7.1: Rendering

Rendering is the process of generating an image by combining geometry, camera, texture, lighting and shading (also called materials) information using a computer program.

Before an image can be rendered Appearance Materials are applied to the various parts of your design to visualize how your design would look in the real word. Materials contain the visual properties of plastic, glass, metal, paint and wood (and pretty much anything else you can think of) to create photorealistic images.

Lesson 1: Applying Materials

Learning Objectives

1. Accessing the Render workspace
2. Understanding the Appearance Material window
3. Assigning appearance materials to geometry
4. Assigning appearance materials to bodies in the browser

Datasets Required

In Samples section of your Data Panel, browse to:

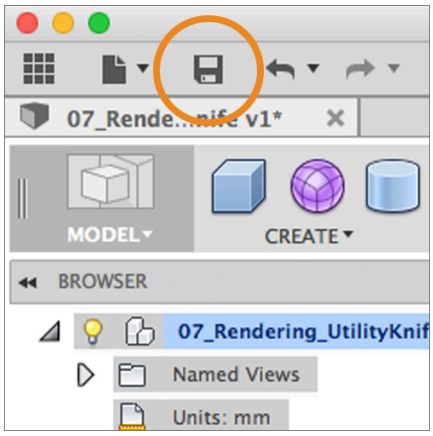
Fusion 101 Training > 07-Rendering > 07_Rendering_UtilityKnife.f3d

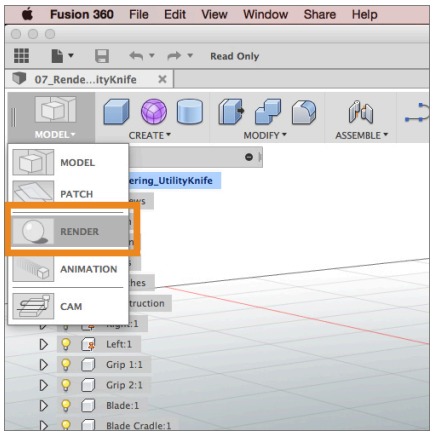
Open the design and follow the step-by-step guide below to get started with the lesson.

Step-by-step Guides

Step 1: Go to the Render workspace – The Rendering workspace toolbar contains tools to Setup your model and to create a Render.

1. Click on the **Save** icon on the top menu bar to copy of this sample file in to your personal project.
2. Click on the **Model** icon in the left of the toolbar to view other available workspaces.
3. Select the **Render** workspace from the dropdown list.

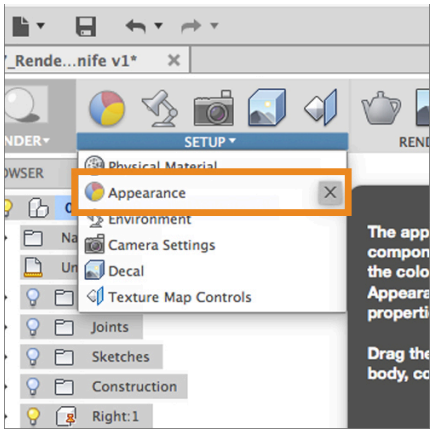




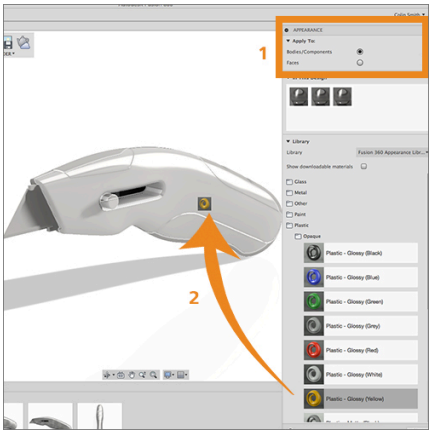
Note: You may have noticed that the environment changed slightly when you moved from Model to Render. This happens because the environment for Rendering is specifically tuned to create good-looking images.

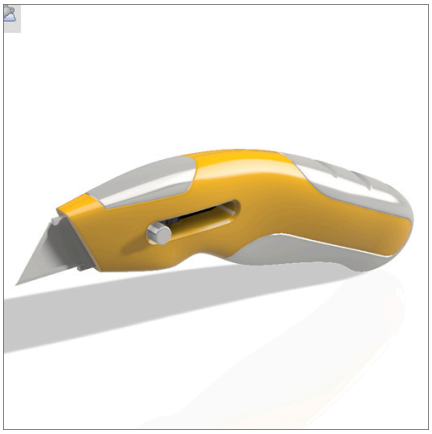
Step 2: Apply Materials to Geometry - Now that the model is in the Rendering Workspace you can begin assigning **appearance materials.**

1. In the **Render Workspace** select **Setup > Appearance** to open the **Appearance window.**
2. In the Appearance window check that the **Apply To** option is set to **Bodies/Components**
3. In the Library section of the Appearance window scroll down to **Plastic > Opaque > Plastic – Glossy (Yellow).**
4. Select and hold on the **Plastic – Glossy (Yellow)** swatch icon and drag it on to the main side body of the utility knife.
5. Repeat these steps so that **Plastic – Glossy (Yellow)** is assigned to both sides of the utility knife.



Note: If you assign the same material to several bodies in your design and do not edit them they will be automatically linked to the one material and only one material will be shown in the **In This Design** section. Editing the one material will affect all of the bodies that have that material assigned.

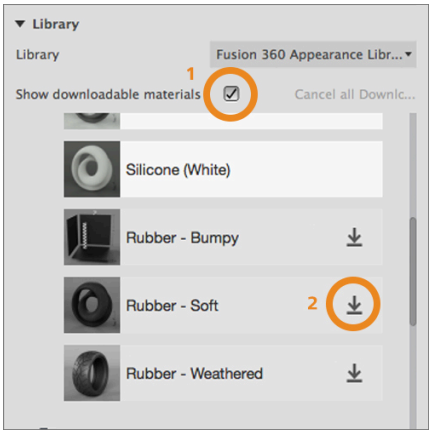


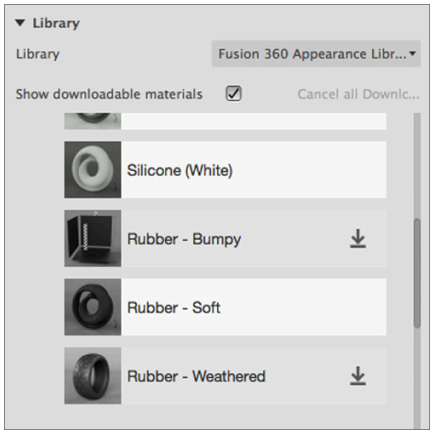


Step 3: Download two new materials. You can download new materials directly in to the Material Library.

