NX 4 Visualization Tutorial

Image Based Lighting using High Dynamic Range Images

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Introduction

Presentation-quality renderings play a crucial role in the product development process. Realistic, photograph-quality renderings are especially important for consumer products, where visualizations in real-world settings are used to sell a concept or an idea to the customer or to a company's development team. It ultimately allows for organizations to **make better decisions right on the digital model**, thus significantly reducing the need for physical prototypes.

Until recently, high-quality rendering was a specialty application requiring expertise beyond that of the typical product designer. While many CAD solutions have included rendering capabilities for quite some time, the procedures for defining environments, light sources and intensities, and other key rendering inputs could be a tedious and lengthy trial-and-error process. The production of appealing, photorealistic images was typically the domain of experts using tools outside the CAD system.

A new technology called **Image-Based Lighting (IBL) is bringing ultra-realistic visualization into the mainstream** of product design. Using an advanced image format called High Dynamic Range Images, image-based lighting dramatically reduces the time and effort required to produce images with stunningly realistic lighting effects. This technology originated and is broadly used in the entertainment industry for the creation of computer graphics special effects.

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Introduction

High Dynamic Range Images (HDRIs) contain much more illumination information than conventional image formats, in effect capturing all the real-world lighting information in a scene – from both natural and artificial sources. Image based lighting uses the information in the HDRI to illuminate CAD models for the rendering process. With **HDRIs, image-based lighting eliminates all the setup of environments, light sources, and intensities** typically required for photorealistic renderings – the user simply orients the model and the image.

Image-based lighting using HDRIs has been incorporated in the latest release of NX, UGS' premier CAD/CAM/CAE solution for digital product development. Included at no additional cost to customers of NX rendering and visualization tools, image-based lighting can reduce the rendering and visualization process time from hours to minutes. Because of the speed and simplicity, product designers can now produce photographic-quality visualizations in a matter of minutes instead of hours – within the same system they use to model the product.

With the image-based lighting in NX, UGS is also delivering sample HDRIs that can be used for immediate productivity. These **images, captured exclusively for UGS customers**, include a variety of photographic studio scenes with professional lighting setups, as well as an outdoor beach scene. With the next interim release, NX 4.0.1, the HDRIs will be included on the software media – in the meantime they are available for customer download from the Global Technical Access Center (GTAC) customer web site.

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Getting started

Some basic setup before you render

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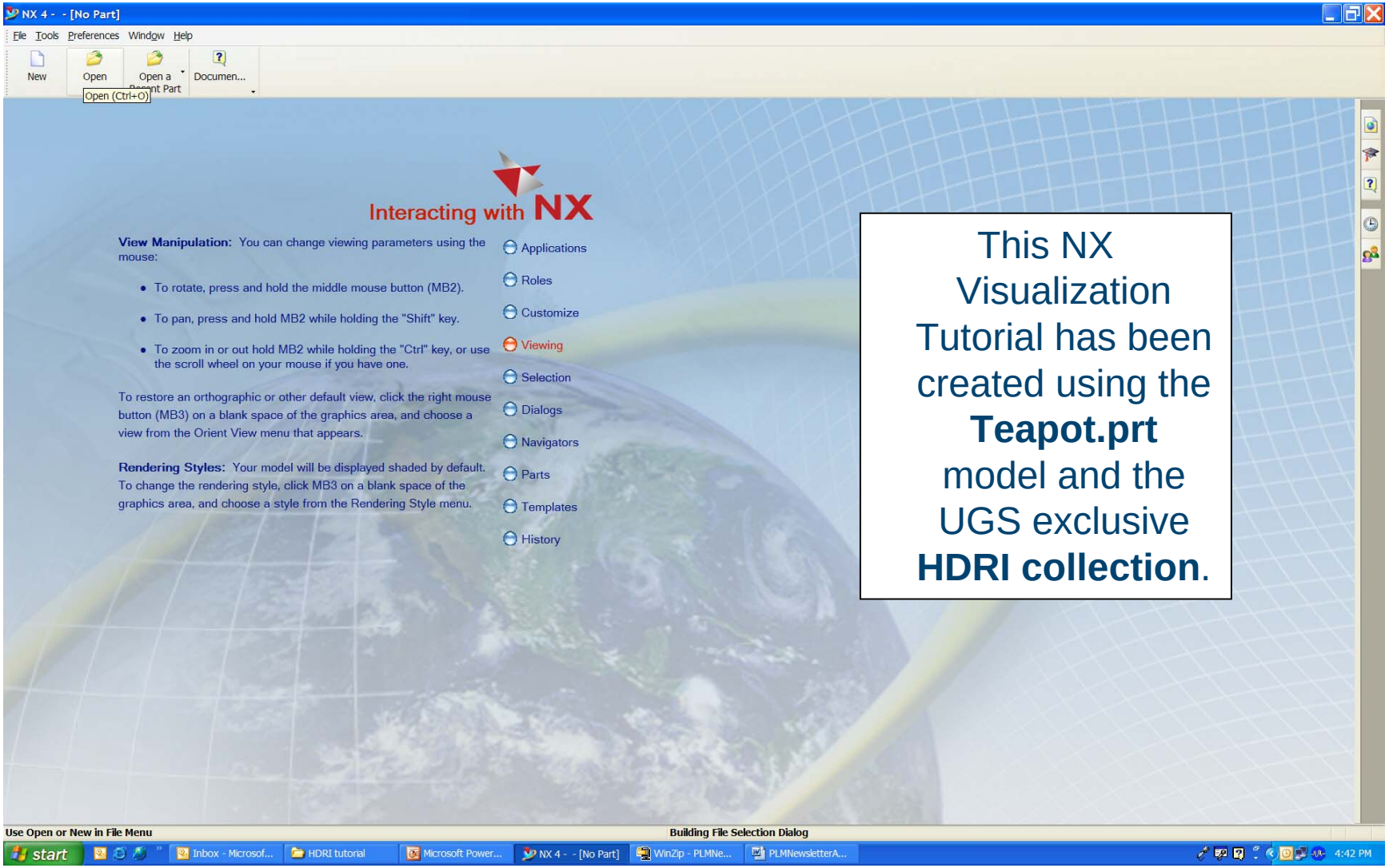
Loading the Teapot



This NX Visualization Tutorial has been created using the **Teapot.prt** model and the UGS exclusive **HDRI collection**.

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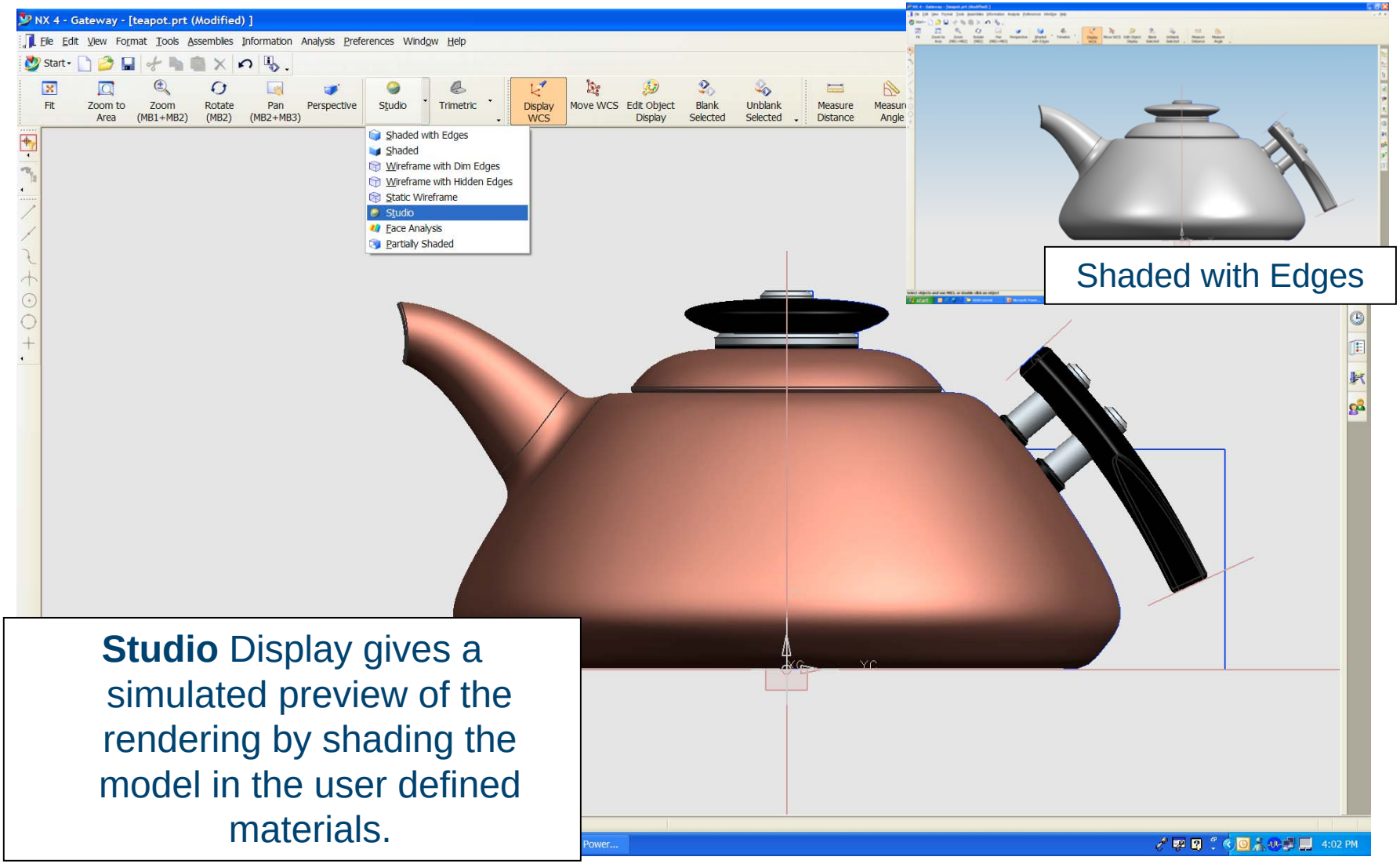
Studio Display



Studio Display gives a simulated preview of the rendering by shading the model in the user defined materials.

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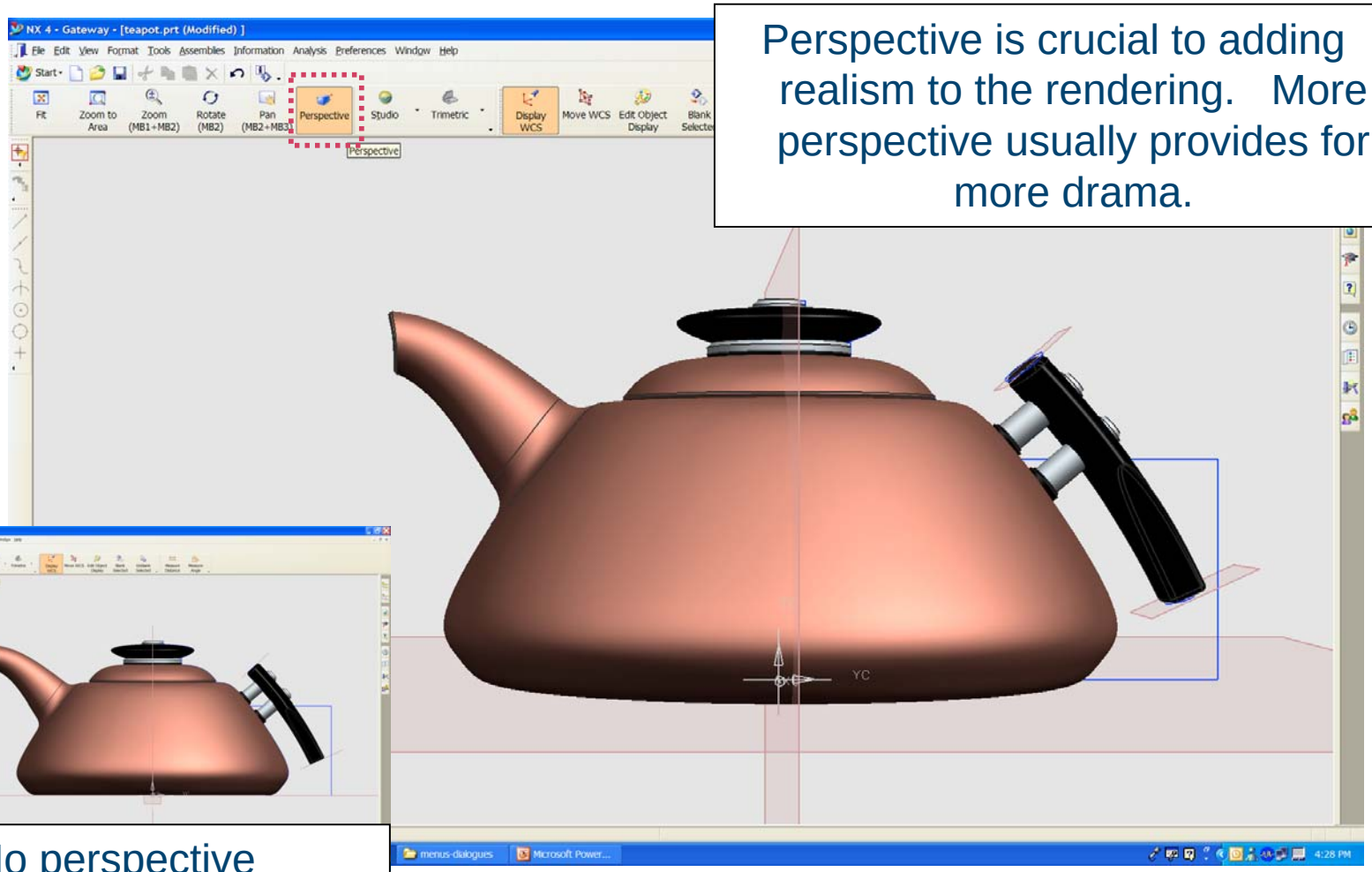
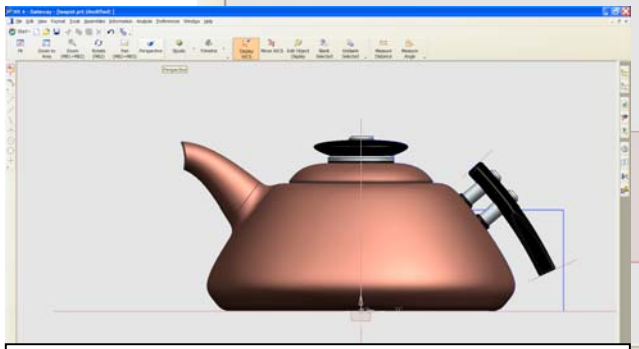
Turning on Perspective



Perspective is crucial to adding realism to the rendering. More perspective usually provides for more drama.



