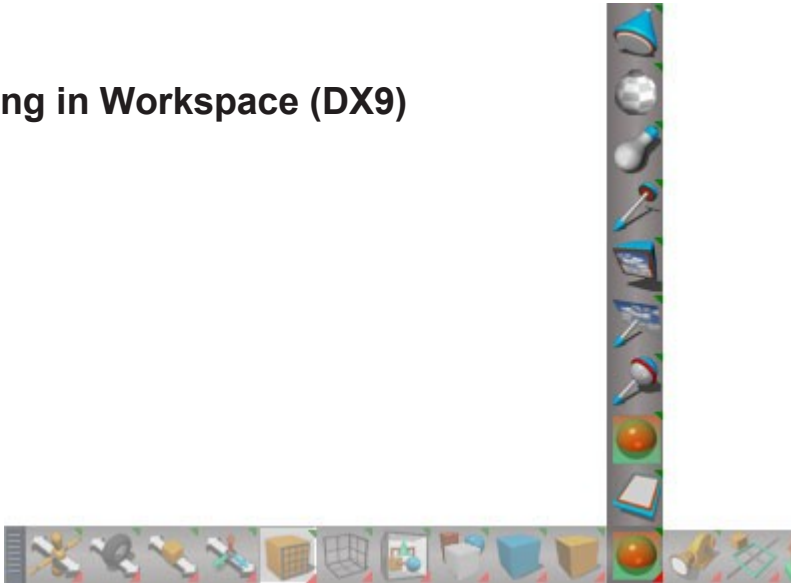


Chapter7 Lighting and Rendering 2

7.1 Lighting in Workspace (DX9)	2
7.1.1 Real-time Light Types.....	3
7.1.2 Examples	10
7.1.3 Working With The Real-time Shadow Parameters.....	13
7.1.4 Shadowing improvements.....	17
7.1.5 Real-time Post Processing.....	20
7.1.6 Real-time Light Libraries.....	24
7.1.7 Real-time Render To File.....	25
7.2 Lighting in the Model side (LightWorks and Virtualight)	27
7.2.1 Tutorial: A Basic Lighting Setup.....	27
7.2.2 Light Types and Parameters.....	30
7.2.3 Light Options	38
7.2.4 Tutorial: Interior and Exterior Lighting.....	42
7.2.5 Radiosity	43
7.2.6 HDRI	54
7.3 LightWorks Render Preferences	64
7.3.1 Render Toolbar	64
7.3.2 Output Options Group.....	68
7.3.3 Quality Settings.....	71
7.3.4 Rendering Visibility.....	72
7.3.5 Anti-Aliasing	74
7.3.6 Raytracing Options.....	76
7.3.7 Lightworks Post-Processing Settings.....	78
7.3.8 Multi-pass Rendering.....	97
7.4 Virtualight Render Preferences	105
7.6 Quicktime VR	121

Chapter7 Lighting and Rendering

7.1 Lighting in Workspace (DX9)



7.1.1 Real-time Light Types

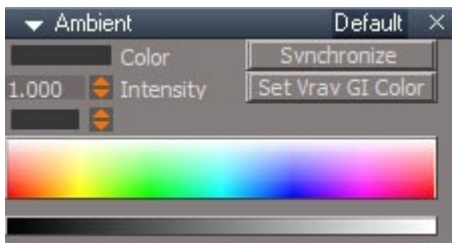


Ambient light

Ambient light provides equal lighting conditions for every pixel of the scene.



- **Color** – Controls the color (and intensity) of the light.



Omnidirectional light

Omnidirectional lights cast the same amount of light in rays starting at the center of the light and emanating in all directions equally.



- **Color** – Controls the color (and intensity) of the light.
- **AttConstant** – Constant attenuation does not depend on distance. Values greater than 1.0 will make the light darker (2.0 means half intensity), and values in the range 0..1 will make the light brighter (0.5 means double intensity).
- **AttLinear** – Specifies a linear attenuation coefficient. The light grows less intense with distance, with a linear relationship between distance and intensity.
- **AttQuadratic** – Specifies a quadratic attenuation coefficient. The light grows less intense with distance, with a relationship to the square of the distance (light will grow less intense more rapidly than with a linear attenuation).