1. In the **Appearance** window check the box next to Show **Downloadable Materials.**
2. In the Library open the folders for **Plastic > Textured** and **Other > Rubber**
3. Click on the **Download Material** icon next to **Plastic – Textured – Polka** and **Rubber - Soft**
4. After a minute the new material will be available to assign.

Note: You must be connected to the internet to download materials.

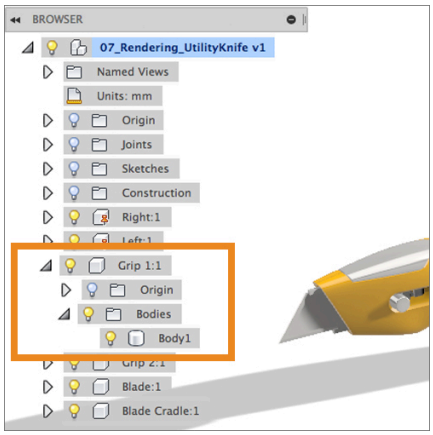


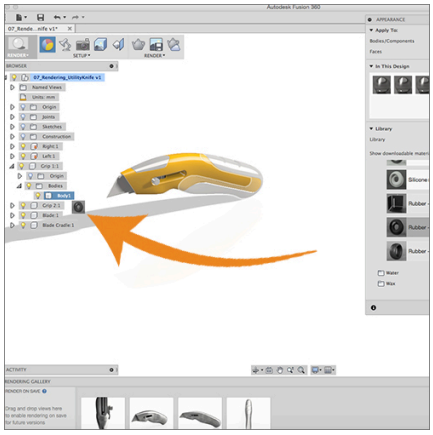


Step 4: – Apply a material to a body in the browser.

1. In the browser locate the component called **Grip 1:1.**
2. Click the arrow to the left of **Grip 1:1** to expand the contents of the component
3. Click the arrow to the left of **bodies** to show the bodies that are assigned to that component.
4. In the Appearance dialog box scroll down to **Other > Rubber > Rubber – Soft**
5. Select and hold on the **Rubber – Soft** swatch icon and drag it on to **Grip 1:1 > Bodies > Body 1** in the browser

Note: To assign a material to all of the bodies in a component, drag the material to the top-level component in the browser.





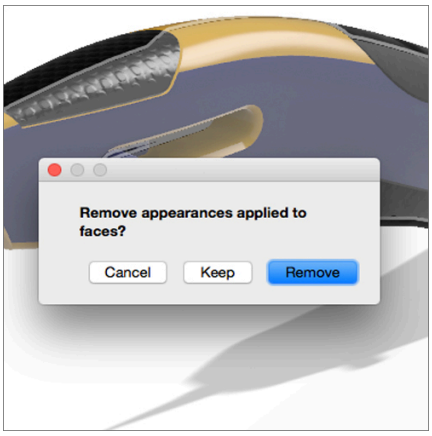
Step 5: Apply additional materials to the model

1. Using the method of your choice apply the following materials to the parts listed
   - **Plastic – Textured – Polka** to **Grip 2:1**

- **Plastic – Translucent – Matte (Blue)** to **Blade Cradle:1**
- **Metal - Stainless Steel – Satin** to **Blade:1**

Note: If you apply a material to a component and one or more of the bodies in the component already have a material applied you will be presented with and option to remove appearances applied to the bodies.

- **Keep** - only the bodies you selected that didn't already have a material applied will have the new material applied.
- **Remove** – all of the existing applied materials will be replaced with the new material you applied to the component.



Lesson 2: Editing Materials

Now that you have all the base materials applied to your design, you can customize the materials to look the way you want.

There are two levels of editing for materials. The basic or "lite" editor window enables you to quickly change:

- Change the name of the material
- Edit the color – either by dragging the color sliders or by entering an RGB value.
- Change the scale of the texture or bump map that is part of the material (if appropriate)
- Rotate the texture or bump map that part of the material (if appropriate)
- Go to Advanced options

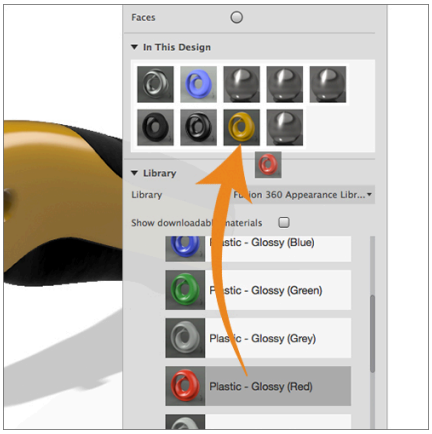
Learning Objectives

1. Assigning appearance materials to geometry
2. Assigning appearance materials to bodies in the browser
3. Editing Materials
4. Downloading New Materials to the Library
5. Assigning Materials to faces
6. Duplicating Materials
7. Adjusting Texture Map Controls

Step 1: Replace the Yellow Plastic Material. There are several ways to replace existing materials.

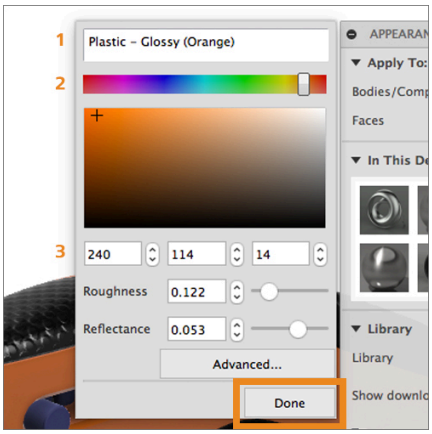
1. In the Appearance dialog box locate **Plastic – Glossy (Red).**
2. Drag the swatch from the library on to the swatch for **Plastic – Glossy (Yellow)** in the "In this design" section of the Appearance dialog box.