No perspective

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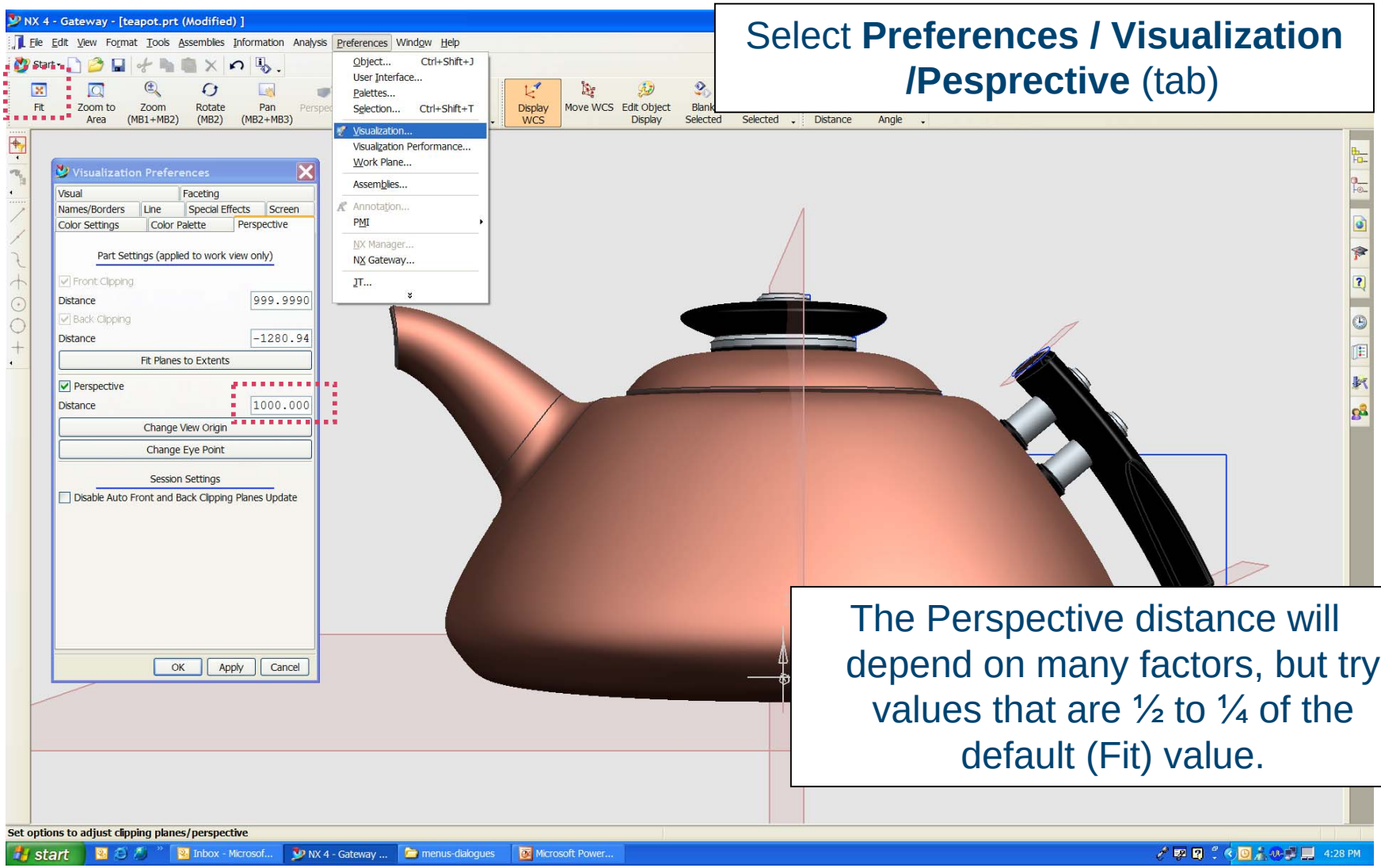
Setting Perspective Distance

Select **Preferences / Visualization /Pesprective** (tab)



The Perspective distance will depend on many factors, but try values that are ½ to ¼ of the default (Fit) value.

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HDRI range

Understanding the lighting and reflections in the various HDRI

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HDRI – Range

indoor photographic studio				outdoor
High Key Studio	Low Key Studio	Tabletop Soft Studio	Automotive Soft Studio	Santa Monica Sunset
Style of lighting that aims to reduce the contrast ratio (key to fill light) present in the scene. High-key lighting can be **harsh and has little contrast**.	Style of lighting that aims to produce a **bold contrast between light and dark**. Low-key lighting has a much higher contrast ratio than High-key lighting.	Style of lighting that aims to produce a very even, **large, soft-beamed light**. Tabletop Soft lighting is for generally **smaller products** and contains a subtle overhead fill light.	Style of lighting that aims to produce a very even, **large, soft-beamed light**. Automotive Soft lighting is for generally **larger products** and contains a low angle light component.	Style of lighting that aims to reproduce the lighting of the **setting sun against a blue-gray cloud filled sky**.

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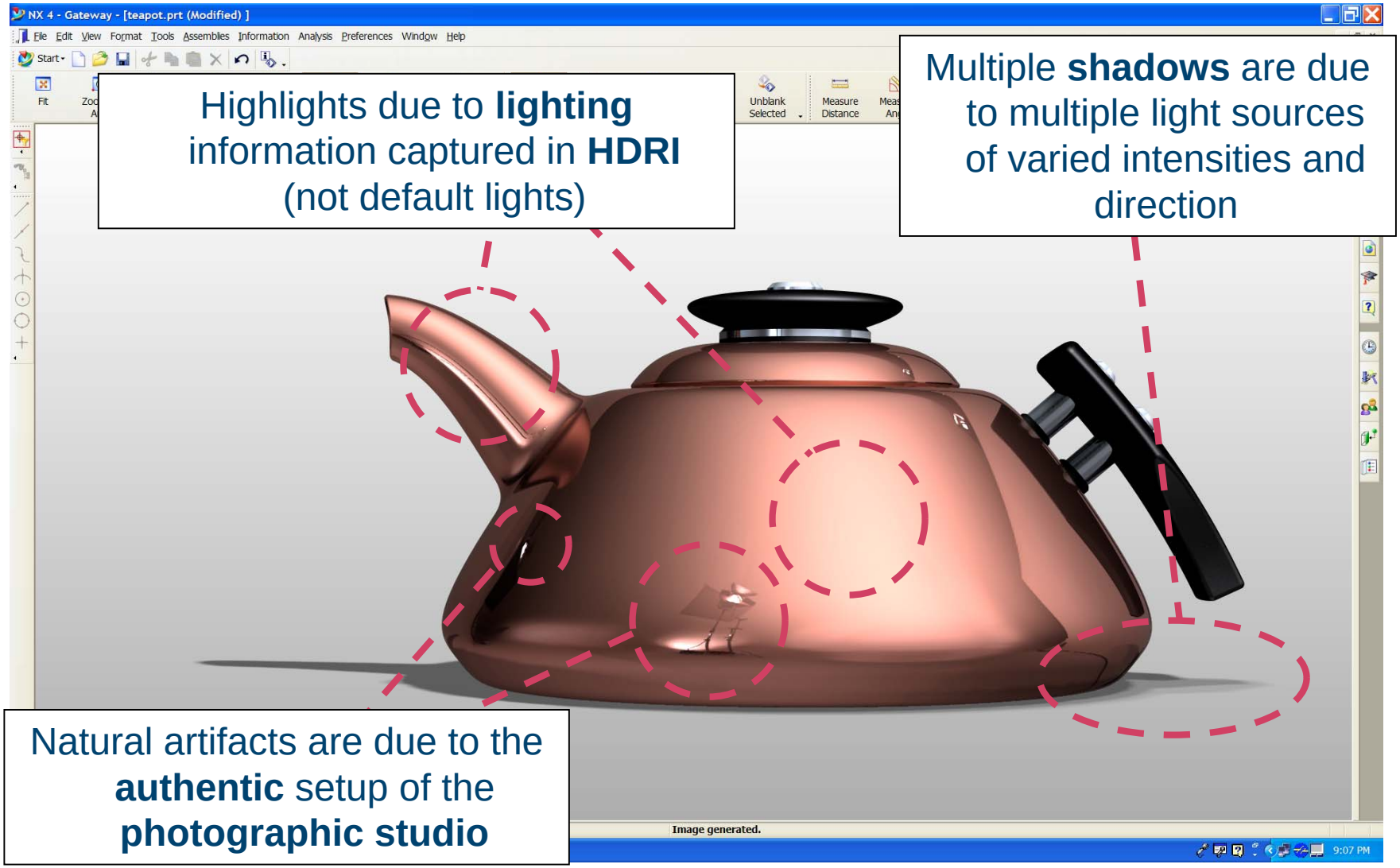
Seeing the HDRI in the Rendering



Highlights due to **lighting** information captured in **HDRI** (not default lights)

Multiple **shadows** are due to multiple light sources of varied intensities and direction

Natural artifacts are due to the **authentic** setup of the **photographic studio**

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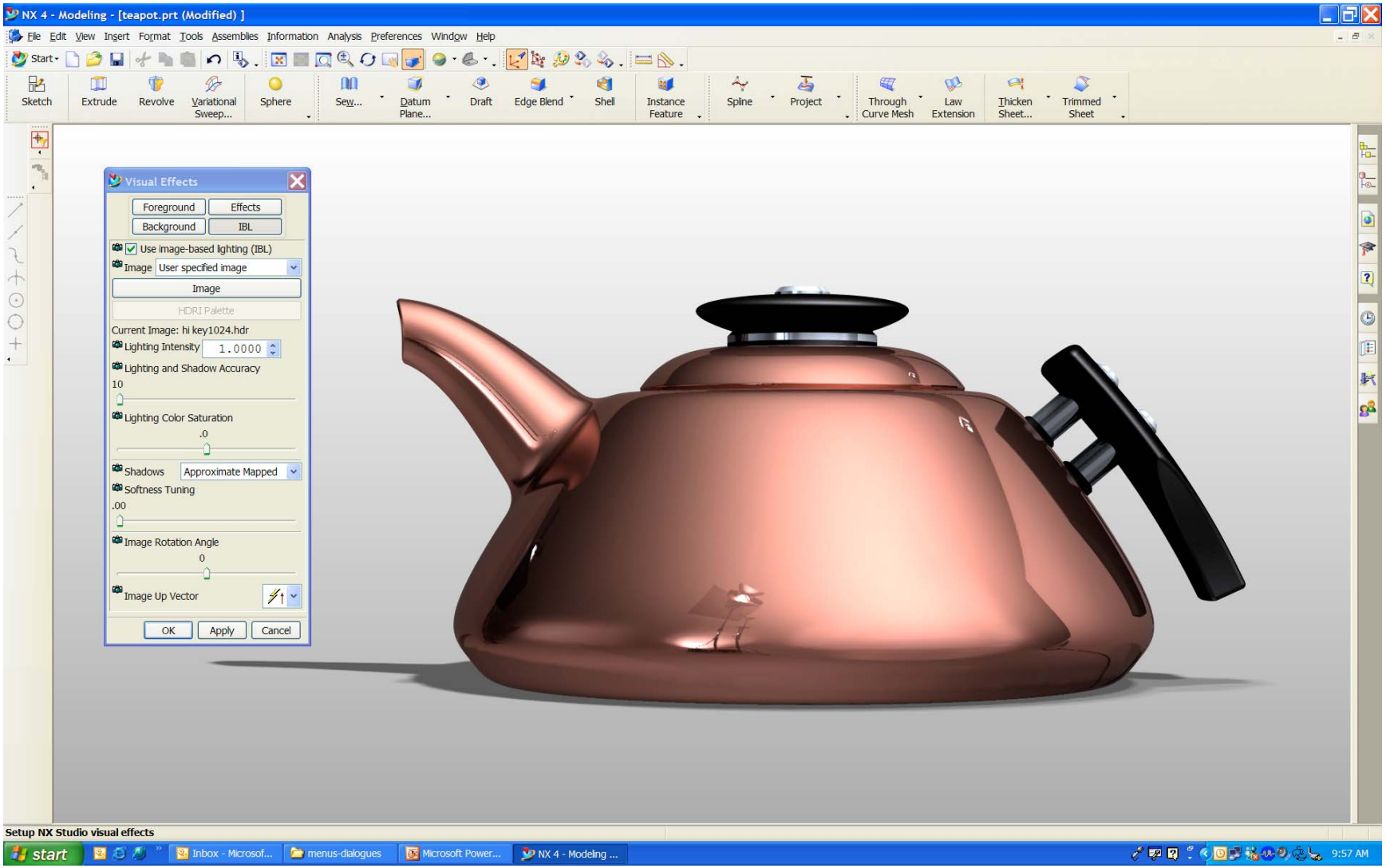
High Key Studio