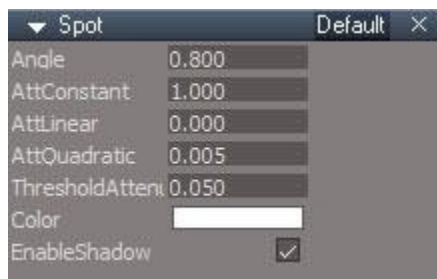
- **ThresholdAttenuation** – This specifies a final light intensity that is considered as zero – any pixel in an area with intensity of less than this value is considered “not lit”. This parameter acts to speed up the processing of the light (a higher value will class more points as unlit, and so reduce processing).

The various attenuations can be freely mixed to produce the desired attenuation level and behavior.



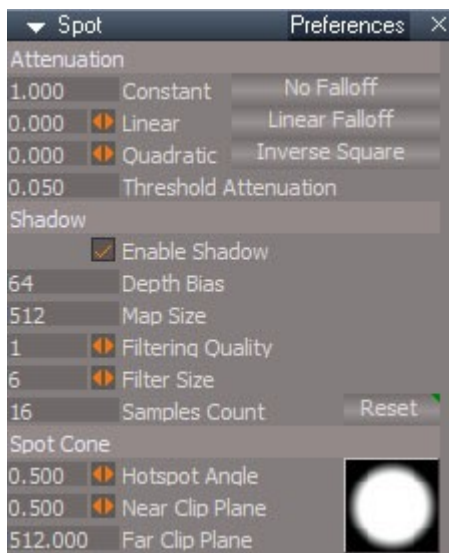
Spotlight

A Spotlight works the same way as an Omnidirectional light, but its area of incidence is limited to a **cone** with a radius set by the *Angle* parameter. A Spotlight can also have shadows in real-time. The number of active shadow casting lights may be limited by your video card’s memory.

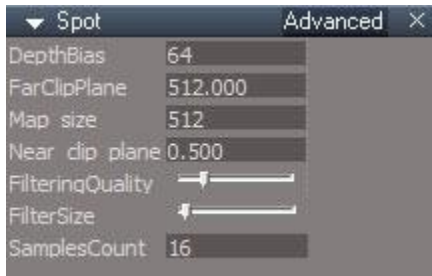


- **Angle** – Controls the radius of the cone of light.
- **AttConstant** – Constant attenuation does not depend on distance. Values greater than 1.0 will make the light darker (2.0 means half intensity), and values in the range 0..1 will make the light brighter (0.5 means double intensity).
- **AttLinear** – Specifies a linear attenuation coefficient. The light grows less intense with distance, with a linear relationship between distance and intensity.

- **AttQuadratic** – Specifies a quadratic attenuation coefficient. The light grows less intense with distance, with a relationship to the square of the distance (light will grow less intense more rapidly than with a linear attenuation).



- **ThresholdAttenuation** – This specifies a final light intensity that is considered as zero – any pixel in an area with intensity of less than this value is considered “not lit”. This parameter acts to speed up the processing of the light (a higher value will class more points as unlit, and so reduce processing).
- **Color** – Controls the color (and intensity) of the light.
- **Enable Shadow** – If checked, the light will cast shadows in real-time. Shadow parameters are found in the Advanced aspect.