Note: All the bodies that had Plastic – Glossy (Yellow) applied now have Plastic – Glossy (Red) applied. This is a quick method for swapping out materials in your design.



Step 2: Edit Plastic – Glossy (Red)

1. Double click on the swatch for **Plastic – Glossy (Red)** in the **In this design** section of the Appearance window to open the editor window for this material.
2. At the top of the dialog box is the current name assigned to the material – double click in the name field and change the name to **Plastic – Glossy (Orange)**
3. Drag the color slider under the name field to an orange color of your liking.
4. In the middle of the dialog box there is section that allows you to enter RBG (Red, Blue and Green) values for a specific color.

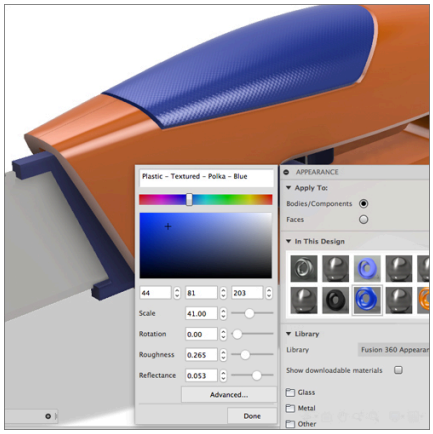


5. Enter **240, 114, 14** to change the color of the plastic material to orange.
6. Click the **Done** button.

Note: If you want to see which materials have been applied to which bodies in your design you can right click on the swatch and select **Select Objects Applied To** from the drop down list. Doing so will highlight bodes in your design that have the selected material applied.

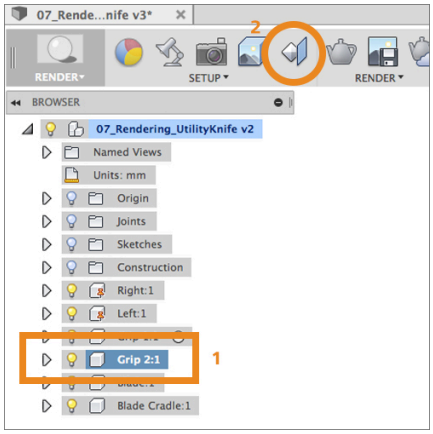
Step 3: Edit color and texture map for **Plastic – Texture – Polka.**

1. Change the name to **Textured – Polka - Blue**
2. Using the method of your choice change the color of **Plastic – Textured – Polka** to blue.
3. Change the scale of the texture map to **41**.
4. Move the slider next to **Rotate** to interactively change the orientation of the texture map.
5. When you are satisfied with the orientation, click **Done**.

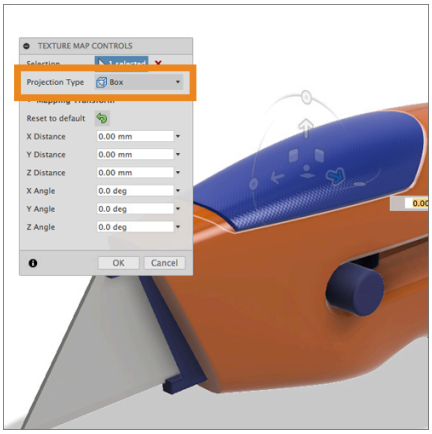


Step 4: Change the texture projection method for **Grip 2:1**. **Texture Map Controls** are used to change the type of projection method used on the object with a texture map.

1. Close the **Appearance** dialog box by clicking on the **Close** button.
2. In the browser, locate the component labeled **Grip 2:1** and right-click on it.
3. Select **Find in Window** to bring the part in the center of the screen.
4. Zoom in further so that you can clearly see the texture map on the surface.
5. In the **Render** menu bar select **Setup > Texture Map Controls**.



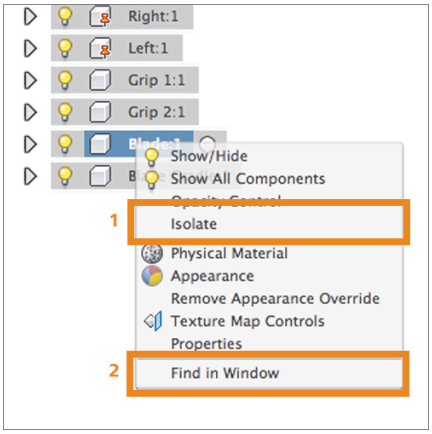
6. Change the **Projection Type** to **Box**
7. Click **OK** to accept the change.

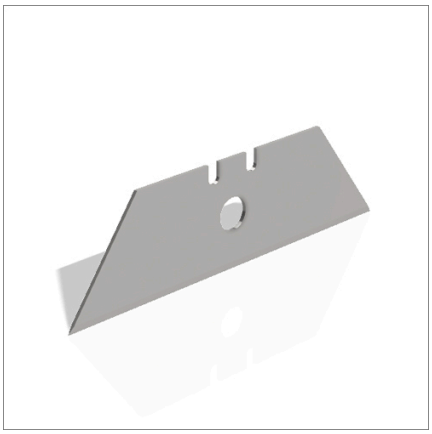


Note: Try selecting the other projection types to see the different results. In some cases you may have to choose an axis for a projection direction. In those instances an axis widget will appear, simply click on the axis that best matches the direction you would like to project. You can also change the location and rotation of the projection with the manipulator.