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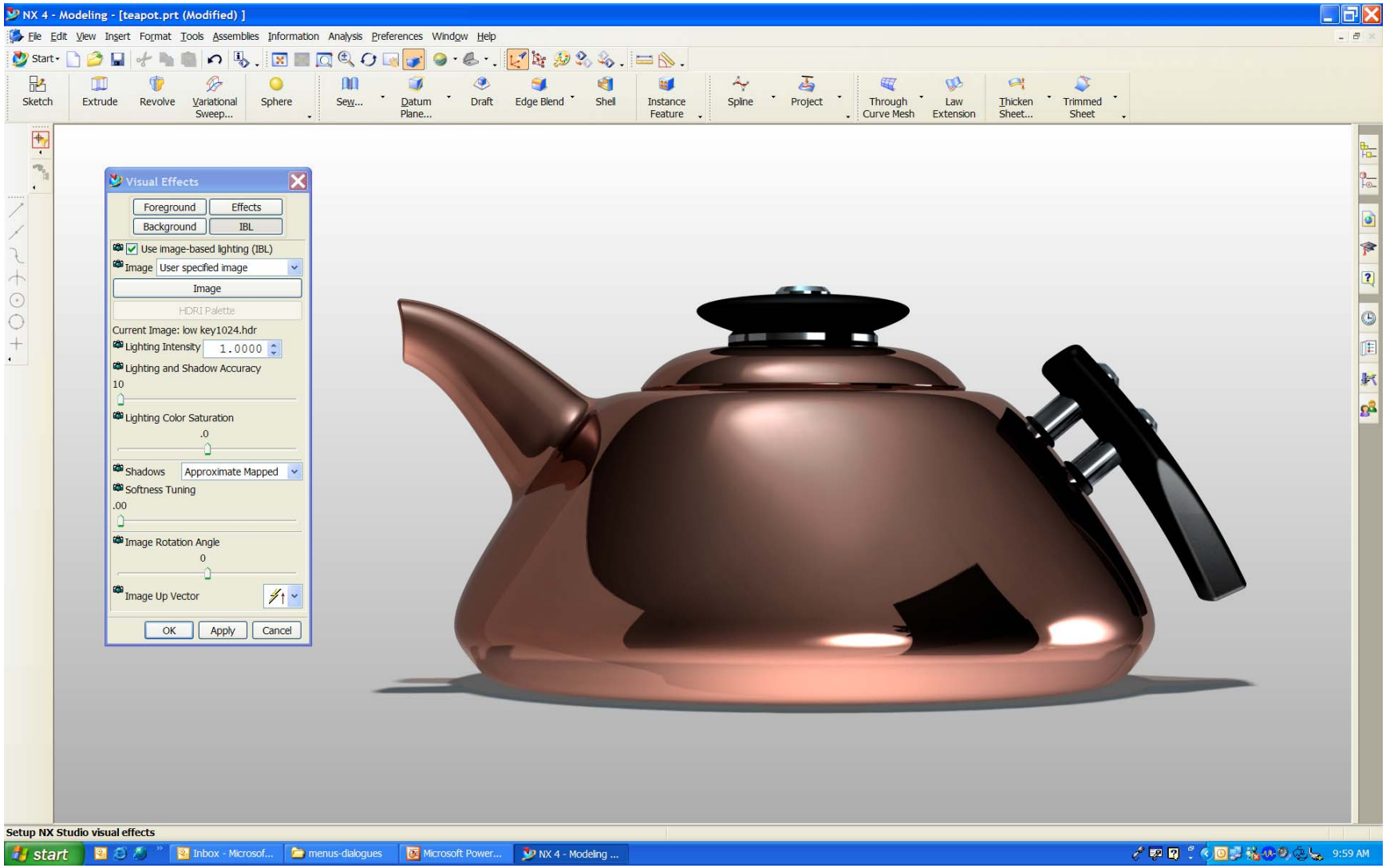
Low Key Studio



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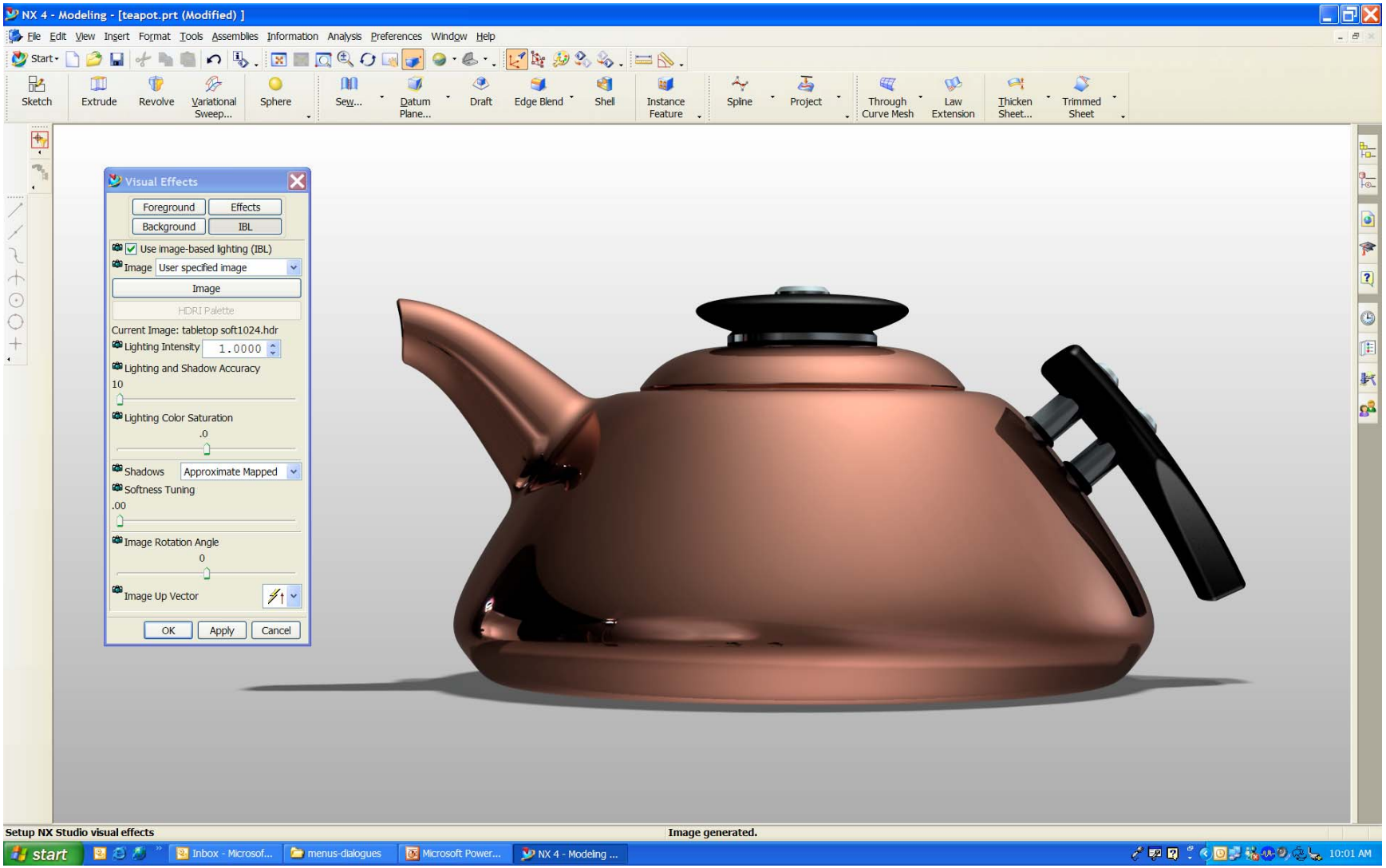
Tabletop Soft Studio



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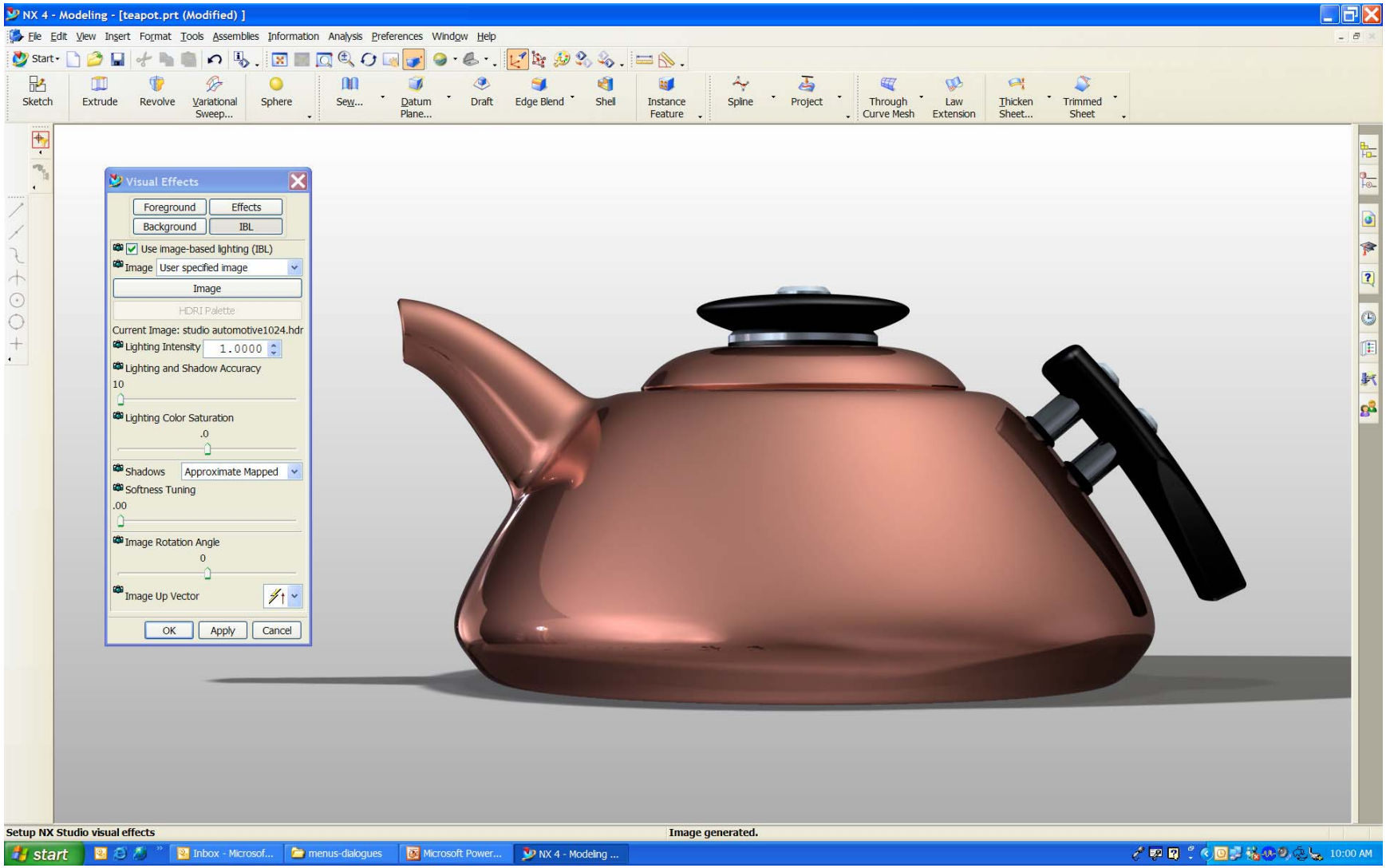
Automotive Soft Studio