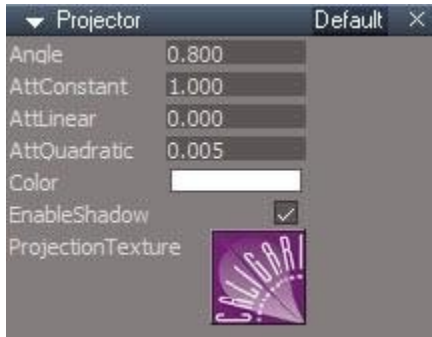


- **Depth Bias** –The main effect is to reduce the moiré pattern artifacts that appear based on the Near Clip Plane parameter. See section 7.1.3 for full details.
- **Far Clip Plane**– Specifies the maximum distance from the light that is still lit. See section 7.1.3 for full details.
- **Map Size** –Larger values give better shadows. See section 7.1.3 for full details.
- **Near Clip Plane** – Specifies the minimum distance of a point from the light source that has lighting calculations performed for it. See section 7.1.3 for full details.
- **Filtering Quality**– Controls the quality of shadows. Setting this to maximum activates Poisson disk shadows if supported by your hardware. See section 7.1.3 for full details.
- **Filter Size** – Only has an effect when Filtering Quality is set to maximum. Larger values give a softer edge to the shadow, but may need a higher samples count. See section 7.1.3 for full details.
- **Samples Count** – Only has an effect when Filtering Quality is set to maximum. Larger values increase the accuracy of soft edges shadows, but at the expense of more processing being required from the GPU. See section 7.1.3 for full details.

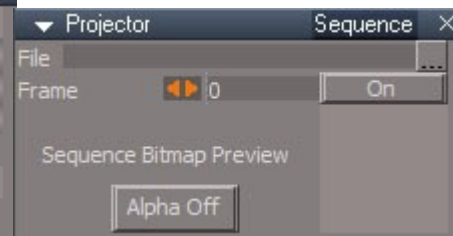
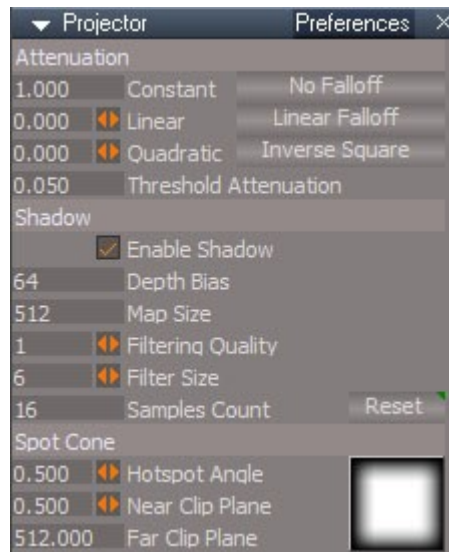


Projector light

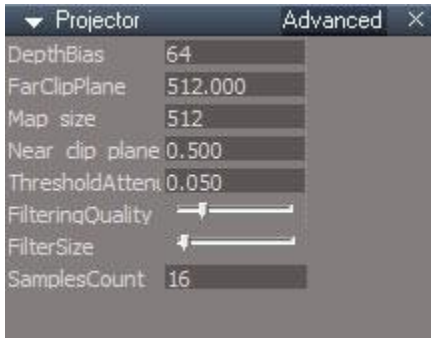
Projector lights are a special implementation of spotlights that project a user-defined texture into the scene. Projector lights have all of the same parameters as Spotlights and also include a new one called *Projection Texture* that specifies the image the light is to project. Like Spotlights, they can cast real-time shadows. The number of active shadow casting lights may be limited by your video card's memory.



- **Angle** – Controls the radius of the square of light.
- **AttConstant** – Constant attenuation does not depend on distance. Values greater than 1.0 will make the light darker (2.0 means half intensity), and values in the range 0..1 will make the light brighter (0.5 means double intensity).
- **AttLinear** – Specifies a linear attenuation coefficient. The light grows less intense with distance, with a linear relationship between distance and intensity.
- **AttQuadratic** – Specifies a quadratic attenuation coefficient. The light grows less intense with distance, with a relationship to the square of the distance (light will grow less intense more rapidly than with a linear attenuation).
- **Color** – Controls the color (and intensity) of the light. Note that this color will combine with the colors contained within the Projection Texture (think of it as shining a light of this color through a transparent sheet with the image on it).
- **Enable Shadow** – If checked, the light will cast shadows in real-time. Shadow parameters are found in the Advanced aspect.



- **Projection Texture** – Sets the image that the light will project.