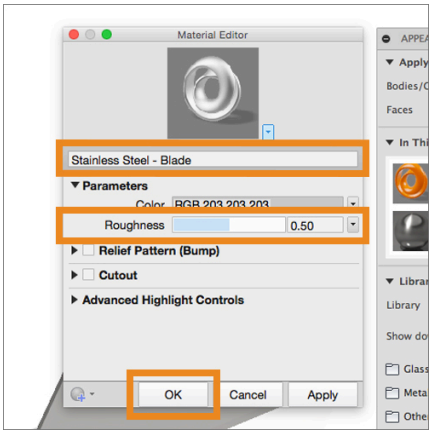
Step 5: Edit a material assigned to the Blade

1. In the browser locate the component labeled **Blade:1**
2. Right-click on **Blade:1** and select **Isolate** from the drop down menu list.
3. Right-click on **Blade:1** and select **Find In Window** from the drop down menu list.
4. Right-click on **Blade:1** and select **Appearance** from the drop down menu list to open the Appearance dialog box.
5. In the Appearance dialog box, double click on the **Stainless Steel – Satin** material in the **In This Design** section.
6. Click on the button labeled **Advanced…** to open the advanced editor window.
7. Change the name to **Stainless Steel – Blade** by click on the name field.
8. The **Roughness** setting controls the amount of reflection in the material, change the setting to **0.50**.
9. Click **OK**.



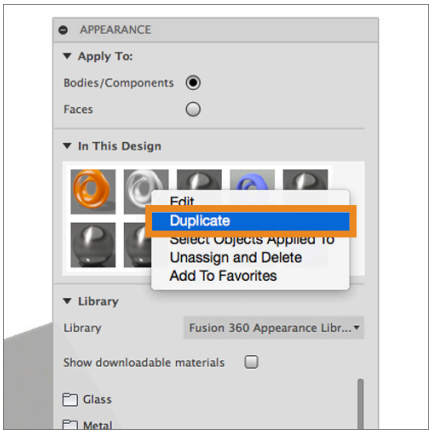


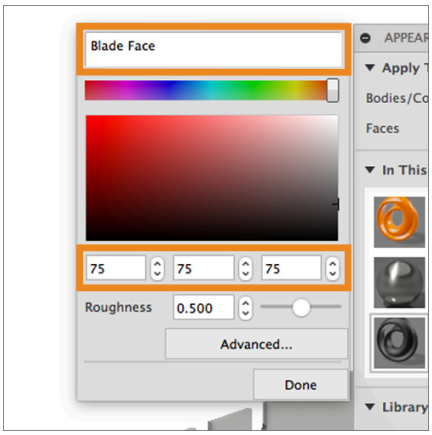
Note: The **Roughness** controls the surface finish of the material and ultimately how shiny and reflective it will look. When set to zero the surface will look like a mirror. When set to one, the surface will not reflect at all.

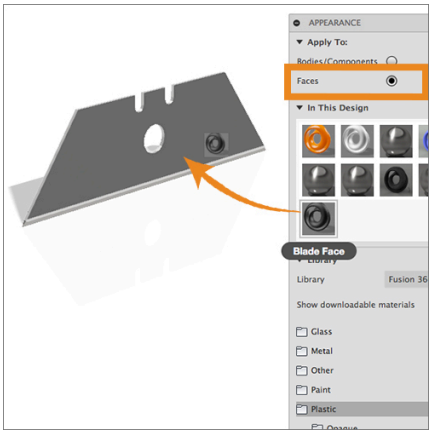


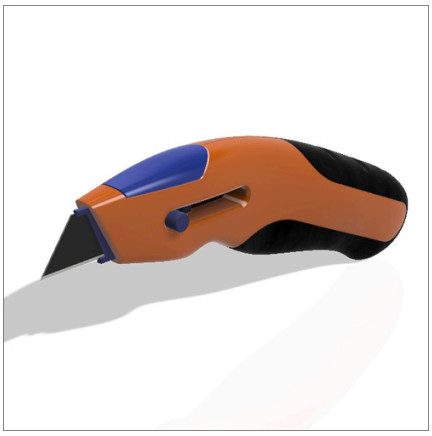
Step 6: Duplicate a material

1. Right click on **Stainless Steele – Blade** and select **Duplicate** from the drop down menu.
2. This creates a second material called **Stainless Steele – Blade(1)** that has the exact same settings as the original.
3. Double click **Stainless Steele – Blade (1)** material to open the Material Editor.
4. Change the name of the material to **Blade Face**
5. Change the color to **75,75,75**.
6. Select **Done**.
7. In the **Appearance** dialog box change the **Apply To:** setting from **Bodies/Components** to **Faces**
8. Now you can only apply materials to selected faces on a body/component
9. Drag the **Blade Face** material to the side face of **Blade:1**
10. Repeat this step on the other side of **Blade:1** so that both side faces have **Blade Face** applied.
11. Close the **Appearance** dialog box.
12. Right-click on **Blade:1** in the browser and select **Unisolate** to show the rest of the design.






APPEARANCE
Apply To:
Faces
In This Design
Blade Face
Library
Fusion 36
Show downloadable materials
Glass
Metal
Other
Paint
Plastic



Lesson 3: Adding a Decal

A decal is used to mimic labels or transfers that appear on the surface of your model. These can be numbers on a keypad or branding and logos. Decals sit on top or the model surface and are applied differently than materials. In this lesson you will apply an image of the Autodesk logo to the body of the utility knife using the decal tool.

Learning Objectives

1. Selecting an image to use as a decal
2. Applying the decal
3. Adjusting the decal

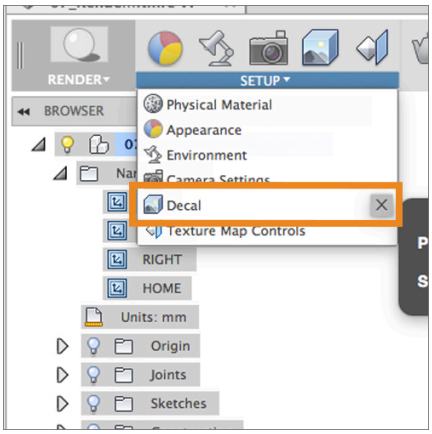
Step-by-step Guides

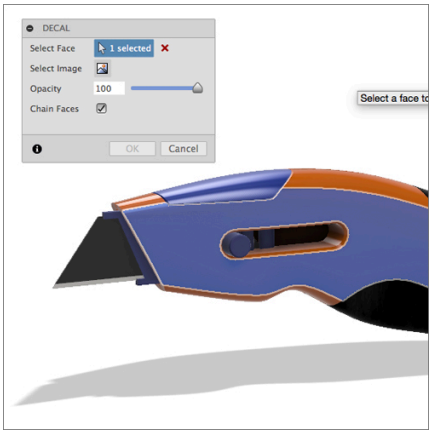
Step 1: Download the image file. Let's start by downloading the image that you will use as the decal. The Autodesk logo has been supplied in the learning materials and needs to be downloaded to your computer to be applied.

