Studio 'Stuff'

Welcome to Studio Stuff!

Autodesk Inventor users have long requested more information on using the Inventor Studio environment to create quality renderings for their own use. I am proud to introduce this great tutorial/article by Bill Bogan - MFG LX, Autodesk, Inc.

Lighting is the key to a dramatic and quality image, so Bill and I thought this would be a great starting point for a series.

We welcome any comments and requests for specific topics. In addition, we would love to see and publish your efforts in future issues. Publication requirements are 300dpi resolution in a minimum of 800x600 size (bigger is better). Make sure that you describe your lighting and scene specifics so that we can share with other readers. All images are credited.

Simply email your requests or submissions to **publications@teknigroup.com**, and I'll be in contact with you shortly!

- Dennis Jeffrey
Editor/Publisher

Studio Lighting Principles *- Bill Bogan*

There are basic principles of lighting that apply universally, whether you are taking photographs, lighting an office, or applying lighting styles to a digital object for rendering purposes. Those principles include light intensity, diffusion, reflection, and direction.

This article will explore those areas in preparation for learning lighting techniques that may be applied to Inventor Studio, 3D Studio Max, Alias and other digital rendering packages. Intensity:

**Download the 2010/ 2011 Dataset Here**

The Inverse Square Law

The inverse square law applies to lighting techniques when applied to digital imaging. This law states that an object that is twice the distance from a source of light will receive one fourth of the illumination emanating from the source. Light emanating from a source diminishes rapidly because it is spread out over a wider distance.

The Inventor Studio setting for Decay, establishes the use of this law and where it starts from the light source. **Decay** is accessible with point and spot lights on the respective Point or Spot tab. The following image sequence shows the comparative results of the three settings.
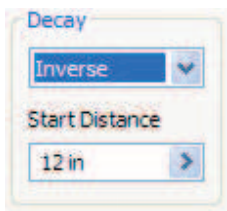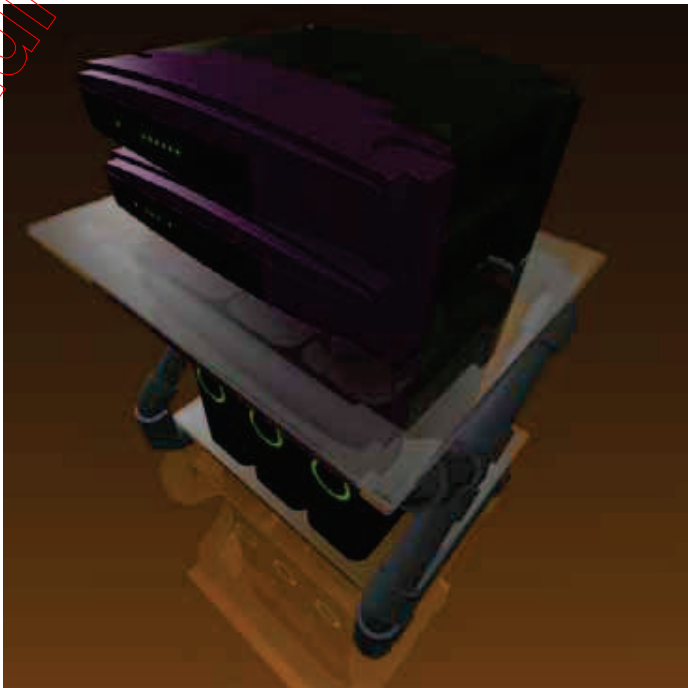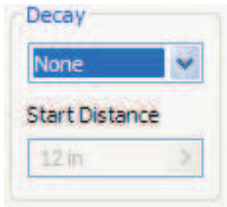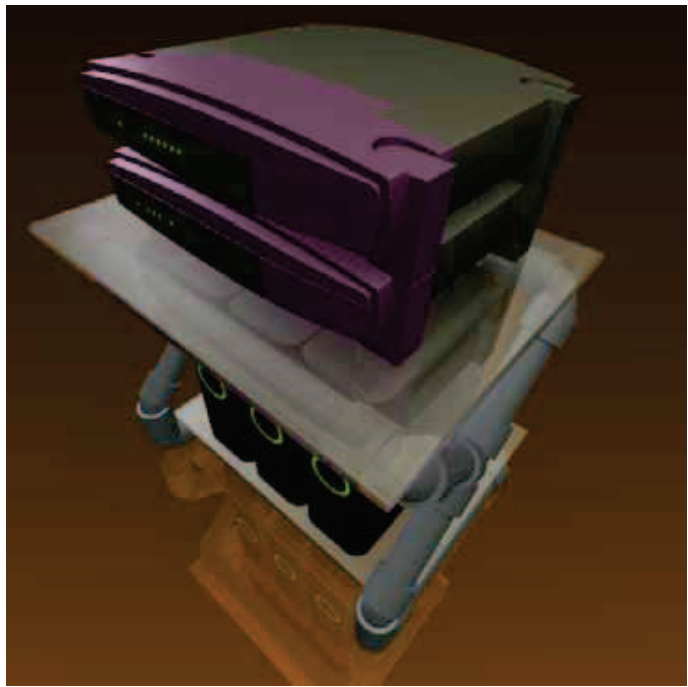

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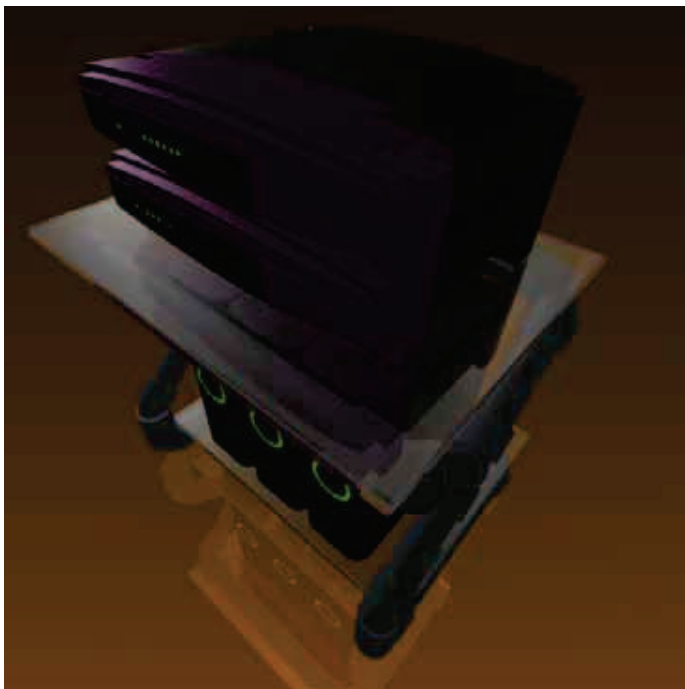
Diffusion: Broad Light Effects