- **Depth Bias** – The main effect is to reduce the moiré pattern artifacts that appear based on the Near Clip Plane parameter. See section 7.1.3 for full details.
- **Far Clip Plane** – Specifies the maximum distance from the light that is still lit. See section 7.1.3 for full details.
- **Map Size** – Larger values give better shadows. See section 7.1.3 for full details.
- **Near Clip Plane** – Specifies the minimum distance of a point from the light source that has lighting calculations performed for it. See section 7.1.3 for full details.
- **Threshold Attenuation** – This specifies a final light intensity that is considered as zero – any pixel in an area with intensity of less than this value is considered “not lit”. This parameter acts to speed up the processing of the light (a higher value will class more points as unlit, and so reduce processing).
- **Filtering Quality** – Controls the quality of shadows. Setting this to maximum activates Poisson disk shadows if supported by your hardware. See section 7.1.3 for full details.
- **Filter Size** – Only has an effect when Filtering Quality is set to maximum. Larger values give a softer edge to the shadow, but may need a higher samples count. See section 7.1.3 for full details.
- **Samples Count** – Only has an effect when Filtering Quality is set to maximum. Larger values increase the accuracy of soft edges shadows, but at the expense of more processing being required from the GPU. See section 7.1.3 for full details.



Directional light

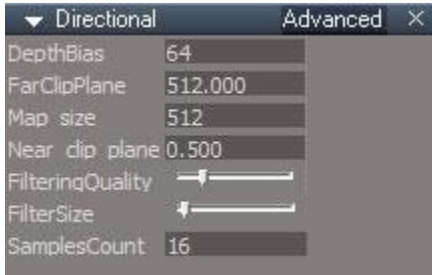
Directional lights cast light rays only in one direction and only within a **cylinder** shape specified by the *Size* parameter. Attenuation parameters work the same as for Omnidirectional lights. Like Spotlights and Projector Lights, Directional lights can cast shadows.



- **Size**– Controls the radius of the cylinder of light.
- **Color** – Controls the color (and intensity) of the light.
- **AttConstant** – Constant attenuation does not depend on distance. Values greater than 1.0 will make the light darker (2.0 means half intensity), and values in the range 0..1 will make the light brighter (0.5 means double intensity).

- **AttLinear** – Specifies a linear attenuation coefficient. The light grows less intense with distance, with a linear relationship between distance and intensity.
- **AttQuadratic** – Specifies a quadratic attenuation coefficient. The light grows less intense with distance, with a relationship to the square of the distance (light will grow less intense more rapidly than with a linear attenuation).
- **Threshold Attenuation** – This specifies a final light intensity that is considered as zero – any pixel in an area with intensity of less than this value is considered “not lit”. This parameter acts to speed up the processing of the light (a higher value will class more points as unlit, and so reduce processing).
- **Enable Shadow** – If checked, the light will cast shadows in real-time. Shadow parameters are found in the Advanced aspect.





- **Depth Bias** –The main effect is to reduce the moiré pattern artifacts that appear based on the Near Clip Plane parameter. See section 7.1.3 for full details.
- **Far Clip Plane**- Specifies the maximum distance from the light that is still lit. See section 7.1.3 for full details.
- **Map Size** – Larger values give better shadows. See section 7.1.3 for full details.
- **Near Clip Plane** – Specifies the minimum distance of a point from the light source that has lighting calculations performed for it. See section 7.1.3 for full details.
- **Filtering Quality**– Controls the quality of shadows. Setting this to maximum activates Poisson disk shadows if supported by your hardware. See section 7.1.3 for full details.
- **Filter Size** – Only has an effect when Filtering Quality is set to maximum. Larger values give a softer edge to the shadow, but may need a higher samples count. See section 7.1.3 for full details.
- **Samples Count** – Only has an effect when Filtering Quality is set to maximum. Larger values increase the accuracy of soft edges shadows, but at the expense of more processing being required from the GPU. See section 7.1.3 for full details.

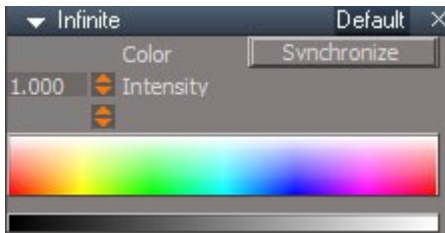


Infinite light

Infinite lights are directional and cast light rays in one direction without any size limitations. The light is spread evenly and directionally within the scene. The infinite light has only the *color* parameter.