1. In the **Data Panel** find the item named **Autodesk Logo.jpg.**
2. Double-click on the thumbnail to launch **A360**.
3. Click on the blue **Download** button on the upper right side of the window.
4. Place the file in a location where you can easily find it. Your desktop for example.

Step 2: Apply the decal

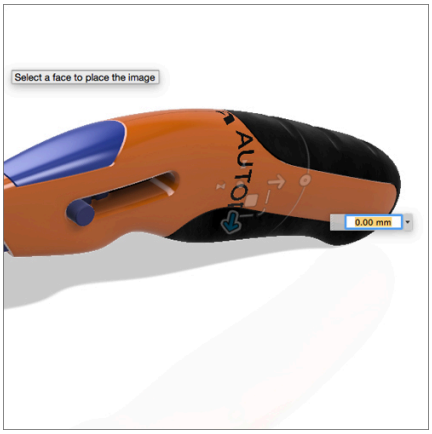
1. In the Render menu bar select **Setup > Decal**.
2. Select the body of the utility knife to highlight it. This is the surface you will apply the decal to.
3. In the **Decal** window, click on **Select Image.**
4. From the file menu go to the location where you saved **Autodesk Logo.jpg**, select the file and click **Open**.





Step 3: Adjust the decal

1. Adjust your view of the knife so that you can see the side of the handle.
2. Use the **rotate** handle on the decal manipulator to rotate the decal so that it is lined up with the handle.
3. Use the XY Plane scale handle to scale the decal down so that it looks correct.
4. Click **OK** to accept the decal location.



AUTODESK

Lesson 4: Changing the Environment Settings

The Environment Setting controls the lighting, background color, and visual effects in the rendering workspace. In Fusion 360 an environment dome with an environment image map (called a high dynamic range image or HDRI) attached to it constantly. In this lesson we will choose the environment, change the background color and turn on effects.

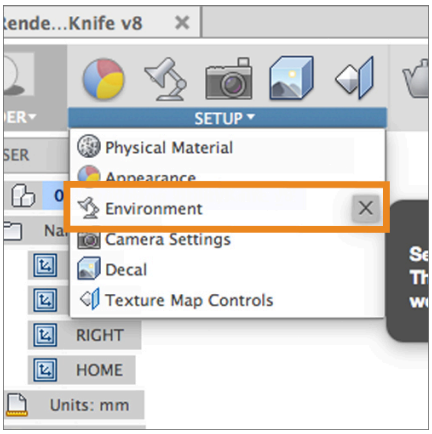
Learning Objectives

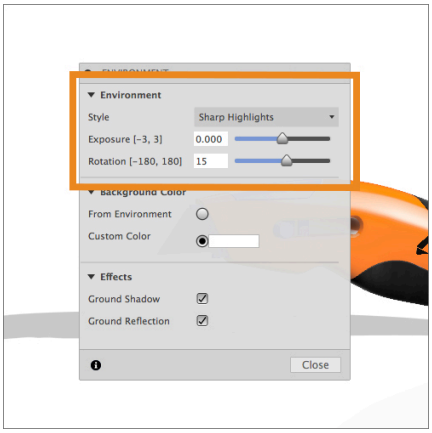
1. Changing the environment
2. Rotating the environment
3. Changing the background color
4. Changing the ground effects

Step-by-step Guides

Step 1: Change the Environment settings

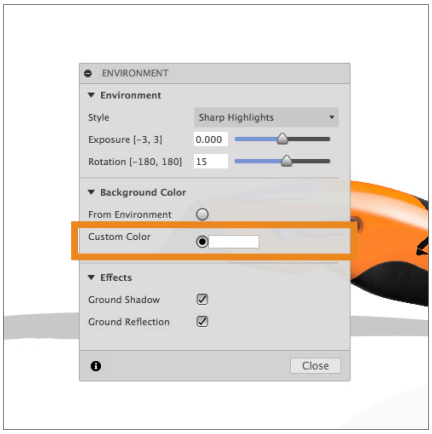
1. Click on **Setup > Environment**.
2. From the **Style** dropdown list select **Sharp Highlights**.
3. Use the slider next to **Rotation** to rotate the environment image around the model.
4. As you move the slider you will see reflected highlight change on the design and the shadows move along the ground.
5. Rotate the environment until you see a highlight across the right side of the knife.
6. Type **15** in the field next to **Rotation**.





Step 2: Choose a background color. By default the **background color** is defined by the **environment style** you choose. You have the option to change the background color to whichever color you want.

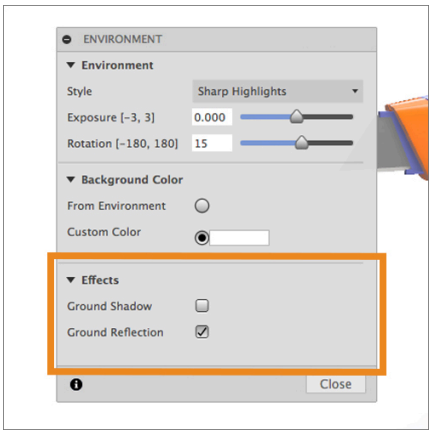
1. In the **Background Color** section click on **Custom Color**.
2. Click on the color swatch next to **Custom Color** to open the color chooser window.
3. In the RGB fields enter **255, 255, 255** to change the background color to white.
4. Select **OK** to close the color editor window and apply the changes.



Step 3: Change the **Ground Effects**. You have the option to have your model cast a shadow or to reflect your model on the ground plane of the environment.