When the light source is much larger in area, we call that a "Broad Light". While the light is still directed from the source, the light will be more diffused in nature, and will tend to "wrap" itself around the object, producing more diffused shadows. The amount of diffusion will depend upon the size of the light compared to the object size.
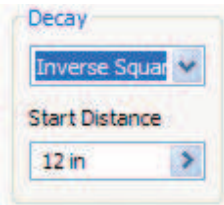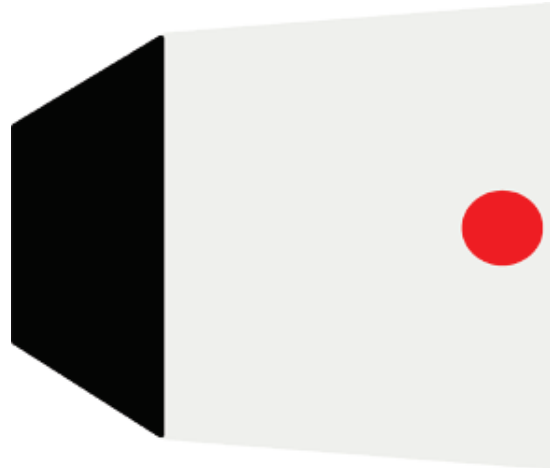
Reflection

This is a little background on light reflection. It is not meant to be authoritative or comprehensive, rather it is a brief discussion so that you can apply the information in rendering images. Light reflection is a factor of one of two types, diffuse or specular. Understanding the laws of reflection will help you get the sense of how to use of light for rendering.

Laws governing reflection state that:

1. The incident ray (the one coming from the source), the reflected ray (the one leaving the reflective surface), and the normal to the reflection surface at the point of the incidence all lie on the same plane.
2. The angle of incident ray relative to the normal is equal to the angle of reflection relative to the normal.
3. Light paths are reversible.

Diffuse Reflection

Light is energy, and when that energy strikes a surface the amount of granularity or roughness of the surface dictates how light bounces off. As surface irregularity increases the more directions the light is reflected. Since light is the means by which we see images, it makes sense that the less light reflecting into the eye the less clear the picture. That is the essence of diffuse reflection.

Specular Reflection

The lower the amount of surface roughness, the more light is reflected in the same direction resulting in our seeing the resulting image more clearly. A flat surface will form a mirror-like image and curved surfaces, while reflecting the image, magnify or demagnify areas of the image.

So, with these things in mind, let's look at how we can set up lighting in Inventor Studio to achieve a certain image.

Direction: Spotlight Effects

When a spotlight is used to illuminate an object, then the beam is precisely focused in a narrow direction, increasing the amount of light that lands on the object. As a result, from the same distance, a spotlight will provide more light in a specific area than a diffused, broader light.

In addition, a spotlight will produce a very directed light that will cast high contrast shadows around the object. Spotlights are often used for dramatic effects.
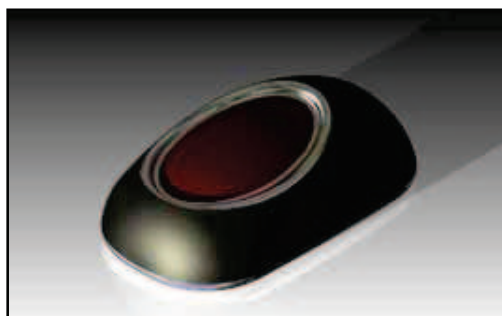
Planning the shot

There are several things to consider in planning your image, but we will save these for an article dedicated to composing a scene. The one thing we will mention is, where possible, establish the camera position for the image before the lighting. That way you can position lights in relation to the camera and reflective components.

These images demonstrate the difference. The next image has a camera angle close to the reflectance ray and is picking up the glass reflecting the light.
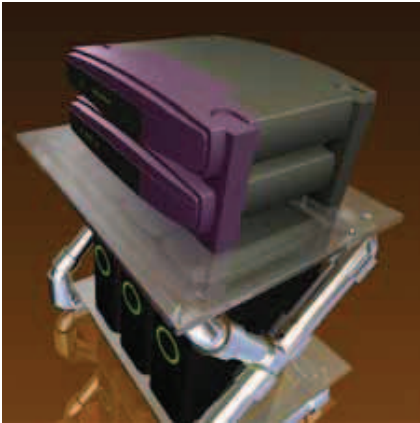
The camera for the image below is far from alignment with the reflection ray and the glass component isn't as reflective in the scene.
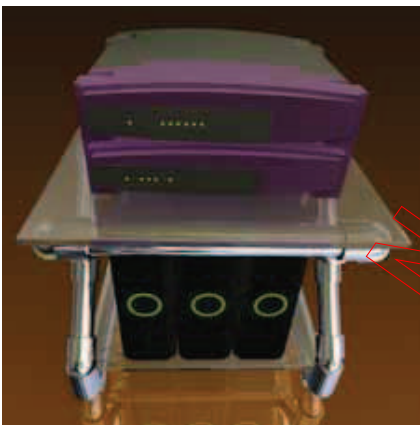
The part that Surface or Color Styles play in the scene should also be taken into consideration. Reflective parts add to the lighting, particularly when using the bounced light option.
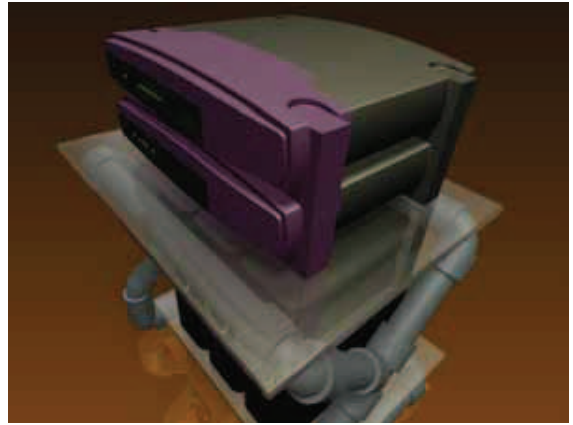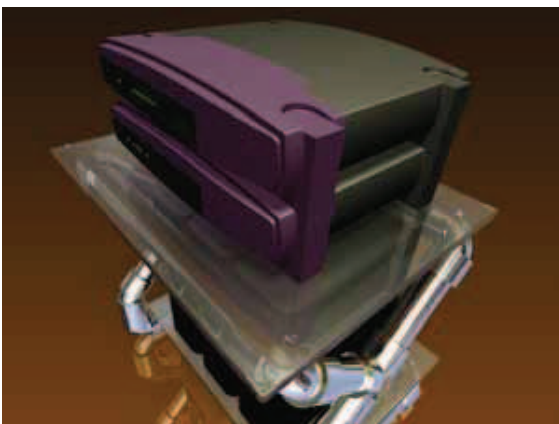
Inventor Studio - Lighting Styles