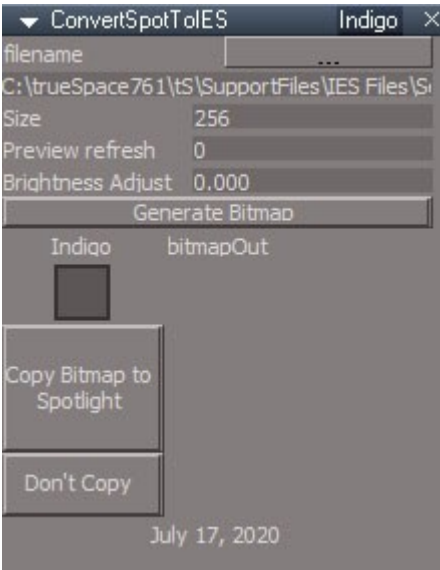
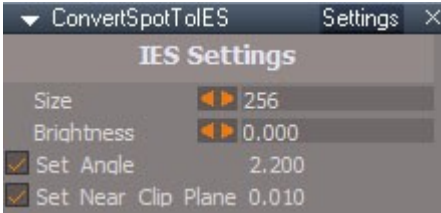
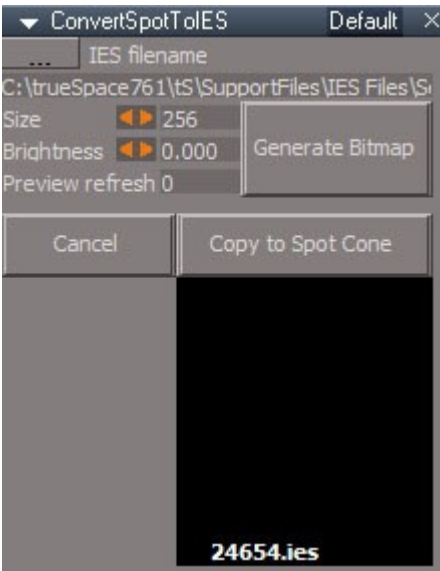
- **Color** – Controls the color (and intensity) of the light.





IES Profile / Spot Cone

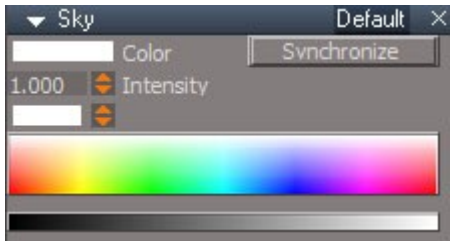
Infinite lights are directional and cast light rays in one direction without any size limitations. The light is spread evenly and directionally within the scene. The infinite light has only the *color* parameter.





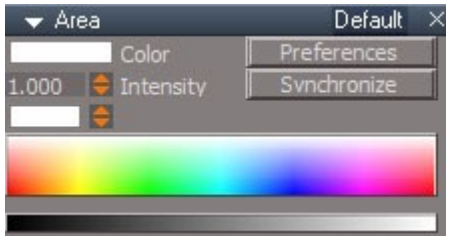
Sky

Infinite lights are directional and cast light rays in one direction without any size limitations. The light is spread evenly and directionally within the scene. The infinite light has only the *color* parameter.



Area

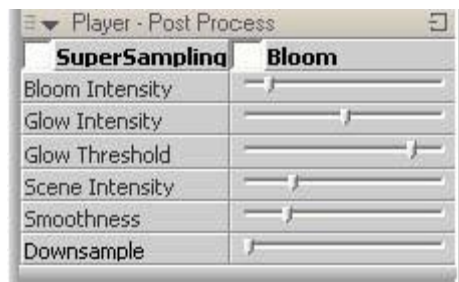
Infinite lights are directional and cast light rays in one direction without any size limitations. The light is spread evenly and directionally within the scene. The infinite light has only the *color* parameter.