1. Click on the button next to **Ground Shadow**.
2. In the **Environment** section change the rotation value.
3. Notice that the shadow location is changing based on the location of the light sources in the chosen environment style.
4. Click on the button next to **Ground Shadow** to turn it off.
5. Click on the button next to **Ground Reflection** to show a reflection of the model in the virtual floor.
6. Select **CLOSE**.

Note: Correct shadow computation takes a lot of time to render. If you want to speed up the render time avoid using ground shadows.



Lesson 5: Creating an image with Rendering

Now that the design has materials applied and the environment is set correctly it is time to create a rendered image. Fusion 360 uses Ray Tracing to create an image. Ray Tracing attempts to simulate the natural flow of light in your scene using a technique called Global Illumination (GI) which takes in to account not only the direct light that comes from a light source but also indirect light that reflects off of other surfaces in your scene.

There are 2 types of rendering methods that you can use in Fusion 360:

- **Local Ray Tracing:** Uses your computer CPU to create photo realistic images from your Fusion 360 models. This Ray Tracer works in is real-time, meaning that as soon as you click on the **Enable Ray Tracing** icon your computer will start rendering the image immediately. The image will start off noisy and will start clearing up. If you change the orientation of the model or change materials and environment the Tracer will restart the rendering process. The length of time needed to create the image is dependent on the **Quality** setting and the number iterations (or passes) that are needed to create the image. The size and resolution of your computer screen determines the size and resolution of your final image. You don't need to be connected to the Internet to start the Ray Tracer.

- **Cloud Rendering**: Uses a rendering engine in the Autodesk cloud to create photo realistic images from your Fusion 360 models. The size and resolution of the images can be set in advance of starting the cloud render. The advantage of using the cloud render is that it will not require any of your computer resources to create an image and create an image faster than your local computer. However, using the cloud rendering service may require Cloud Credits to create images and you must be connected to the Internet to start a cloud render.

Learning Objectives

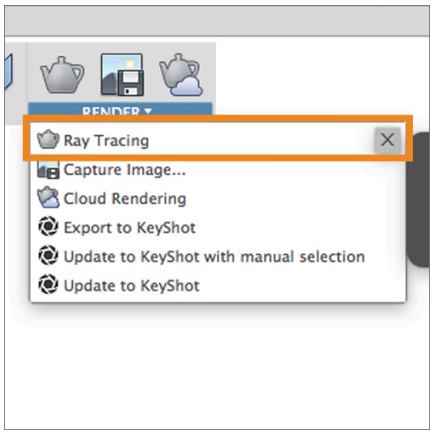
1. Using local ray tracing to create an image
2. Using cloud rendering to create an image
3. Viewing cloud rendered images in the Render Gallery

Step-by-step Guides

Step 1: Render an image using local Ray Tracing.

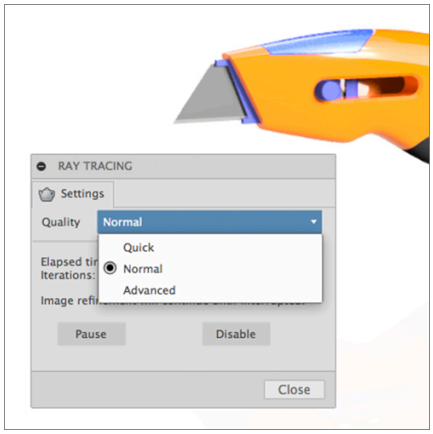
1. From the Render tool bar select **Render > Ray Tracing**.

Note: As soon as you start Ray Tracing you will notice that the screen starts to get “noisy” and starts to clear up as the Ray Tracer starts to work on the image. If you move the camera the Ray Tracer restarts the calculations.



Step 2: Change the Quality setting. There are 3 quality settings to choose from in the Ray Tracing settings. Quick, Normal and Advanced.

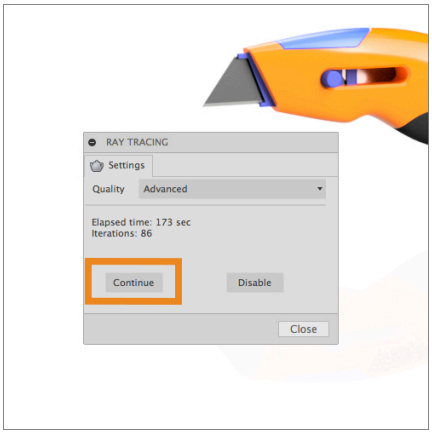
1. Set the **Quality** setting to **Quick**
2. The image clears up rapidly but the image is not high quality.
3. Change the **Quality** to **Normal**
4. The image clears quickly but you will notice that the edges of the model look jagged or pixelated and will slowly smooth out as the number of iterations rise.
5. Change the **Quality** to **Advanced**.
6. The image is very noisy to start and will continue to clear up over time.



Step 3: Pause and Disable the Ray Tracing

1. In the **Ray Tracer** window select Pause to pause the Ray Tracer.
2. Select **Continue** to let the **Ray Tracer** continue rendering from where it left off.
3. Select **Disable** to turn off the **Ray Tracer**.

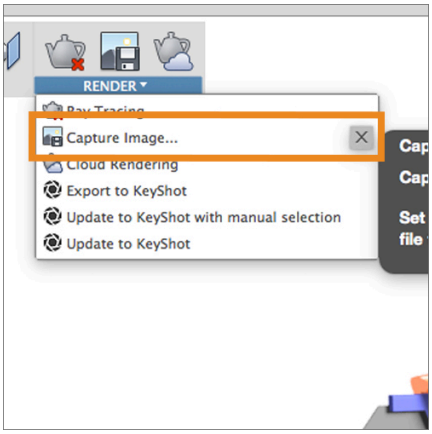
Note: Do not disable the **Ray Tracer** if you intend to capture an image of the render.