Note please, that I will not discuss every control in detail; rather, I will walk through a general process of creating the lighting for a model, adjust parameters to get better results, and conclude by rendering this image.

The Process

1. Download the dataset and unzip it into a familiar location. The dataset is 2010. If you are using an older version of Inventor, **let us know** and we'll provide an alternative - STEP, SAT, etc.

2. Open the model and go into Inventor Studio.
3. Generate a new lighting style.
4. Position the style and individual lights.
5. Modify the lighting style/light settings to meet the goals for the scene.
6. Render the image.

Along the way, I'll discuss some of the parameters and how they contribute to the image.
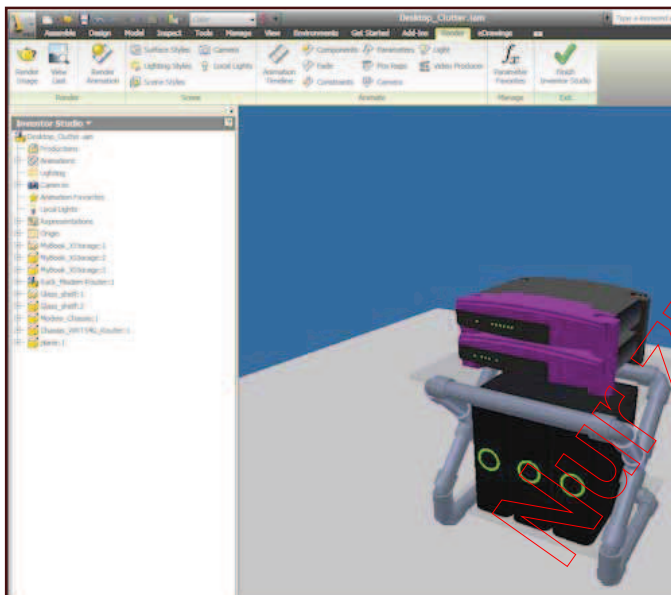
Let's get started

Download the dataset and locate it where you can easily find it.

Open the file in Inventor. Use the File > Open command to navigate to and open the dataset: *Desktop_Clutter.iam*.

Click the **Environment** tab at the top of the application, and in the Begin panel, click **Inventor Studio**.
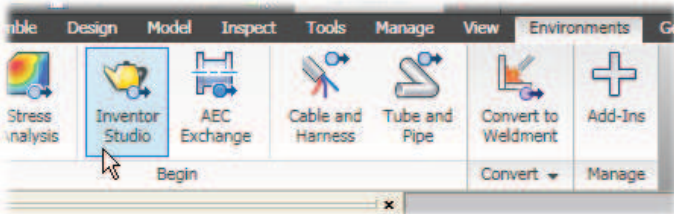
Your session should look something like this:

The components include several characteristics that allow you to see the effect of lighting styles. There are transparent flat surfaces, semi reflective surfaces, curved diffused surfaces, and so on.
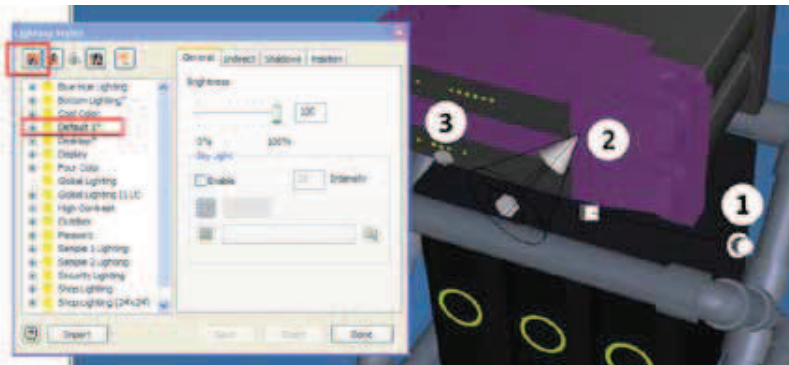
Create a new lighting style

There are a few ways to create the lighting style for your rendering.
• **New Lighting Style** - this method starts you with one each - directional, point, and spot lights placed approximately at the center of your dataset.
• **Copy Lighting Style** - identify a style close to what you feel you need and then copy it using the command in the context menu.
• **Edit an existing lighting style** that is close to your needs, but needs modifying.

If you will use the lighting style later, it is usually good to create a new one and save it to a meaningful name.