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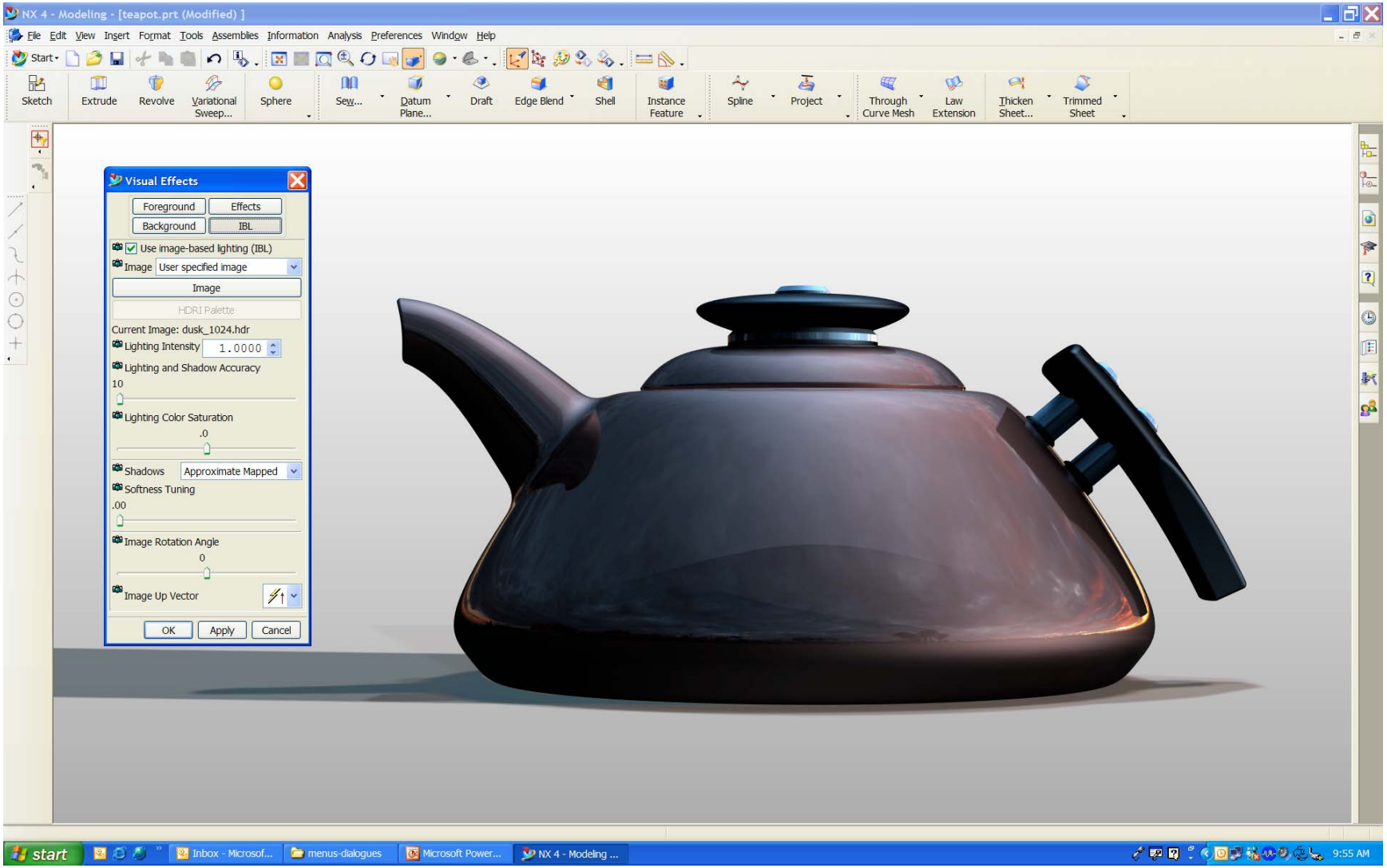
Santa Monica Sunset



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Light direction inherent in the HDRI

Understanding lighting and reflection orientation

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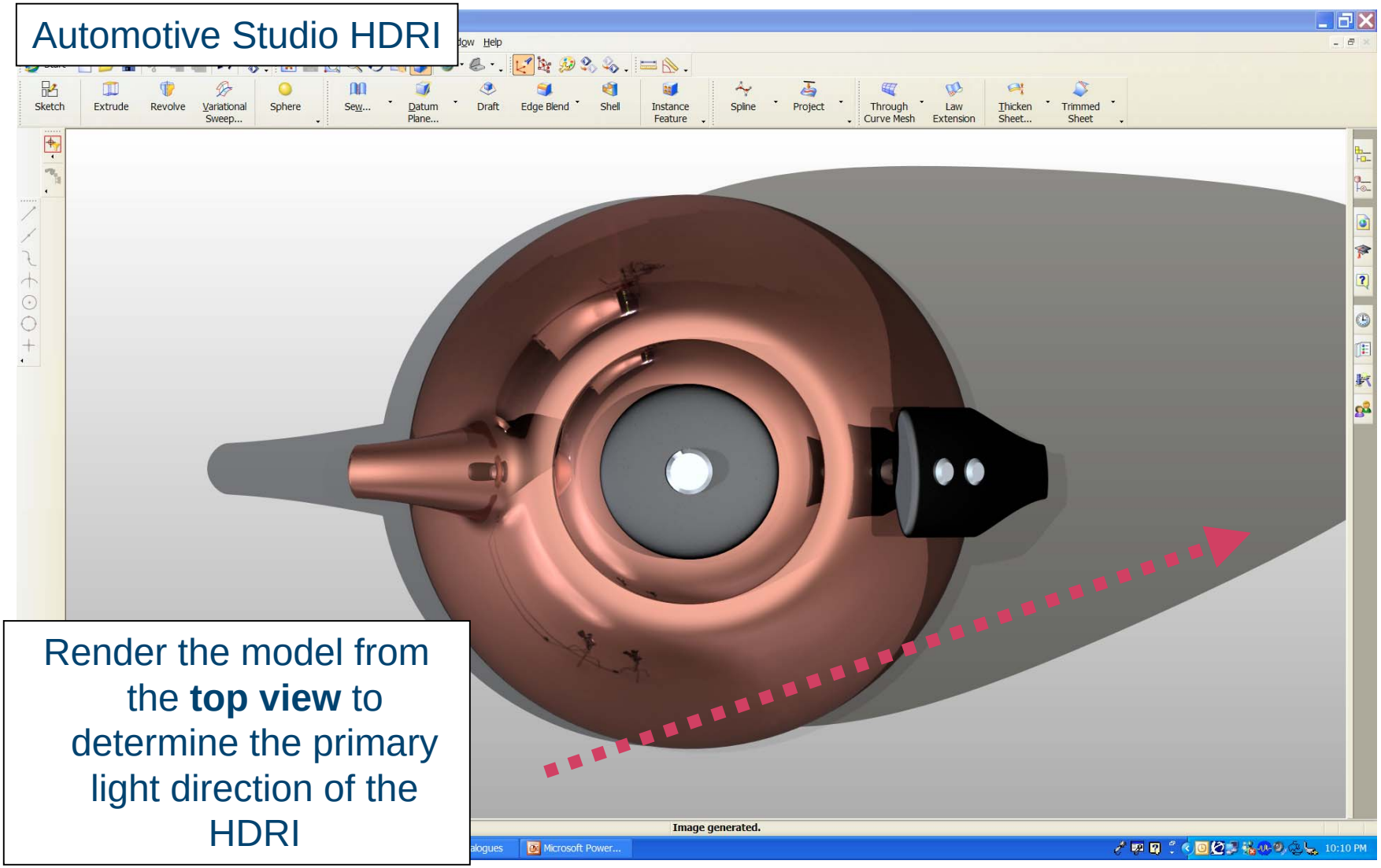
Understanding HDRI Light Direction

Automotive Studio HDRI



Render the model from the **top view** to determine the primary light direction of the HDRI

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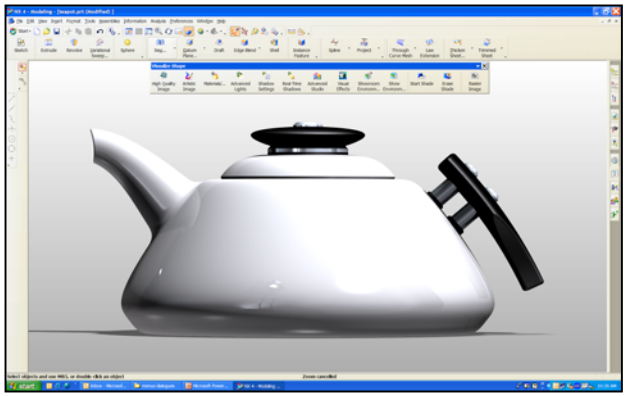
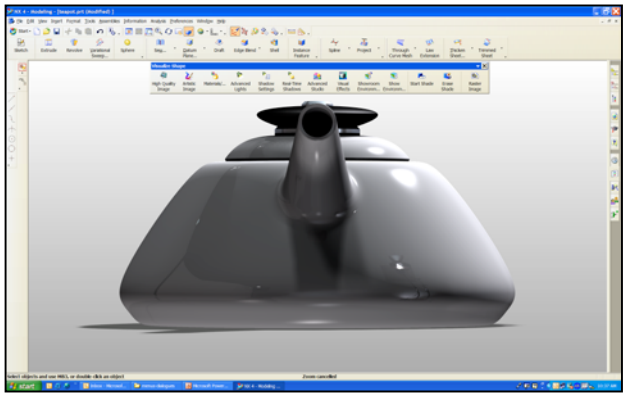
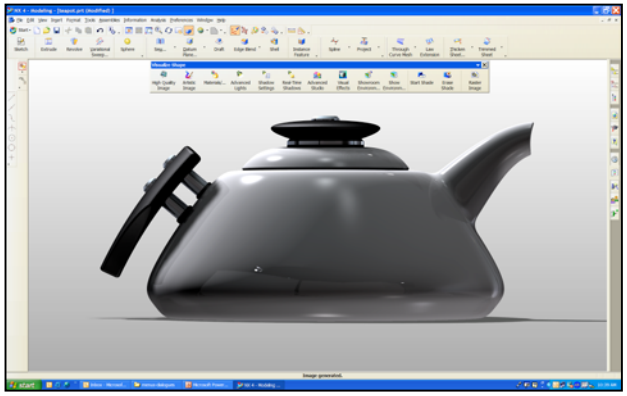
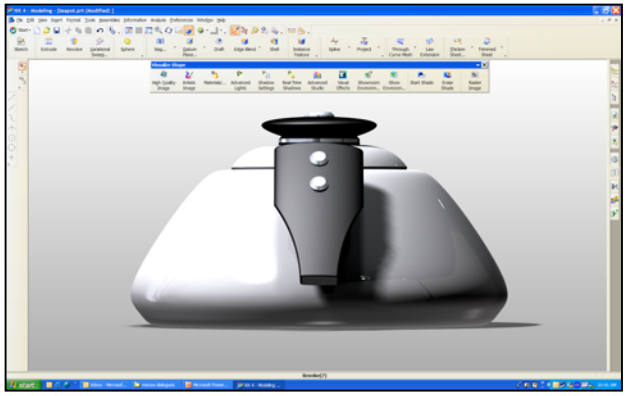
Understanding HDRI Light Direction

High Key Studio HDRI (lighting and reflection information is fixed to the model)









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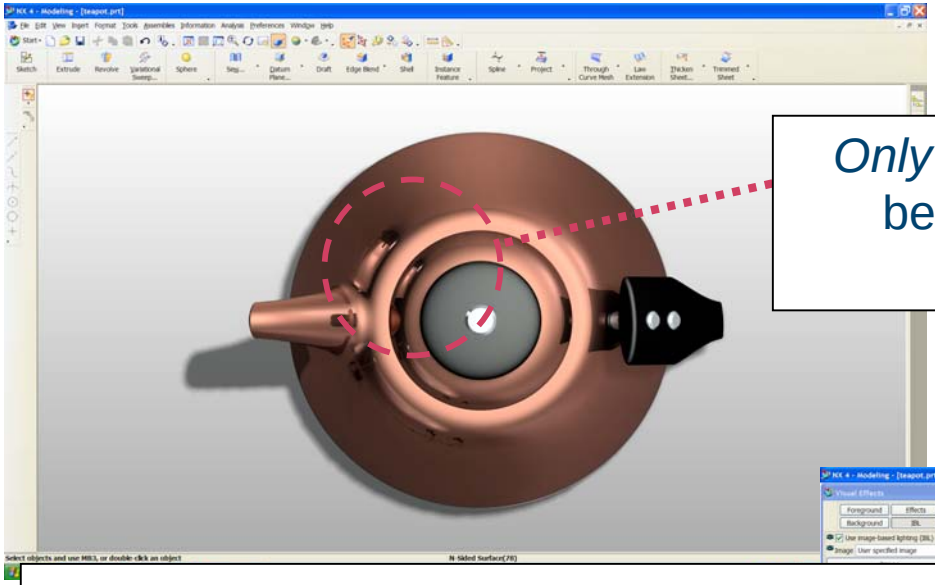
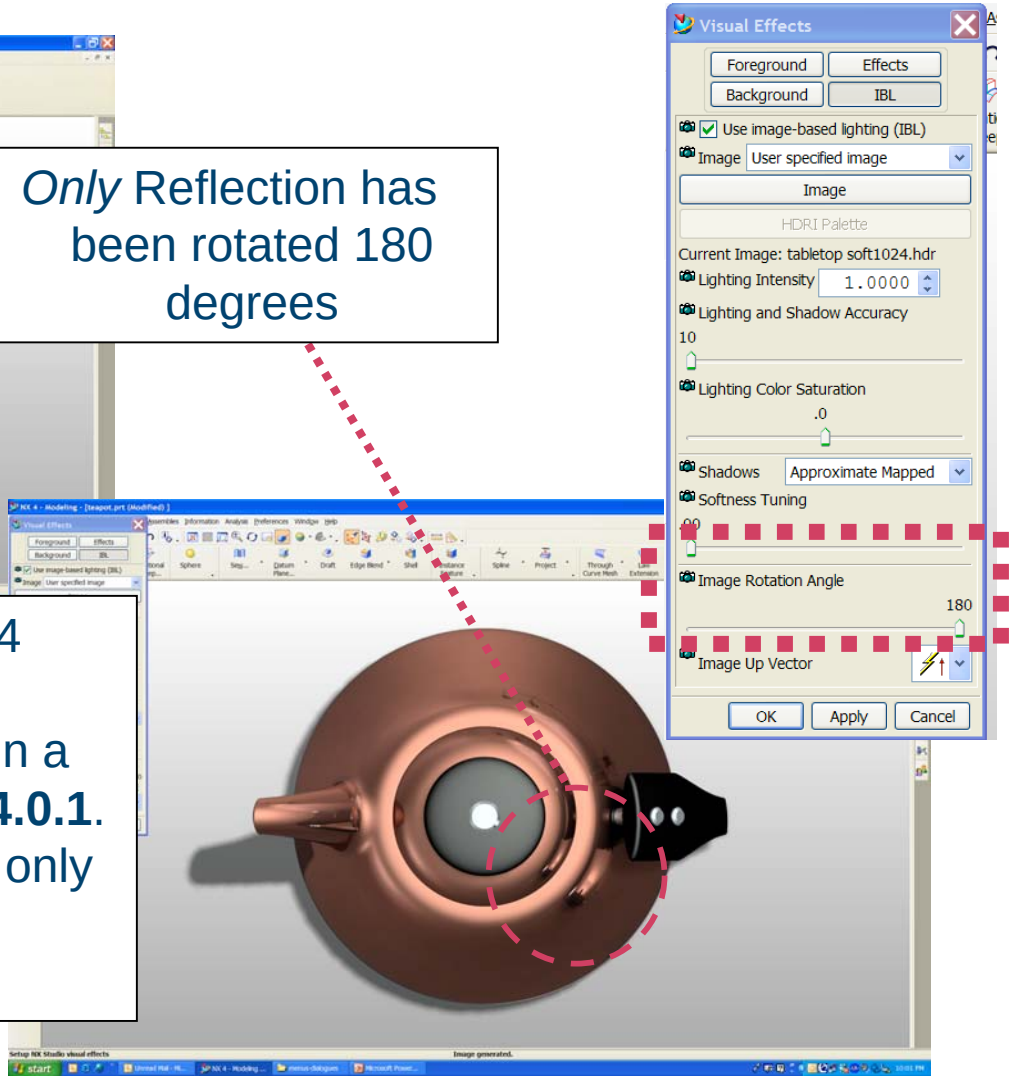
HDRI Image Rotation Angle *