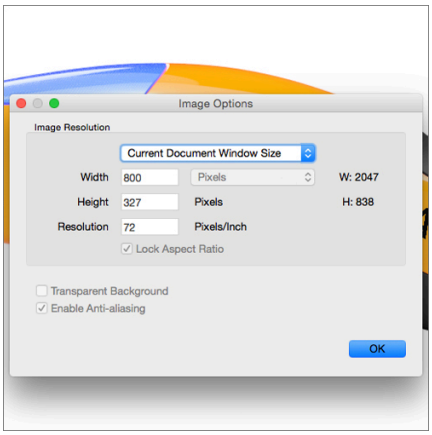


Step 4: Start the **Ray Tracer** and **Capture** an image. When rendering locally you manually capture an image when you are satisfied with the look of the image. All local **Ray Tracer** images will be based on the size and resolution of your screen.

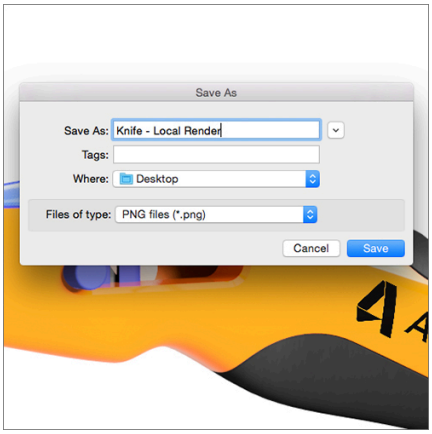
1. Select **Enable Ray Tracing** in the **Render** tool bar.
2. Change the **Quality** setting to **Normal**
3. Allow the **Ray Tracer** to run for about 120 seconds or until you are satisfied with the look of your image.
4. Select **Pause** in the Ray Tracing window
5. Select **Capture Image** from the **Render** tool bar.
6. Leave the **Image Resolution** options at the default and click on **OK**.
7. In the **Save As** window enter a name for the image file and select a location to save the image.
8. Click on the **Save** button to save the image.
9. In the **Ray Tracer** window click on the **Close** button.

Note: When creating an image using the local **Ray Tracer**. The image size and resolution is always based on the size and resolution of the screen you are using. You do not have



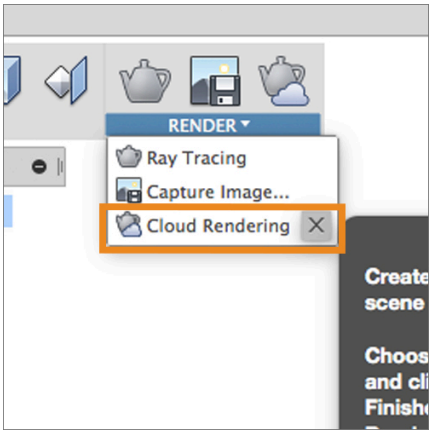


independent control over the size and resolution of the final image.



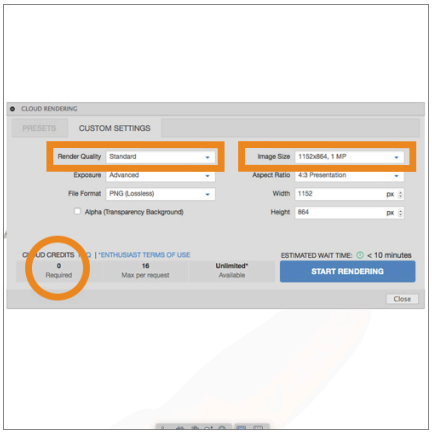
Step 5: Start a Cloud Rendering. The steps for creating an image using the Autodesk cloud is different from creating a local Ray Tracer image. With cloud rendering you have more choices for image size and resolution, the images you create are stored in the **Render Gallery** in the cloud. Images created using the the Autodesk cloud can cost **Cloud Credits**.

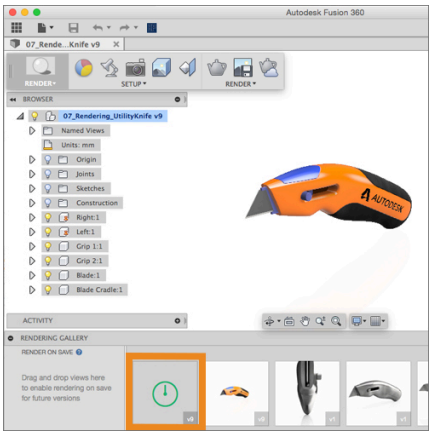
1. In the **Render** toolbar select **Render > Cloud Rendering.** To open the Cloud Render options window.
2. The default size and resolution of your image will always be based on the size and resolution of your screen. The bottom of the window shows how many Cloud Credits will be used to create the image.
3. In the **Cloud Render** window change **Render Quality** to **Standard.**

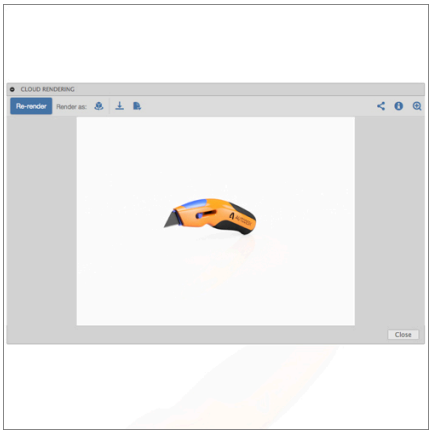


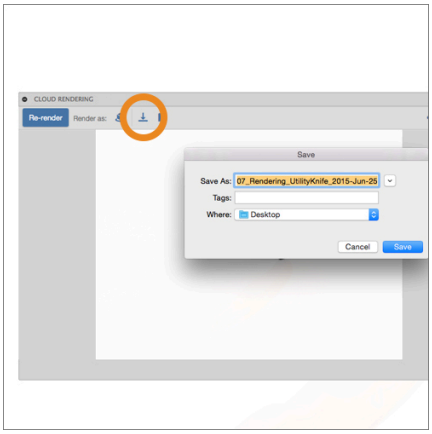
4. Change the **Image Size** to Web > 1152x864, 1 MP. At the bottom of the window the cost of the **Cloud Credit** is now **0**.
5. Click on **Start Render**.
6. In the Render Gallery you will see a green clock icon appear. This indicates that the render job has been sent to the Autodesk cloud and is the queue to be rendered to an image.
7. When the image is completed a thumbnail of the image will replace the clock icon.
8. Click on the image in the **Render Gallery** to view the image full size.
9. To download a copy of this image to your computer click on the download icon at the top of the **Cloud Render** window.
10. Enter the location where you would like to save the image and click on the **Save** button.
11. In the **Cloud Rendering** window click on the **Close** button.