To create a lighting style from scratch:

1. Click the Lighting Styles command in the dialog box upper left position.

A new style (Default #) is created containing three lights, one of each type - 1) Directional, 2) Spot, and 3) Point.

2. To rename the style, right-click the style node and click Rename lighting style. Alternatively, slow double-click the node name to edit it.

Position the style and lights

The lights are positioned close to one another and roughly in the center of the dataset. We need to move the lights to the general vicinity where they will need to be. Then we can fine tune them.

Tip: If you have a physically large dataset (such as a building, super-tanker, printing press, etc) it is best to position the lights and then if you need to change them a little later on, you can use the scale command to spread them all out. For this example, it is best to use the interactive move of the light itself, and then adjust the source and target positions.

There are a couple of ways to reposition lights, using explicit coordinates and interactive move.

Lights, when selected, have "handles" you use to reposition them. When you position the cursor over a handle it highlights. Click on it and the 3D Move/Rotate command is activated with the handle selected.
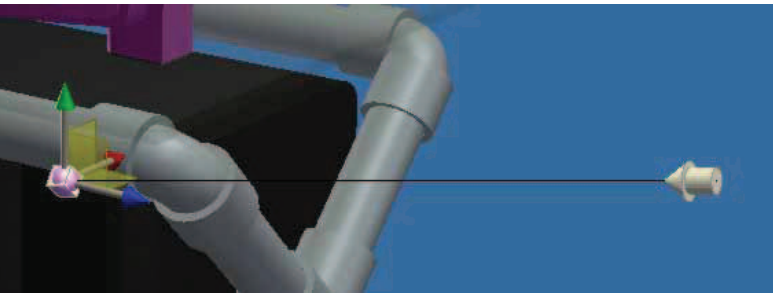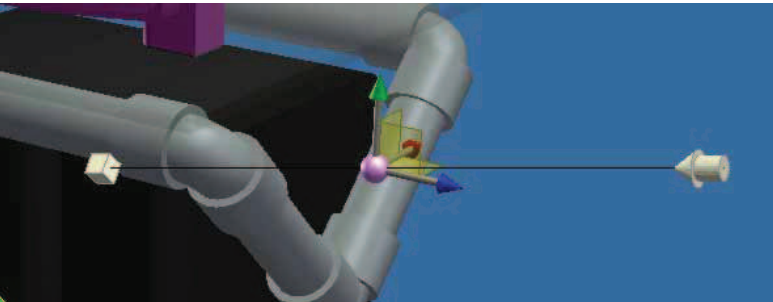
The three handles are:

Light Source:

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Light Target:

**Whole light** - represented by the beam line between the other two handles.

If you are not familiar with the 3D Move/Rotate tool, use the Help to familiarize yourself with it. Remember this: Make good use of Inventor Help, it is very good. Also, two things about Inventor, context menus (right click) and pausing the cursor over something; these quite often will yield information or selection.
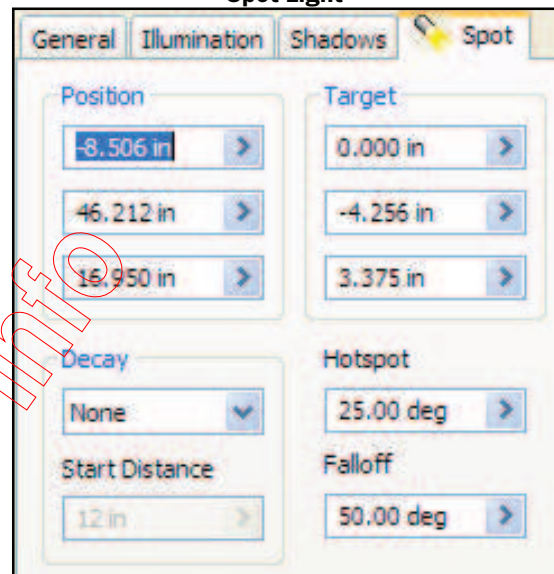
The lighting positions for the model are as follows:
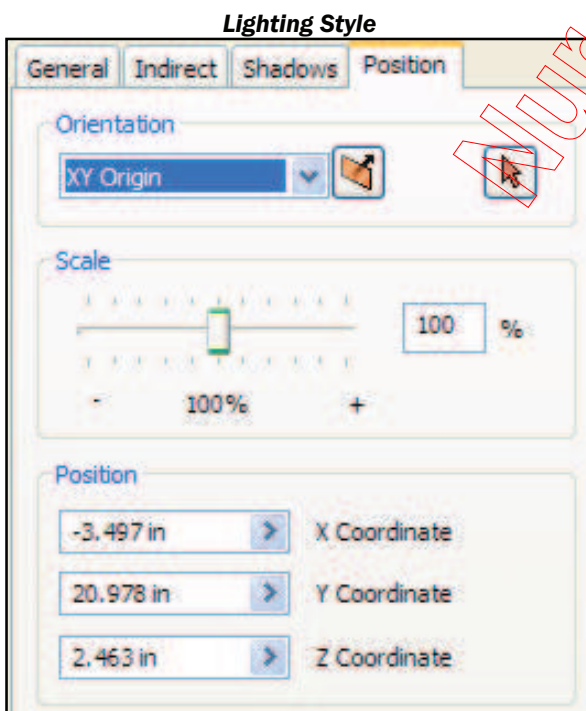
Lighting Style