Only Reflection has been rotated 180 degrees



***** Note that in the first release of NX 4 **Image Rotation Angle** is not fully implemented and will be completed in a future point release, most likely **NX 4.0.1**. Therefore Image Rotation Angle will only affect the reflection and not the light direction and subsequent shadows.

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UGS

Transforming the process of innovation

Ready to render

Selecting the desired HDRI and creating a High Quality Image

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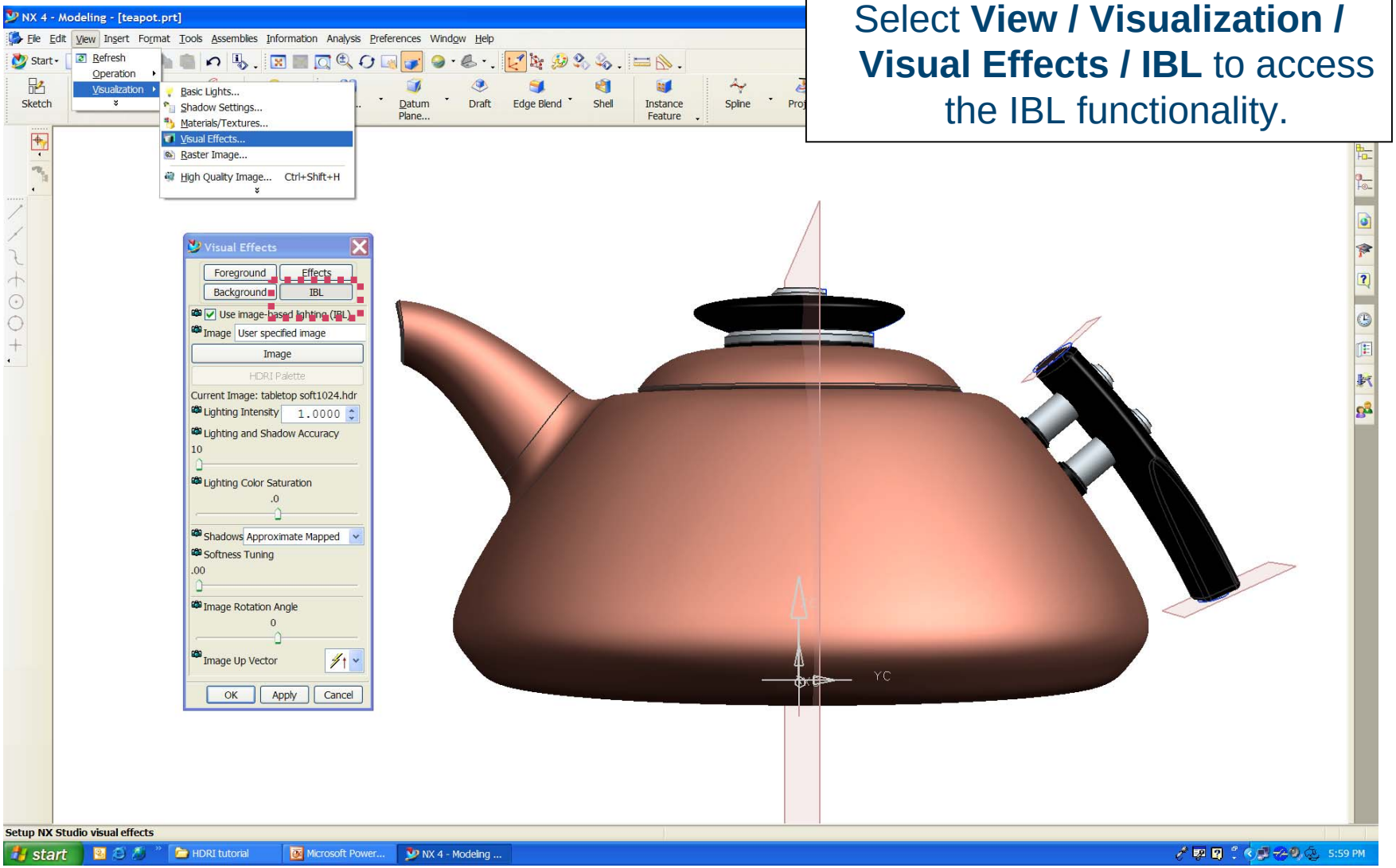
IBL Dialogue Box

Select **View / Visualization / Visual Effects / IBL** to access the IBL functionality.



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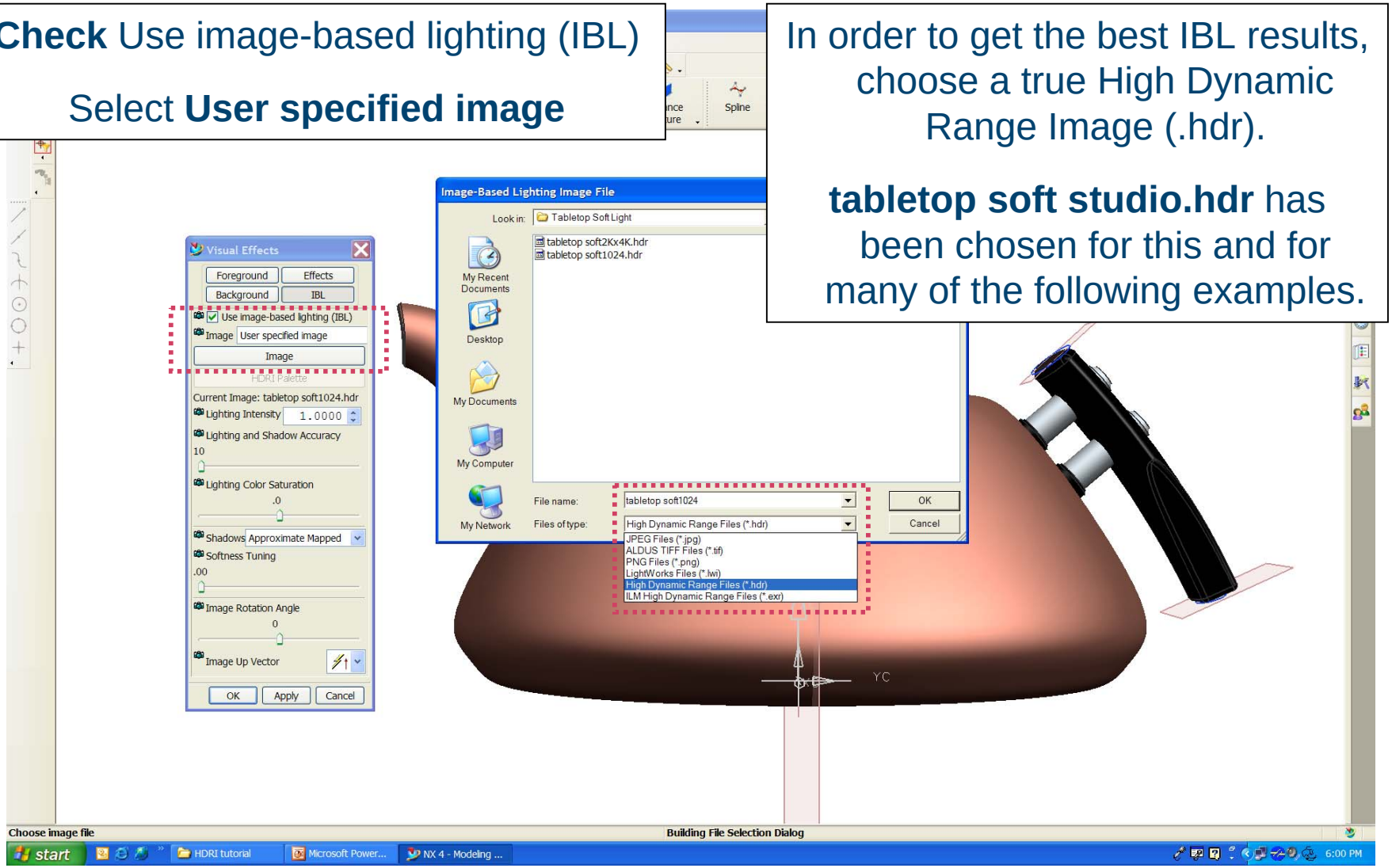
Selecting the HDRI file

Check Use image-based lighting (IBL)

Select **User specified image**

In order to get the best IBL results, choose a true High Dynamic Range Image (.hdr).

tabletop soft studio.hdr has been chosen for this and for many of the following examples.



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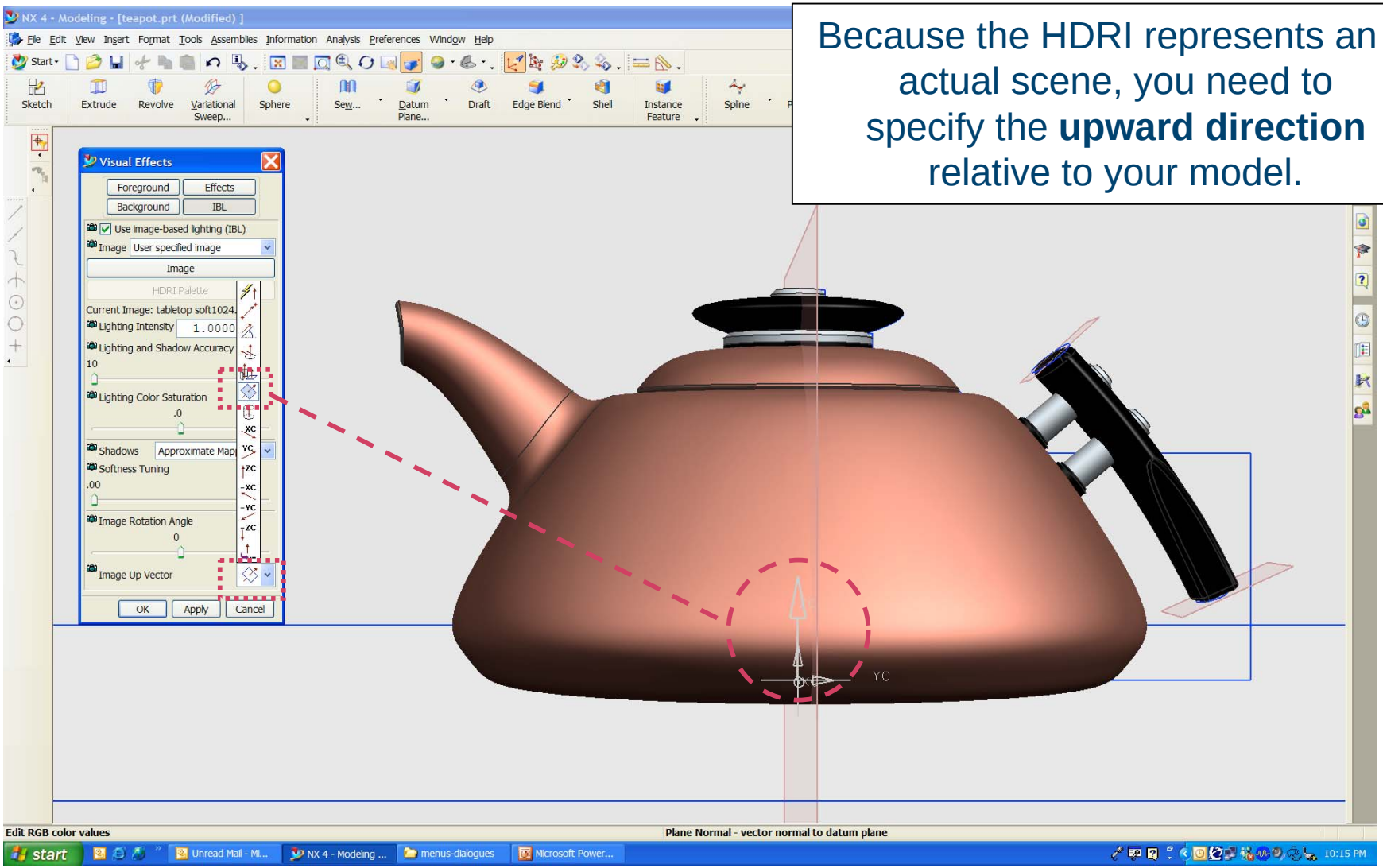
Setting the Image Up Vector



Because the HDRI represents an actual scene, you need to specify the **upward direction** relative to your model.