7.1.5 Real-time Post Processing

Workspace supports real-time post-processing of rendered images to achieve better and more atmospheric images. The post-processing settings panel can be displayed by switching to the Preferences aspect  of the Stack View while the workspace window is active. The following image shows the post-processing settings panel in its default state.



Post-processing panel in the default state.

Supersampling

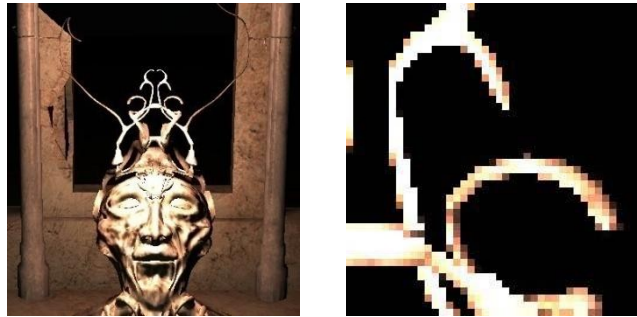
Supersampling can be used to produce anti-aliased images. The scene is rendered at double the resolution and is then down-sampled to the original resolution. The down-sampling process averages every four pixels (2x2 pixel regions) of the double-sized image and uses this average value as the pixel color in the final image. The resulting rendered scene is shown with anti-aliased edges.

The cost of such a process is that it requires more video card memory to store the double-sized image, and it also renders four times more pixels than the original mode, so can be slower on some video cards and systems.

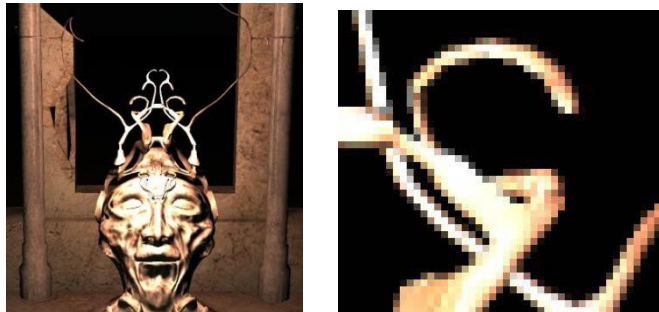
The supersampling mode relies on the capabilities of the graphics hardware, and therefore it might not work with some video cards or at certain window sizes. If the video card does not support supersampling, or if there is not enough video card memory to enable it, then the effect is silently ignored and scene is rendered without it. For example, ATI Radeon cards like the X800 and all previous versions and model modifications (X300, X600, Radeon 9700, 9800, etc.) can support surfaces up to the size 2048x2048; therefore the maximum window size for the enabled supersampling effect is 1024x1024.

If supersampling does not work after being enabled, try decreasing the size of the window. If there is enough memory then the effect will be enabled as soon as the required maximum window size is reached.

The following figures illustrate the effect of rendering with and without supersampling enabled.



Scene with supersampling disabled (left) and a detail from the scene (right).



Scene with supersampling enabled (left) and a detail from the scene (right).

Bloom effect

The bloom effect actually consists of two parts: Bloom and Glow. Both effects can be freely combined and blended when Bloom is enabled in the post-processing panel. The Bloom effect adds the appearance of a slightly over-bright, unfocused view to the scene. This can significantly change the mood of the rendered image. The Glow effect, on the other hand, finds pixels with the greatest luminance and adds the effect of very high light reflection coming from these pixels. The following figures illustrate the difference in a scene with the Bloom/Glow effect disabled and enabled (with default settings).



Scene with Bloom/Glow disabled.



Scene with Bloom/Glow enabled.