Directional Light
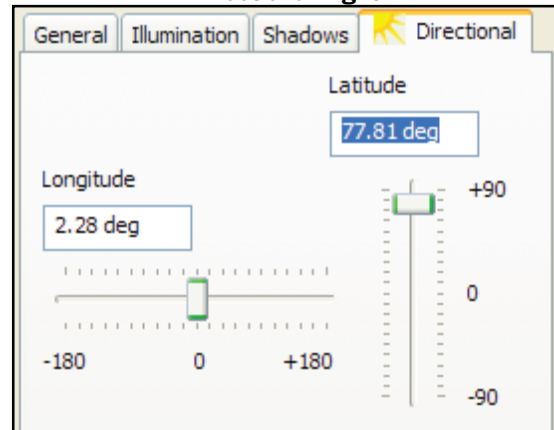
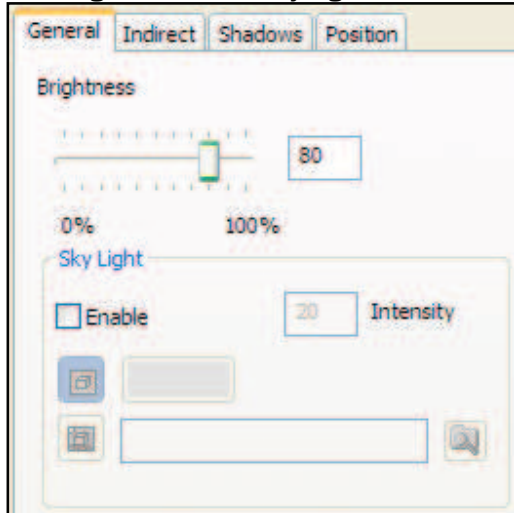**Spot Light**

Point Light

To make it easier for everyone involved, the model has a positioned lighting style called **MyLight**. If you want to skip making the changes and simply open it and make adjustments, that's up to you.
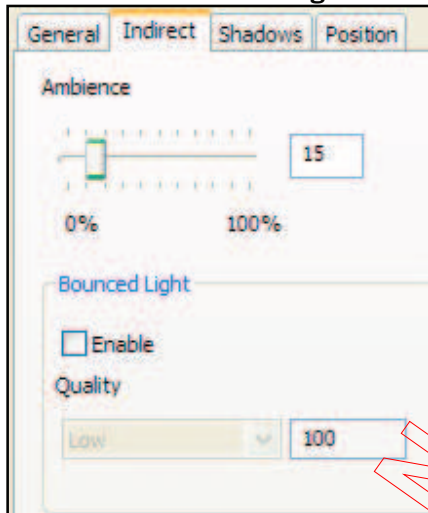
Lighting Style Parameters

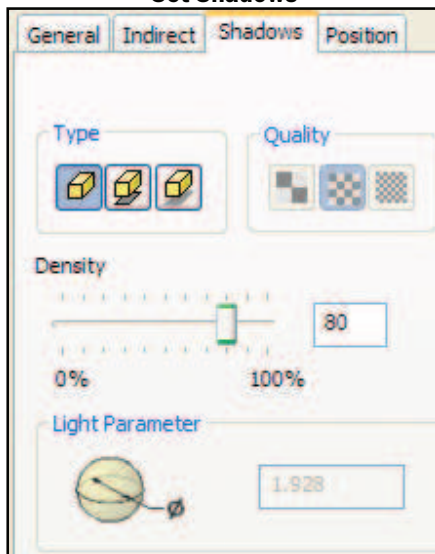Set the new lighting style parameters to reflect the following:

Set Brightness: 80% - Sky Light: not enabled

Set Ambience: 15% - Bounced Light: not enabled

**Set Shadows**

Directional Light Parameters

As the light name implies, the light emitted comes from a specific direction. Think of it as parallel rays of light going in one direction throughout the scene. I most often reduce their intensity and use them to flood fill the scene with a small amount of directed light. I use this to complement the ambient light filling in places where more light would be beneficial. Depending on the scene you may want to use a point light instead.

In the following example, a comparison is made with the directional light Off /On, with all other settings the same. The light intensity is 5%.
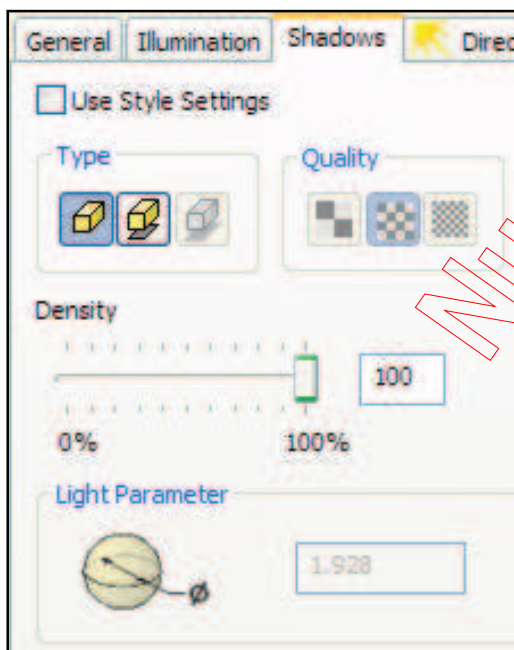
Directional Light Off

Directional Light On
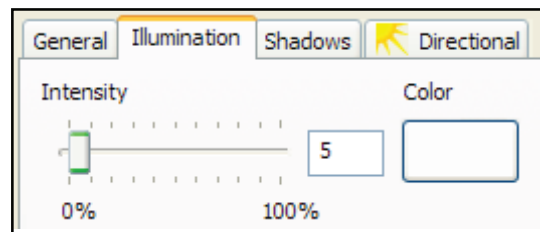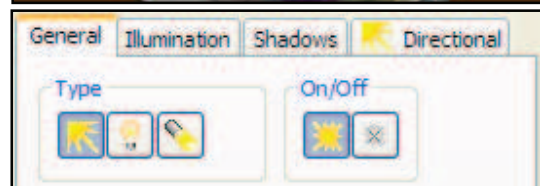
As you can see, the highlighted area exposes a little more detail in the shaded regions without adding significantly to the overall lighting scheme.