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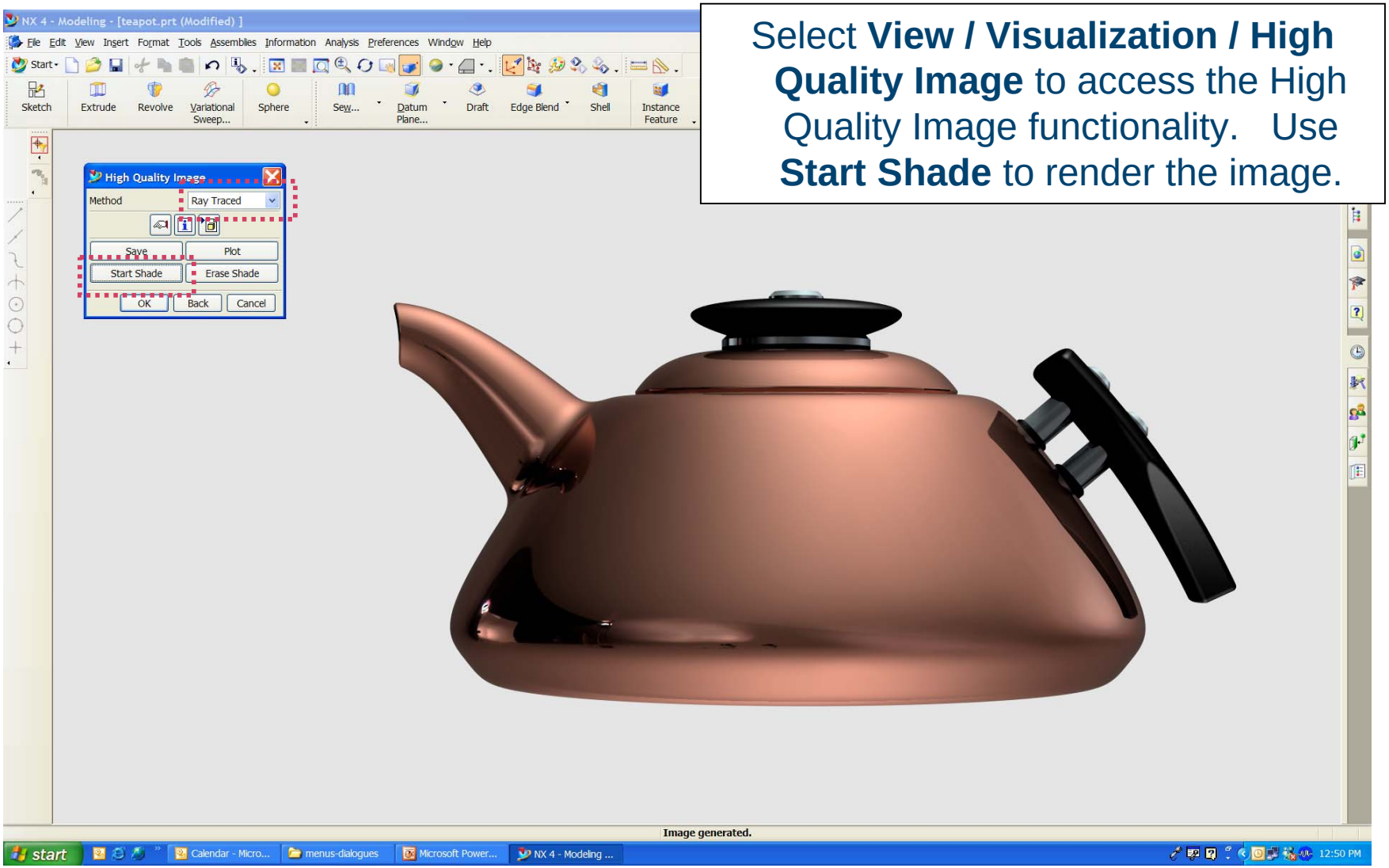
Creating a High Quality Image

Select **View / Visualization / High Quality Image** to access the High Quality Image functionality. Use **Start Shade** to render the image.



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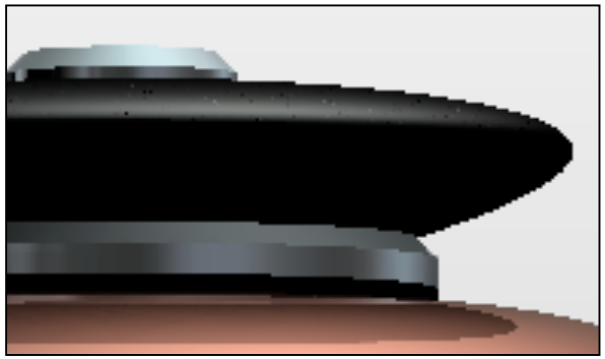
High Quality Image – Render Method

Increasing render time

Increasing anti-aliasing



Preview

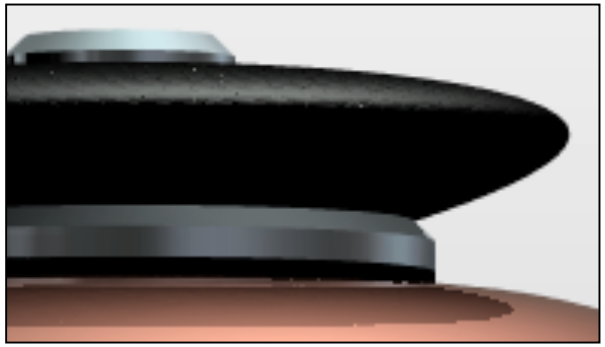
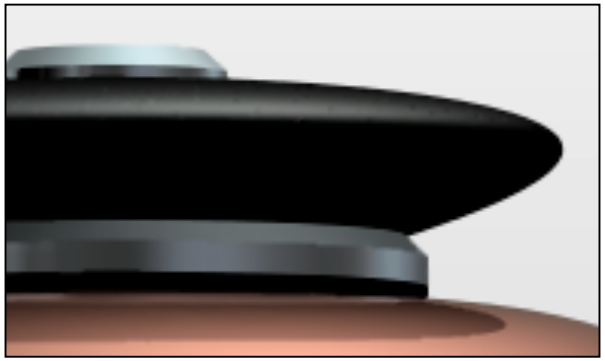
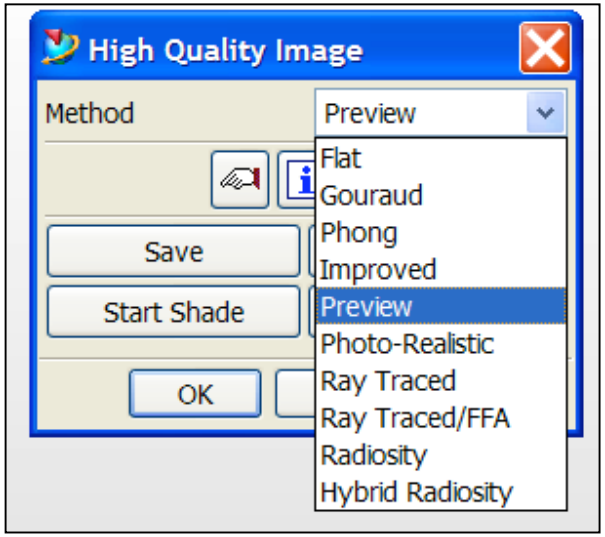


Photo-Realistic



Ray Traced



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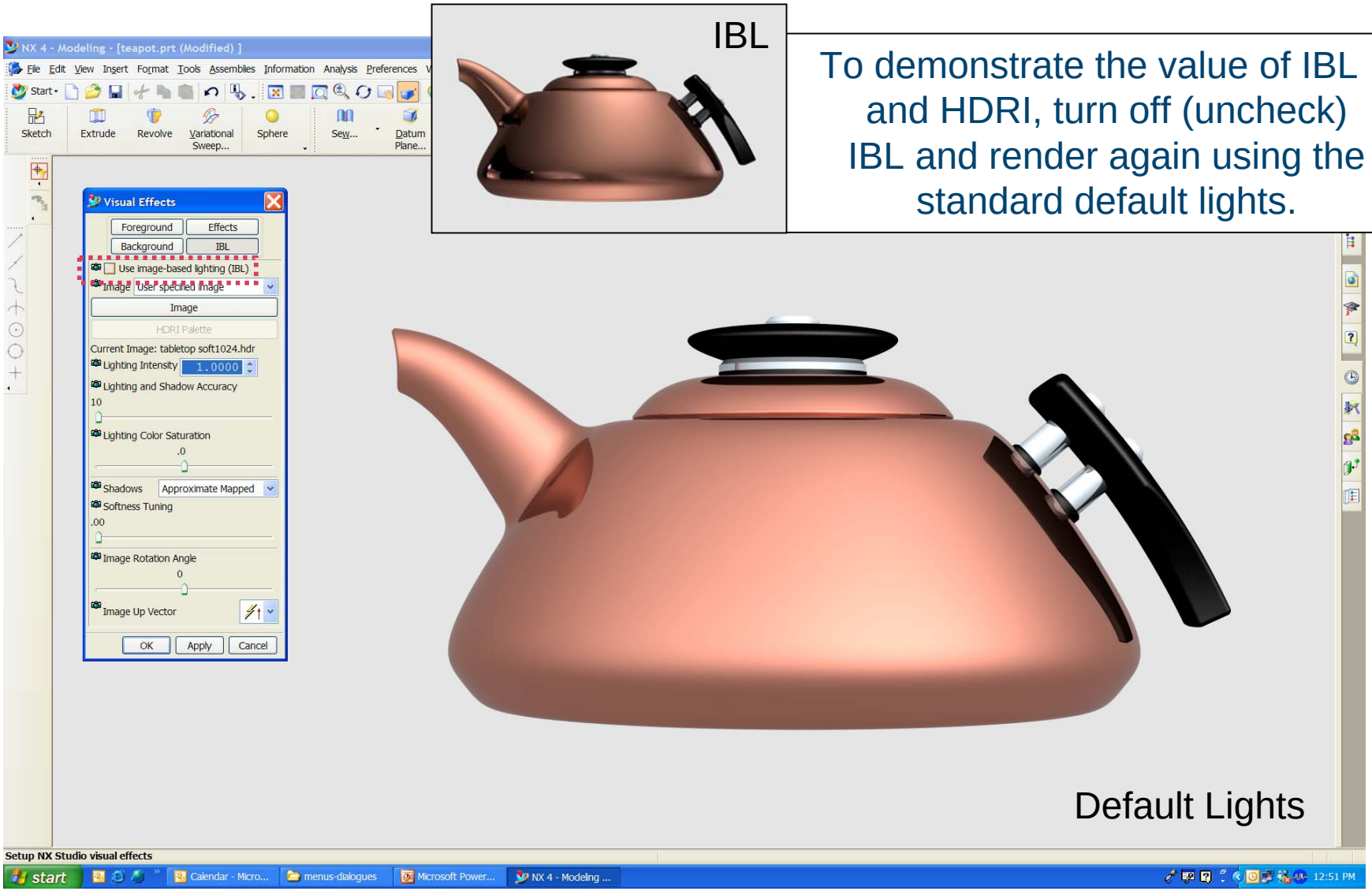
IBL vs. Default Lights



To demonstrate the value of IBL and HDRI, turn off (uncheck) IBL and render again using the standard default lights.