Note: The Render Gallery shows you all of the cloud rendered images that have been created.

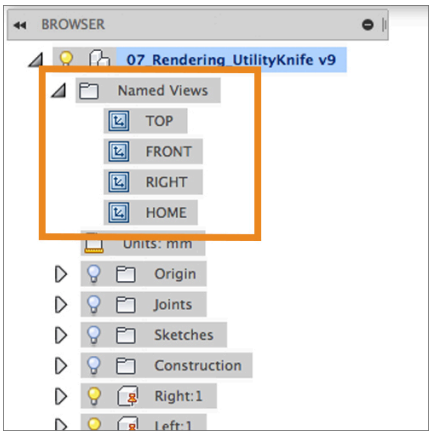






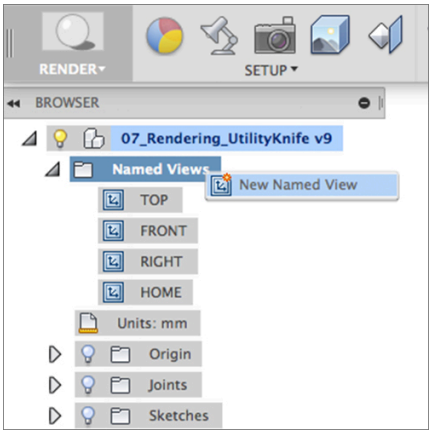


Step 5: Create a cloud render using Named Views. The cloud renderer automatically creates small sized rendered images based on the **Top**, **Front**, **Right** and **Home** named views every time you manually save a new version or an auto save is done. If you want to create automatic Cloud Render images of a specific view you can create a new named view to accomplish this.



1. In the **Browser** click on the small arrow next to **Named Views** to expand the list of current named views.
2. Arrange your design in the main window in a way that you would like your Cloud Rendered image to look.
3. In the **Browser** right mouse button on Named View and select New Named View.
4. You have now created a new named view based on the current camera angel with the label **NamedView** in the **Browser**.
5. To change the label for your custom named view double click on **NamedView** to highlight it and type **Render** and hit your Enter key.
6. Click on the **Save** icon to save a new version of the design.

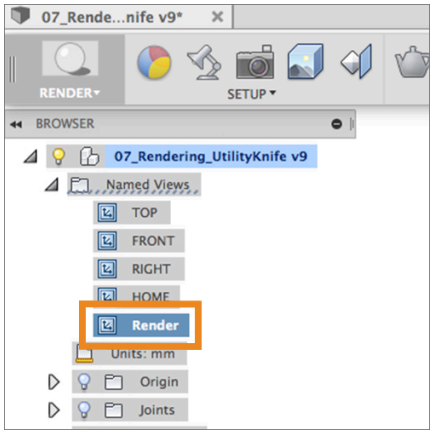
12. After the save is complete a green

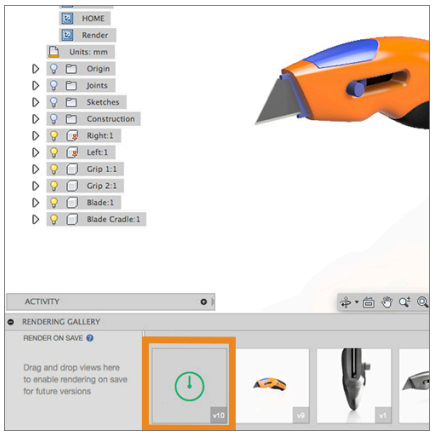


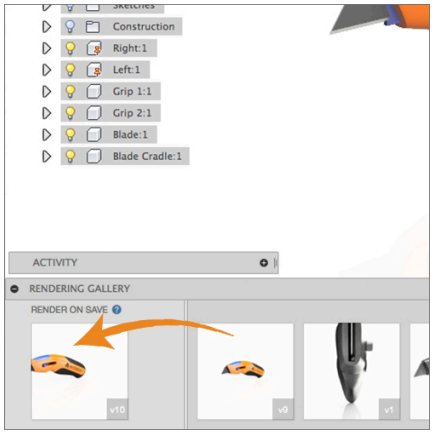
clock icon will appear in the **Render Gallery**.

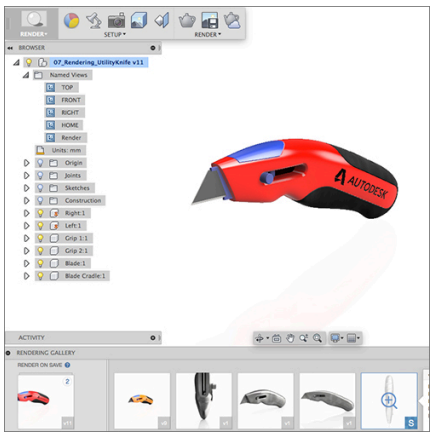
13. This indicates that the render job has been sent to the Autodesk cloud and is the queue to be rendered to an image.
14. When the image is completed a thumbnail of the image will replace the clock icon. Your custom named view is now saved.
15. Click and hold on the thumbnail image in the Render Gallery and drag it to the box on the left labeled **Render On Save**. Fusion 360 will now automatically re-render this Named View when a save or automatic save is performed.
16. Select **Setup > Appearance**.
17. Change the color of the material assigned to the body of the Knife.
18. Click the **Save** icon in the menu bar.

Note: After the save is completed, the thumbnail image of the named view you moved to **Render On Save** section of the **Render Gallery** will update. All the other images that are not in that section will will stay the same.








RENDER
SETUP
RENDER
BROWSER
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Named Views
TOP
FRONT
RIGHT
HOME
Render
Units: mm
Origin
Joints
Sketches
Construction
Right:1
Left:1
Grip 1:1
Grip 2:1
Blade:1
Blade Cradle:1
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