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For the goal image, the Directional light settings are as follows:
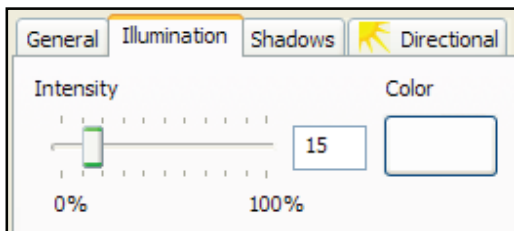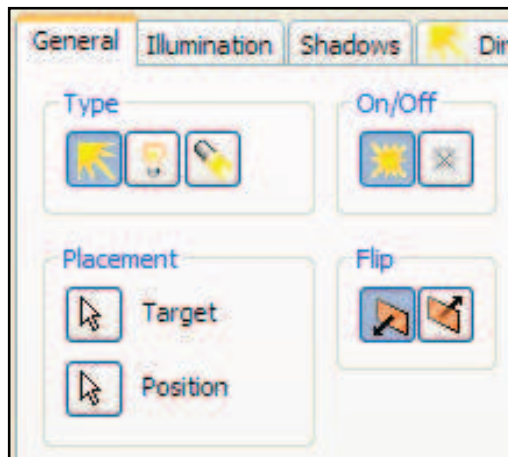
Point Light Parameters

Point light emanates in all directions and illuminates all objects in the scene. You might use it for a room light, sun light, etc. In this scene it serves to light up the far side of the model and cast some light across the glass to complete the scene.

Next, the Point light settings are as follows:

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Spot Light Parameters

This light serves as the main source of light for this image. Spot lights allow a greater control over the light than the other two types.

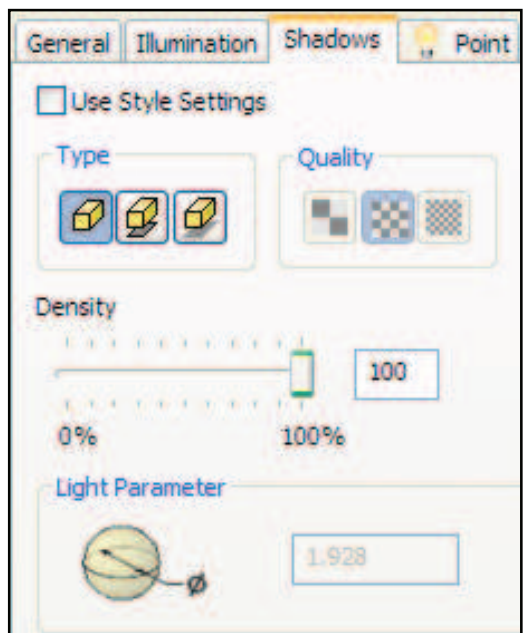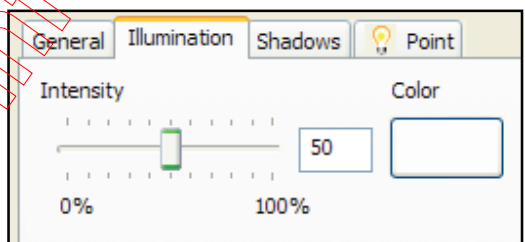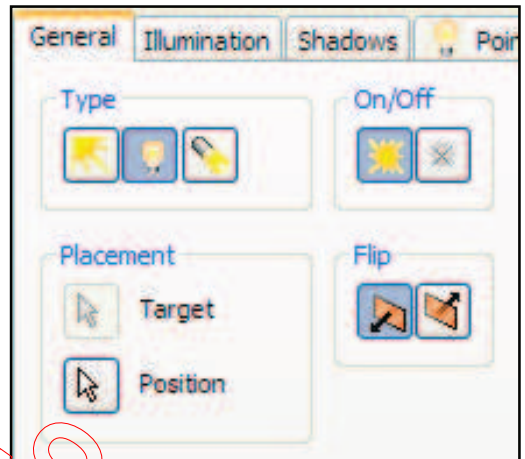The main difference between a Point Light and Spot light is the Spot has a target position with hotspot and falloff parameters. The Hotspot and Falloff values provide a means to use the light to draw the viewer's attention to an area of the image you want them to see. These images show the impact of changing just the falloff.

Falloff @ 50 Degrees

Hotspot	
5.00 deg	>
Falloff	
50.00 deg	>

Falloff @ 30 Degrees

Hotspot	
5.00 deg	>
Falloff	
30.00 deg	>

Falloff @ 10 Degrees

Hotspot	
5.00 deg	>
Falloff	
10.00 deg	>

As you can see, depending on your requirements, falloff provides a means of drawing attention to an area of the image/animation.

**For the goal image, the Spot light settings are as follows:**
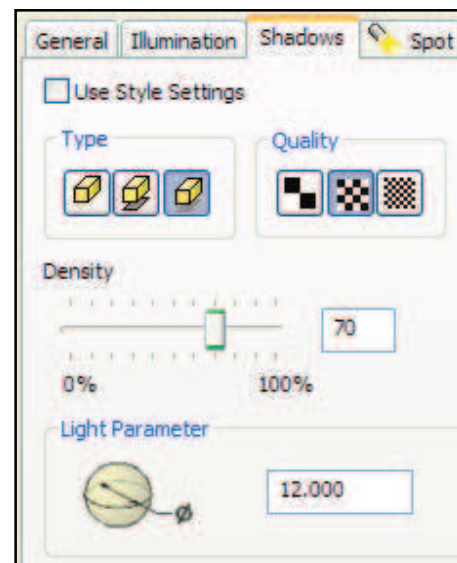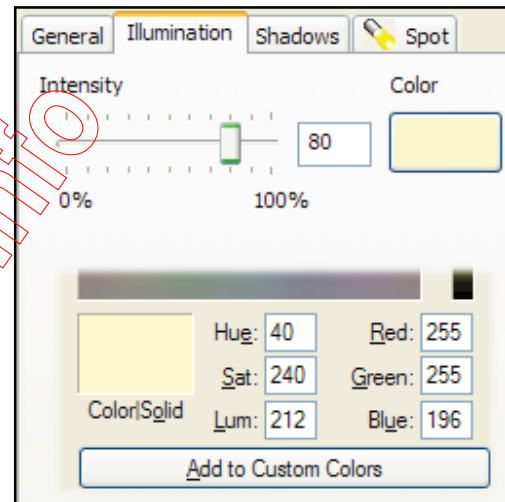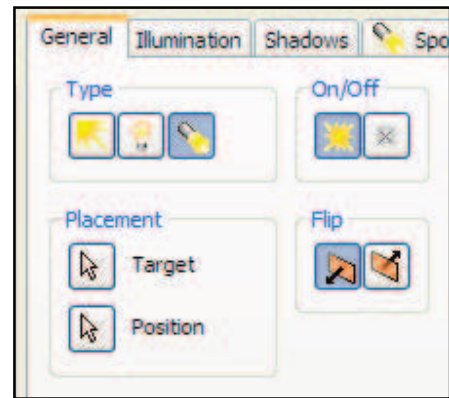

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Rendering Settings

The render settings in the following images use the lighting and scene styles for this image. If you created and tweaked your own lighting style, then select it instead and see how it turned out.