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Saving a High Quality Image

Adjusting Image Preferences to get the desired result

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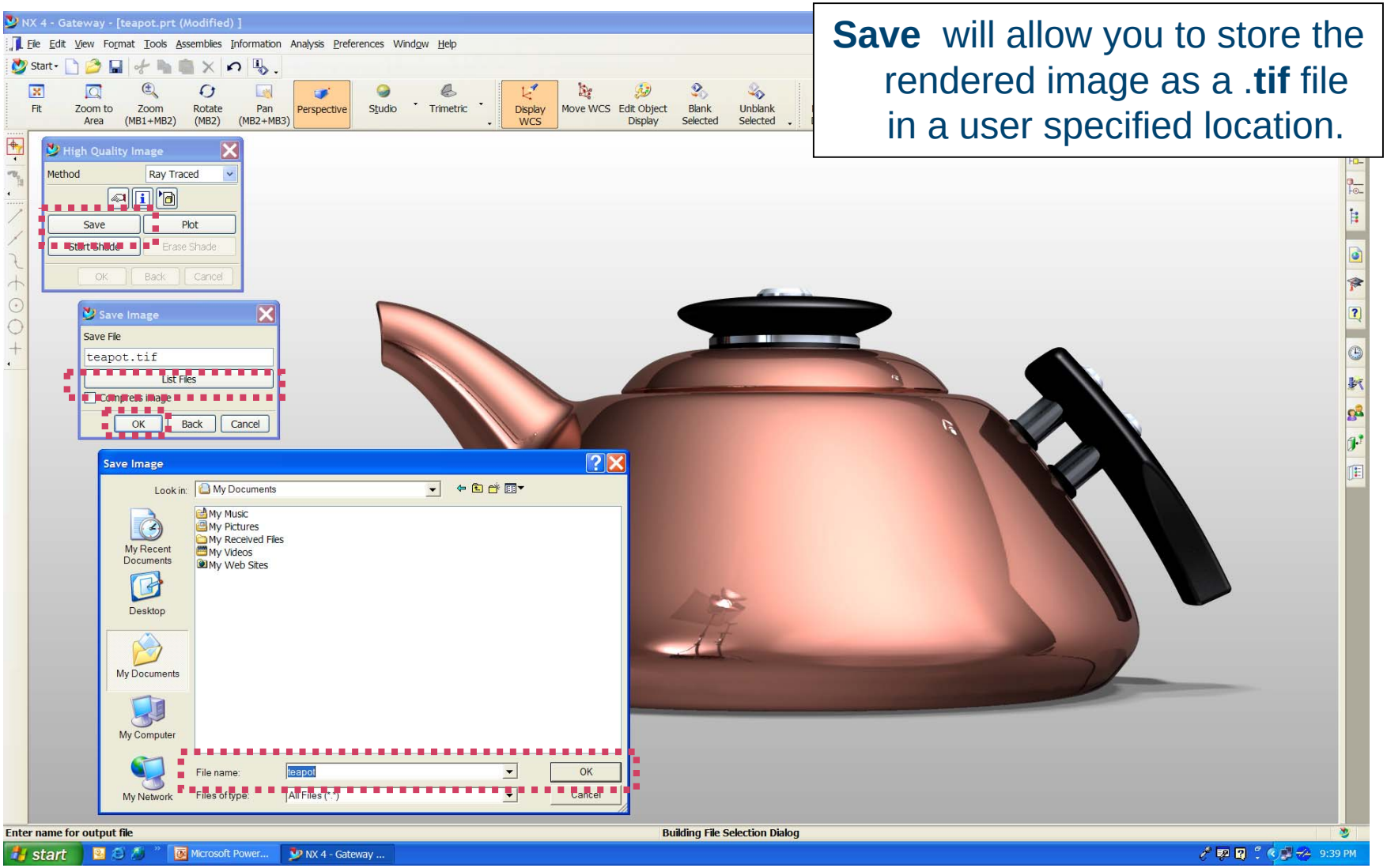
Saving a High Quality Image

Save will allow you to store the rendered image as a .**tif** file in a user specified location.



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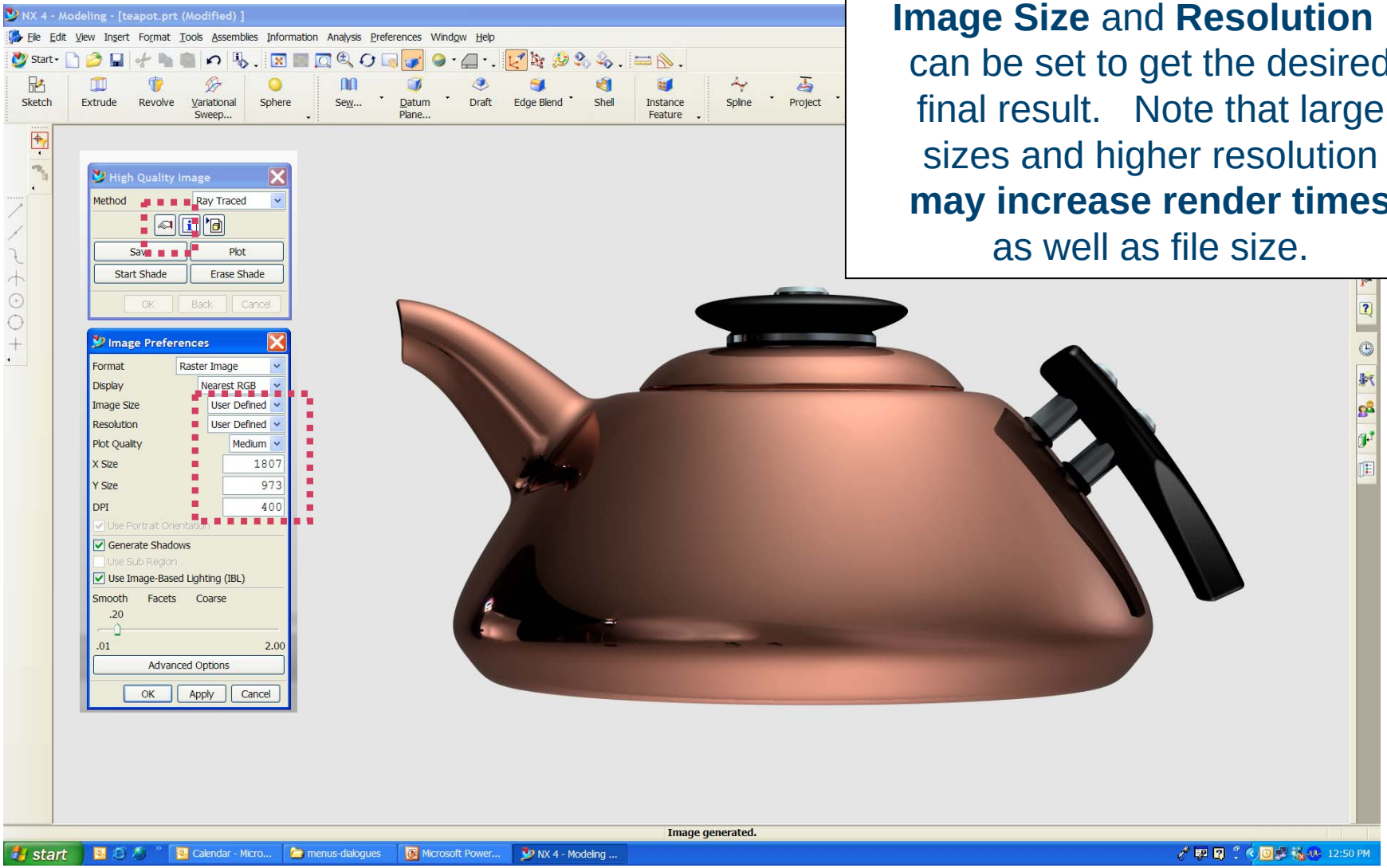
Render Image Size and Resolution

Image Size and **Resolution** can be set to get the desired final result. Note that large sizes and higher resolution **may increase render times** as well as file size.



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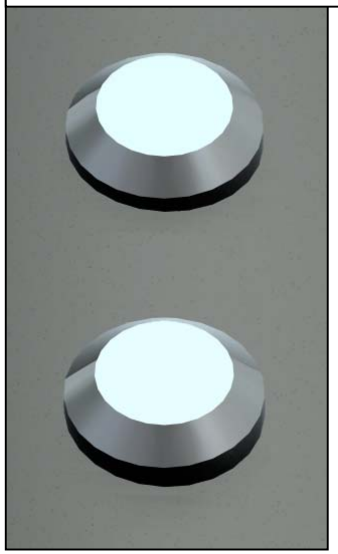
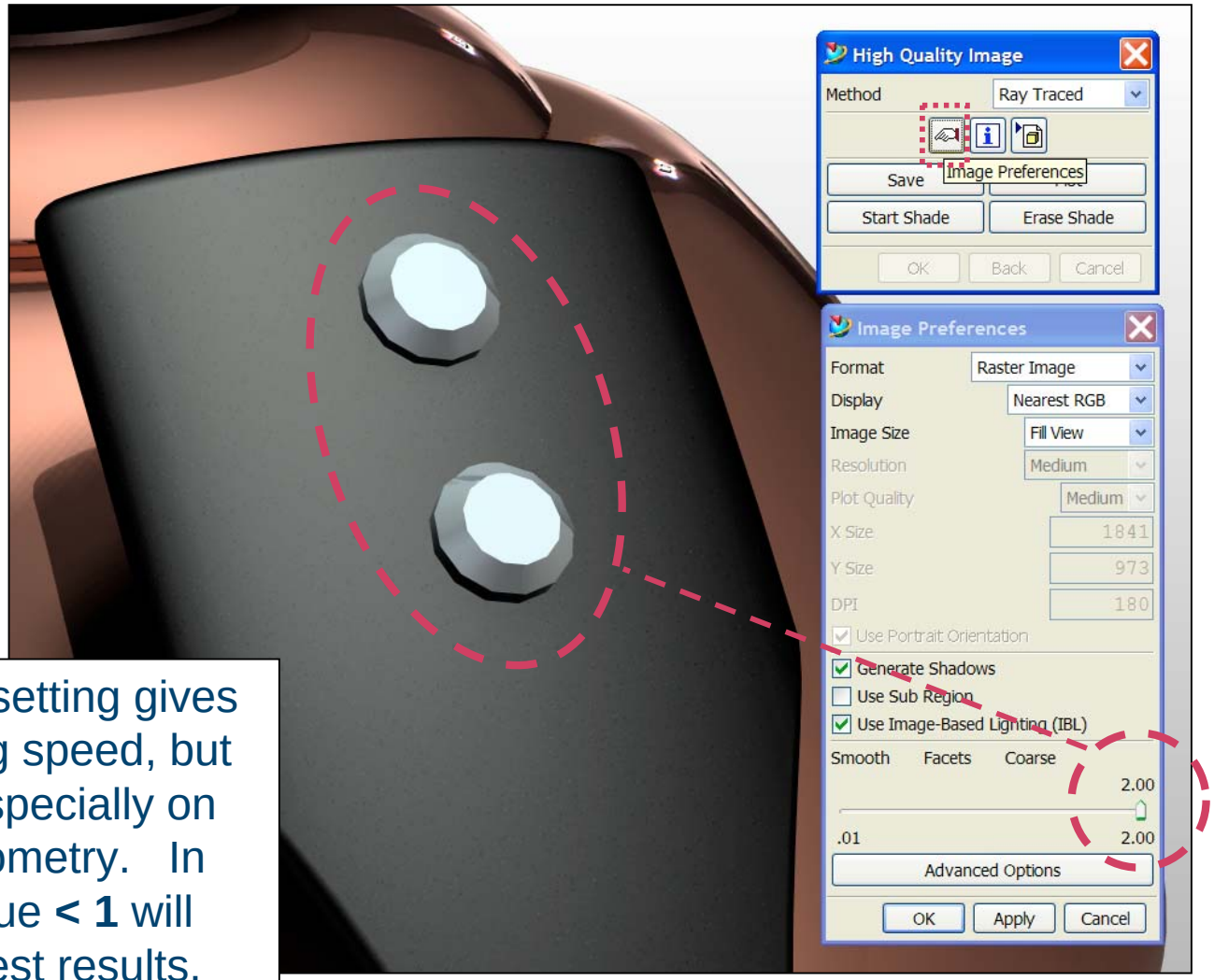
Facets setting < 1 for Best Results

Facets = 1.0 (default)





A Coarse **facets** setting gives faster rendering speed, but poor results especially on cylindrical geometry. In general a value **< 1** will provide the best results.

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Adding more realism with a floor

Techniques for adding a floor or base to the model

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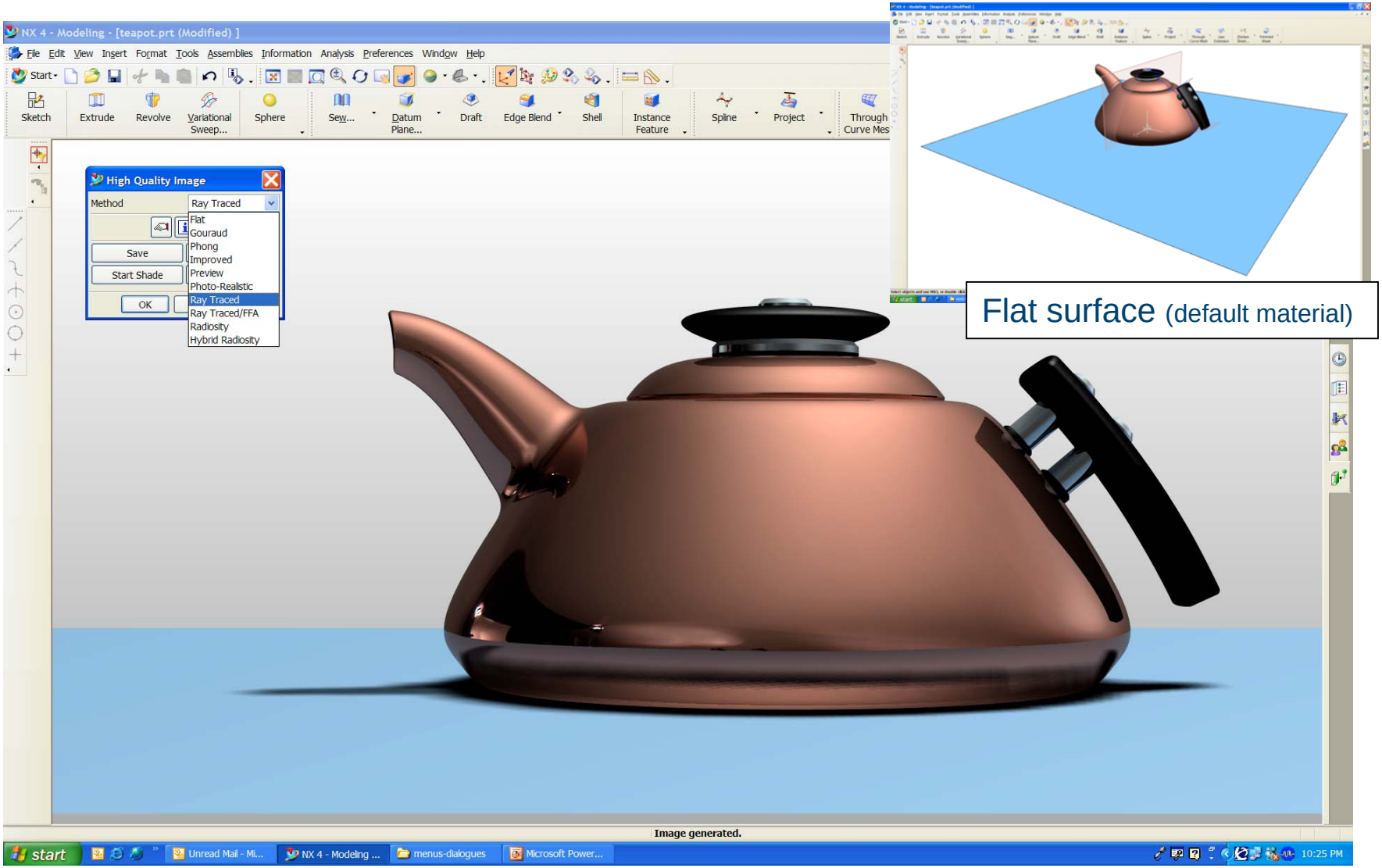
Floor in default Material



