position controllers Parameters rollout provides tools for creating and deleting keys. PRS stands for the 3 basic transform controllers: Position, Rotation, Scale.
Rotation Controllers	It make animation of rotations for any selected object.
Scale Controller	scale controllers used to control and make animation of X, Y, Z scale for any selected object.
Attachment Constraints	The Attachment constraint is a position constraint that attaches an object's position to a face on another object.
Path Constraint	It positions the service platform along the side of the bridge. A path constraint restricts an object's movement along a spline.
Bones and Hierarchy	A Bones system is a joint hierarchical linkage of bone objects that can be used for animating character models that have a continuous skin mesh.
Skinning	Skinning works on the principle of moving one or more vertices of a mesh object in a weighted manner like "deformer" gizmos to cause it to deform locally.
Gravity Space Warp	The Gravity space warp simulates the effect of natural gravity on particles generated by a particle system.
Shape Operator	3D Max features of shape operator like Script, Spin, Shape mark, Speed, Render, Cache, Display, Age test, Collision, Collision spawn, Find Target, Scale, Spawn, Split amount etc.