The XZ Reflective scene style has the gradient color for this image. Naturally, you can change it to suit your needs.
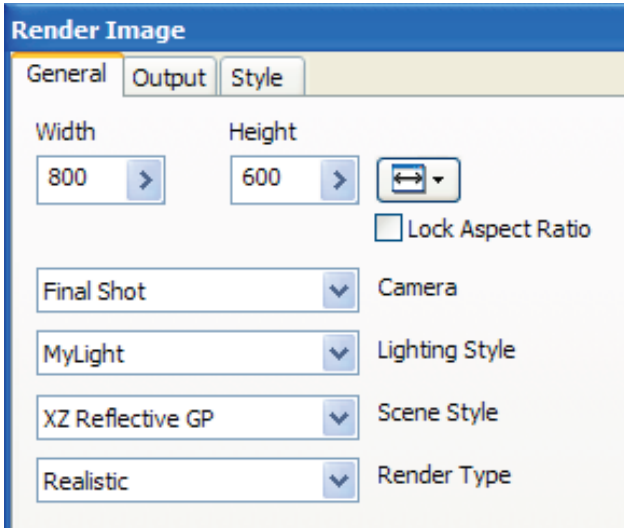
In the Output tab, select either the 3rd or 4th antialias option. The third one is the preferred setting for images without soft shadows and the 4th one is for use with soft shadows. It is recommended that you use the 4th option only for your final render. It can be resource intensive. So, for this image, I chose the 3rd option.
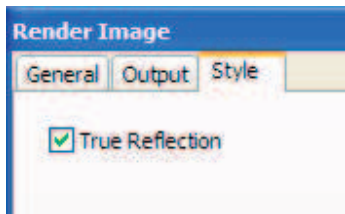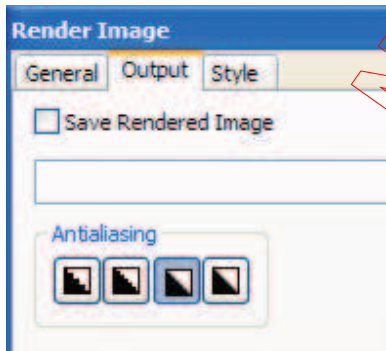
Click Render and see your result!
Happy Rendering!

About The Author

Bill Bogan is a Product Designer and Technical writer at Autodesk. In 1973, he started as a Technical Illustrator on the board. In 1977, he moved on to the drawing board as a Designer/Drafter and Illustrator.

His entry into electronic design media began in 1983 as a mechanical designer and CAD system administrator. From 1992 to 1997 he was a product engineer and technical trainer for Computervision before moving to Autodesk in 1997 as a product designer.

He formed B2 Design in 2003 and returned to Autodesk as a Product Designer and SME Technical Writer.

He is an avid auto racing fan (http://b2-design.biz/racing/bogan_racers.htm). His website is http://b2-design.biz

Want to be an Author?

One of the goals of this magazine is to create an environment for new authors and contributors to be published. The benefits are enormous, whether for personal satisfaction, or to be recognized for your hard learned skills. Being published does not hurt your resume' content either.

Regular columnists are also needed.

Both articles and tips will be accepted for consideration in future issues. The only requirements are that the contributions be relevant to the manufacturing community, and are based upon current software versions.

Please contact the magazine at:
publications@teknigroup.com and we will provide you with the mechanical (image and text) requirements.

Let's see your name on an article soon!
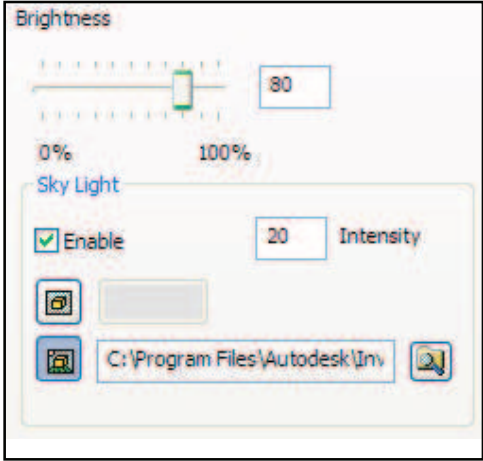
-Dennis Jeffrey
Publisher

Inventor Studio Bonus Material! - *Bill Bogan*

More on Lighting Styles

Like Inventor Styles, in general, a lighting style is a collection of objects and their settings. Lighting style controls affect all lights in that style. However, each light has settings that can be overridden so that you can tailor the light to your specific needs.

The style settings include:

Setting	Description
General (tab)	
Brightness	Controls the collective intensity of lights in the style.
Sky Light	Similar to Global Illumination, but not entirely. This section of controls floods the scene with light of the specified color and intensity. You can use an image to provide the light color. Here is a comparison of the two uses: The only difference is the on the left uses white colored lighting and the one on the right uses an image having blue sky and white clouds. The results are considerably different. The General settings for these images is: Using the color option disables the image option and vice versa. **IMPORTANT: The project file must include the directory where your image is stored.**