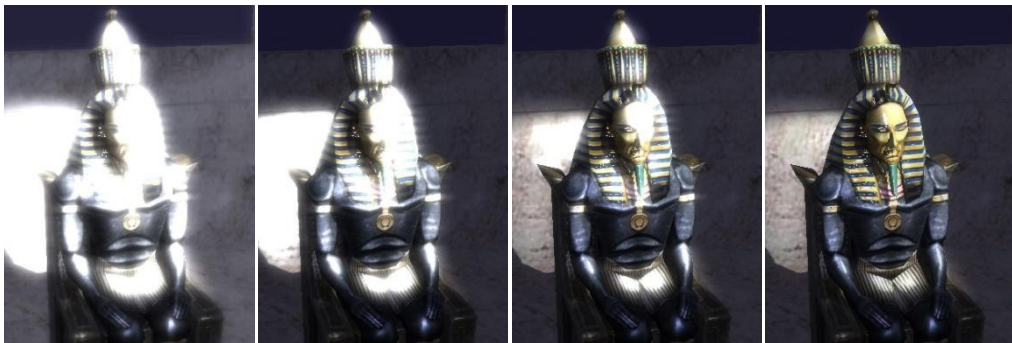
Bloom/Glow Settings

The *Smoothness* slider controls the smoothness of both the bloom and glow effects. The higher the Smoothness value, the wider the area of the screen that bloom and glow can affect. The smoothness value also directly affects the performance of the algorithm. Higher smoothness values result in slower rendering times because more filtering passes have to be applied. The following figures illustrate how different values of the smoothness parameter can affect Bloom and Glow – note how too high a smoothness setting can cause the effect to become so smoothed out as to be hard to see. In images with more intense and larger highlighted areas, the effect could be more useful than here, where the aim is to achieve a glow just off the highlights on the statue.



Minimum smoothness at left to maximum smoothness at right.

The *Glow Threshold* slider specifies the minimum luminance that is considered as a highlight. Pixels considered as highlights are processed by the Glow part of the filter. The following figures show how different values of the threshold parameter affect the Glow effect, and control which parts of the image are affected and which not.



Minimum threshold at left to near maximum threshold at right.

The final image is computed by blending three components: the bloom effect, the glow effect, and the rendered image of the original scene. The *Bloom Intensity* parameter specifies the amount of the computed Bloom that will be added to the final image. *Glow Intensity* specifies the amount of the computed Glow to be added to the image. The *Scene Intensity* parameter specifies the intensity of the original scene image.

The final parameter is the *Downsample* slider. The original image is always downsampled using the ratio specified by the Downsample slider, and the Bloom and Glow effects are performed on this smaller image. The downsampling step allows much faster computation of the effect. The slider allows you to specify three different

values. The minimum value means that the effect will be performed on an image that is half the size of the original image. The middle value downsamples to one quarter of the original size. The maximum value means the effect is processed on an image one eighth of the original image size.

The downsampling step not only allows you to use a smaller image for the effect (and therefore significantly faster rendering speeds), but it can be also used to produce wider Bloom and Glow effects in place of the smoothness slider (while the smoothness slider decreases the speed of the rendering, downsampling actually increases it, but the trade off is that the result is less accurate).

The following figures illustrate how downsampling affects the image – note how the highlights are more clearly and sharply defined with less downsampling (you can see the difference between the individual gold and blue stripes on the mask), while more downsampling smooths out the highlights until they can barely be seen.



Minimum downsampling at left to maximum downsampling at right.

7.1.6 Real-time Light Libraries



The light library.

You can create light libraries to store your favorite lighting set ups, which you can then apply to any scene with the click of a button. The default light library that comes installed with trueSpace contains a range of lighting set ups you can choose from.

You can load a saved light set up by double clicking it in the library. To save a new set up, right click in an empty space in the library and choose Insert; to replace an existing saved set up, right click on the set up and choose Replace.