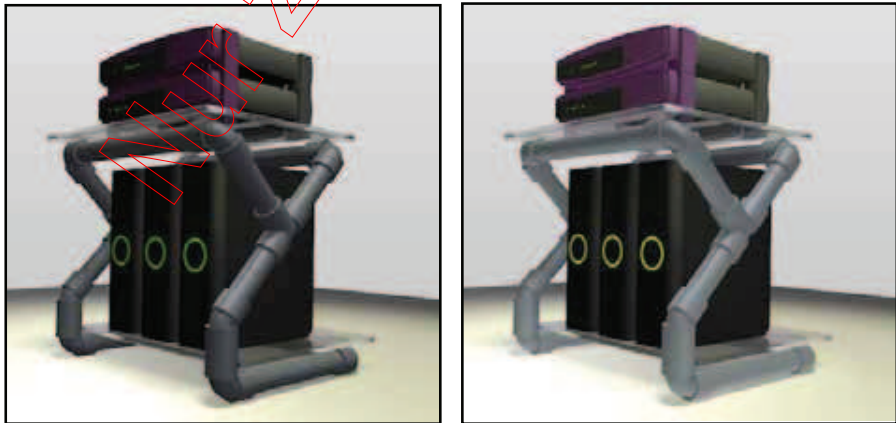| Indirect (tab)	
Ambience	Indirect lighting or lighting that is not specifically purposed for the scene. It can also be called available light. The lighting style has specific lights, and it has a setting for ambient light so you can control how much light exists before your scene lights come into play. For example, if you attend a sporting event, such as a basketball game, the court and surrounding areas are lighted. If you take a picture, the light supplied by the arena is available or ambient light. The image on the left has 10% ambient light while the right image has 40% ambient light.
Bounced Light	The example that comes to mind is that of indirect lighting in a room, where light, near the ceiling is hidden and directed to bounce off the ceiling providing a more uniform distribution of light. The way it works in Inventor is that the light is sampled a minimum of 100 times (lowest setting) to 1000 times in order to represent light bouncing between the different objects in the scene. In the images below, the one on the left has no bounced lighting. The image on the right has bounced lighting set to medium (500 samples). The image on the right demonstrates the uplighting that occurs due to the white surface the assembly sits on. The light bouncing off that surface coming back up at the assembly more evenly illuminates the scene. **Note:** The degree of sampling you use will impact the render times. The more samples, the longer the rendering time. How much so? The image on the left rendered in less than one minute, the one on the right, slightly longer than 6 minutes. Your times will vary. **Specs for the machine used:** Dell M90, 4 GB RAM, 256 MB nVidia Quadro FX 1500M, WinXP-32 bit. Note: If you specify the use of Skylight, Bounced light is automatically turned on and used for the render solution.
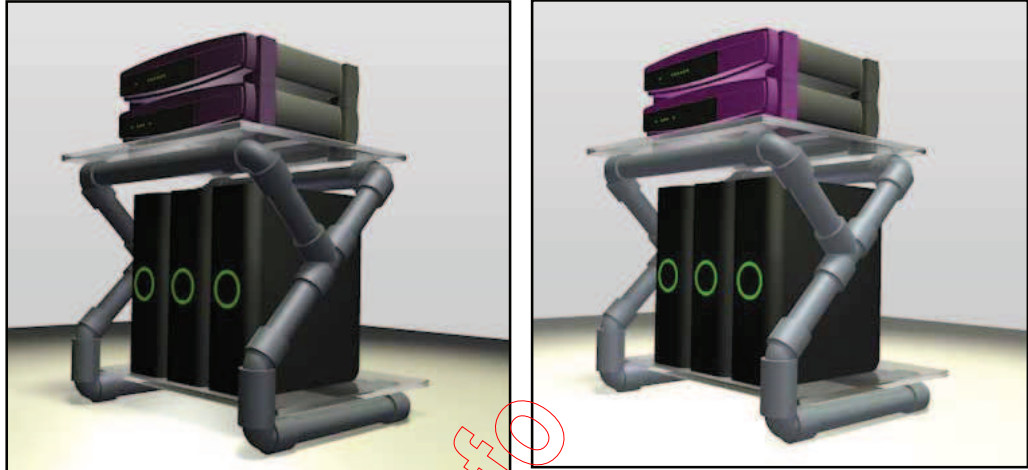
Shadows (tab)	
Type	Consists of three options: None, Hard, and Soft shadows. Hard shadows result in a sharp line delineating the shadow and the lighted areas, minimizing the penumbra - that transitional boundary area between light and shadow. The more diffused the light, the greater the penumbra effect. Comparing hard and soft shadows, the following images demonstrate the difference: You can see the slight penumbra in the soft shadow image on the right. To increase the diffuse or soft effect, set the Light Parameter value to an amount greater than the distance between the light and the objects it is lighting. The Light Parameter is a sphere of influence controlling the penumbra. For example, in the dataset, the spot light is about 50 inches from the assembly. The soft light image, above, has the Light Parameter set to 6 inches. The following image has a value of 60, nearly eliminating the shadow line altogether.
Density	Specifies the shadow density, I routinely find that I set the value to between 70 - 80 percent for my shots. Experiment to get the value that works for you.
Position (tab)	
Orientation	A list of the various planes in the dataset is provided to select from. Alternatively, a face selector tool provides the option to select any planar face in the dataset as the orientation setting. The light style is positioned normal to the selected plane or face.
Scale	Expands or contracts the lighting style as a percentage of the created style and positioning you establish. Because this setting has limits, +/- 10X, it is helpful to create styles relative to model size.
Position	Position A new lighting style is created in the center of the dataset. Three lights, one of each type - directional, point, and spot, are provided. Use the coordinates to move the lighting style (all lights) to the position you want.

Bonus Styles and View Representation

Doubtless you've seen models presented this way before:

The dataset includes the color/surface style, scene style, and lighting style for this effect.

Switch to the assembly modeling environment. Should read: "Double-click the view representation which changes all component color styles to White (Matte). Go back into Inventor Studio and render the scene using the following render parameters:
*   View Representation: Global_illum
*   Camera: Global_illum
*   Lighting Style: Global Lighting
*   Scene Style: XZ Ground Plane (not the reflective one)
*   Render Type: Realistic (2010) or Shaded (2011)

Happy rendering!! And, don't forget to show your stuff (renderings) in the Inventor discussion group so we can all be inspired by your work. - Bill

**Join the Discussion Groups
at Autodesk.com**

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