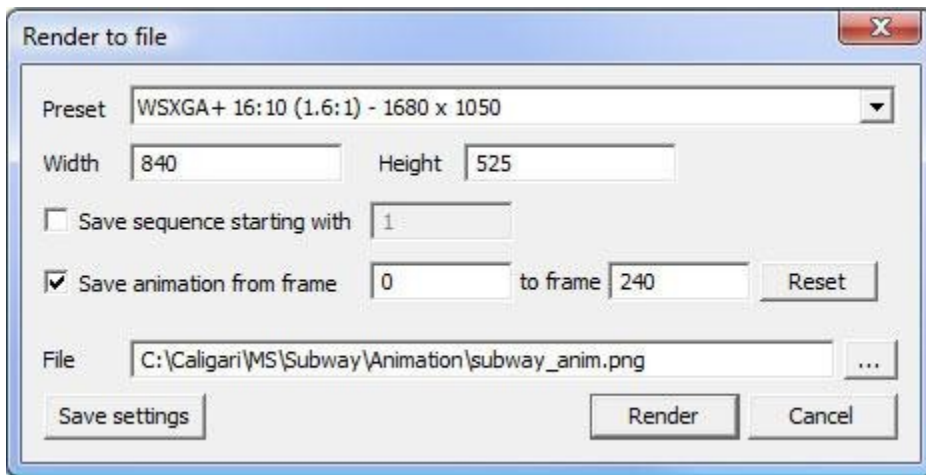
There are some important things to note about lighting set ups. First, loading a light set up will erase all lights stored at the scene level that are already present. If a light is encapsulated inside another object, then it will not be erased. Similarly, when saving a light set up, only those lights at the scene level are stored – any lights that are grouped or encapsulated inside other objects will not be saved.

7.1.7 Real-time Render To File



The capabilities of the real-time render engine are good enough to produce images and animations that you will want to keep. Not only that, but the real-time engine can let you produce 1 or 2 frames a second (on a good GPU), compared to 2 or 3 minutes per frame in an offline engine. You also get to use the anti-aliasing, supersampling, blooms and glows in the final image or animation.

To save an image or animation to file, click on the Render To File icon in the workspace (shown on the left), and this will open the save dialog (see below).



The real-time Render To File Dialog.

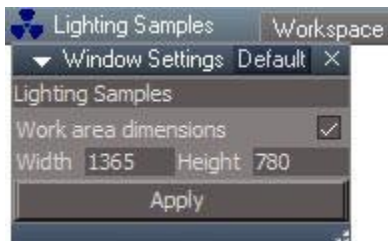
You can now, or you can enter a width and height manually. You can choose to start an image sequence at a particular number

- **Preset** – choose from a range of preset image sizes, selected to match various TV, film and video standards.
- **Width / Height** – Manually enter a particular width and height for the render.
- **Save Sequence Starting With** – This will let you render repeated images, saving them to a new file name each time without the need to manually type in a new name. This is useful if you are making a series of separate renders, perhaps from different views, or adjusting the lighting, etc. For instance, if you check this box and start at value 1, giving it a file name of MyRender, the first time you render will produce a file name MyRender1. The dialog will then update to show 2 in the Save Sequence Starting With box, and the next time you render it will be named MyRender2 automatically. If unchecked and you are rendering a single image, then no number will be

appended to the file name – in our example, you would save a file MyRender, and the next time you rendered, you would be asked if you wanted to overwrite the MyRender file (unless you type in a new name yourself in the File field). You cannot check this option and the Save Animation From Frame option at the same time.

- **Save Animation From Frame** – If checked, will render an animation from the start frame to the end frame. If unchecked, trueSpace will render just a single image. When rendering an animation, each image has the frame number appended to its file name automatically. For example, if you rendered to a filename of MyRender, then the image representing frame 0 in the animation will be named MyRender00000, and image for frame 1 would be MyRender00001, and so on. This means if you start rendering at a later frame, then your images will be numbered from that frame – e.g. if you render from frame 50, then the first image will be named MyRender00050.
- **Reset** – Will reset the From Frame and To Frame to match the range displayed in the Animation Editor. Note that this is not necessarily the same as the first and last keyframe of your animation.
- **File** – Specify the file location and name. Note that numbering will be applied to the file name if Save Animation is checked, or if Save Sequence Starting With is checked.
- **Save Settings** – Lets you capture your chosen settings so they automatically appear in the Render To File dialog next time you open it.

A Note On 3D Window Sizes



If you want to ensure your window matches the size settings for a Render To File preset, or if you want to use the size of your window in the Render To File dialog, then you can open the Window Settings dialog in the top left of your real-time window.

This dialog will let you either set your 3D window to the appropriate size by entering values and clicking on Apply, or will show you the Width and Height details to enter into the Render To File dialog.

D3D Render Scripts

TODO write up

Offline Render Engines

TODO Mention getting started with yafaray and vray render engines