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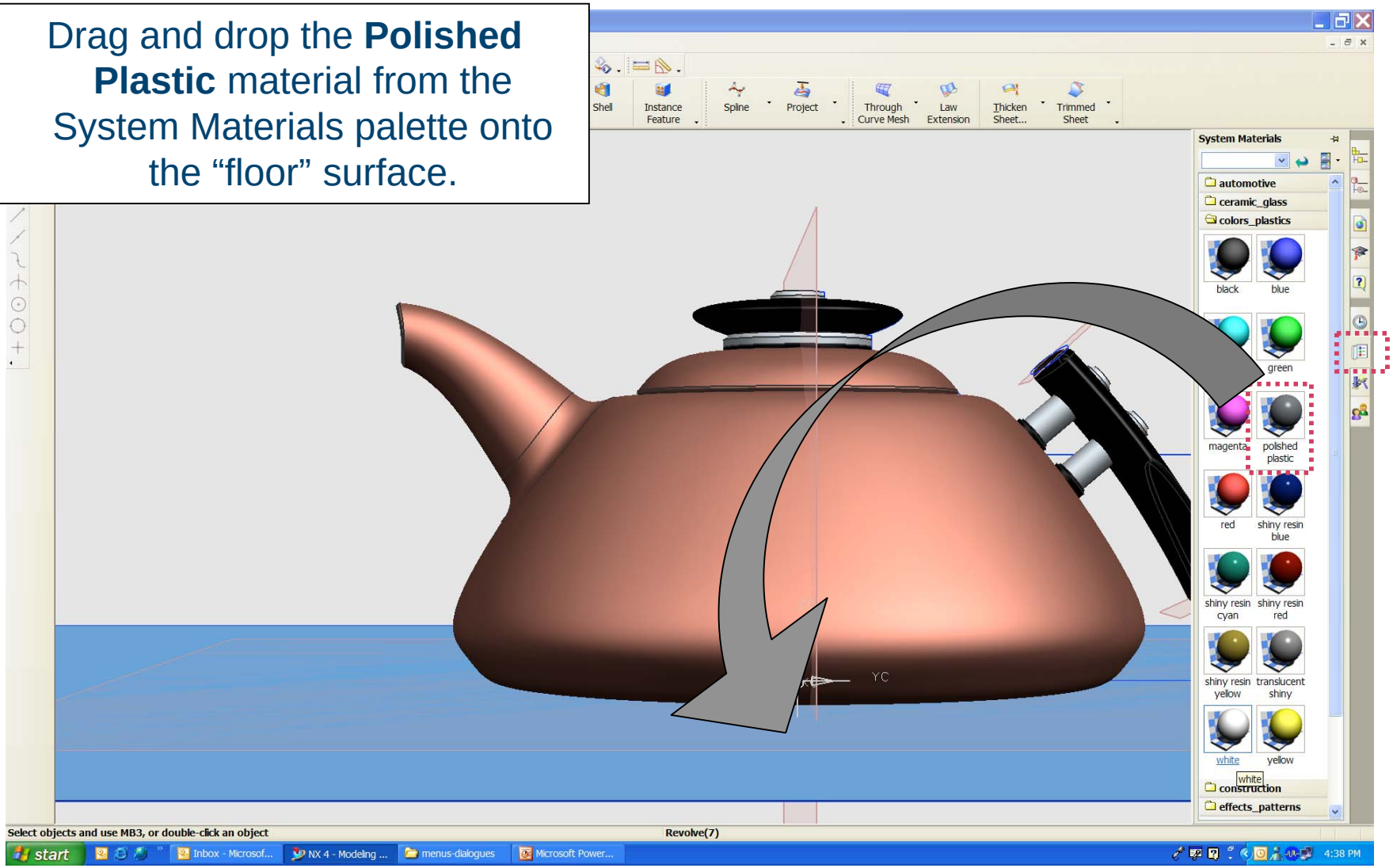
Setting the “floor” Material

Drag and drop the **Polished Plastic** material from the System Materials palette onto the “floor” surface.



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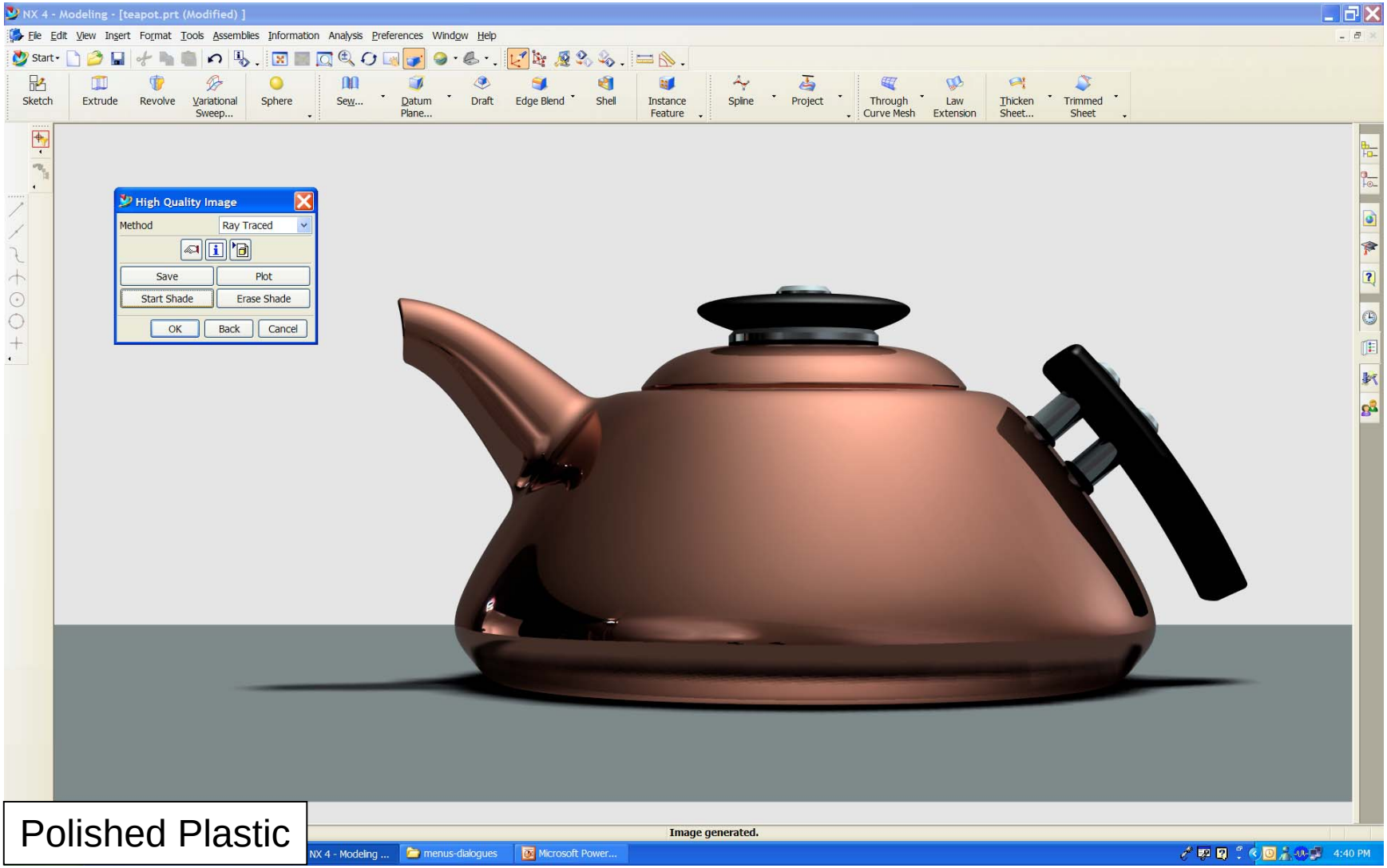
Floor in Polished Plastic



Polished Plastic

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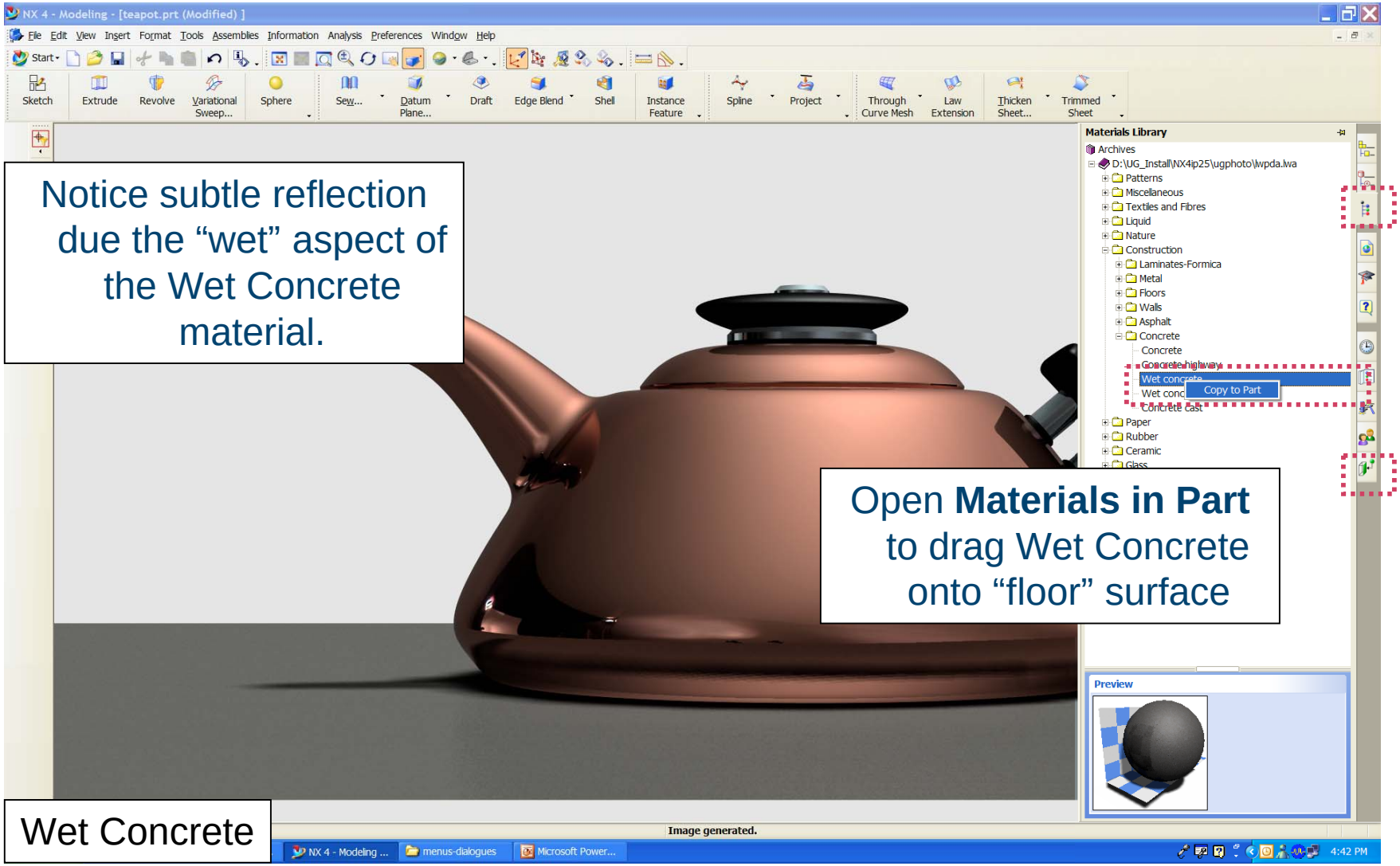
Floor in Wet Concrete



Notice subtle reflection due the “wet” aspect of the Wet Concrete material.

Open **Materials in Part** to drag Wet Concrete onto “floor” surface

Wet Concrete

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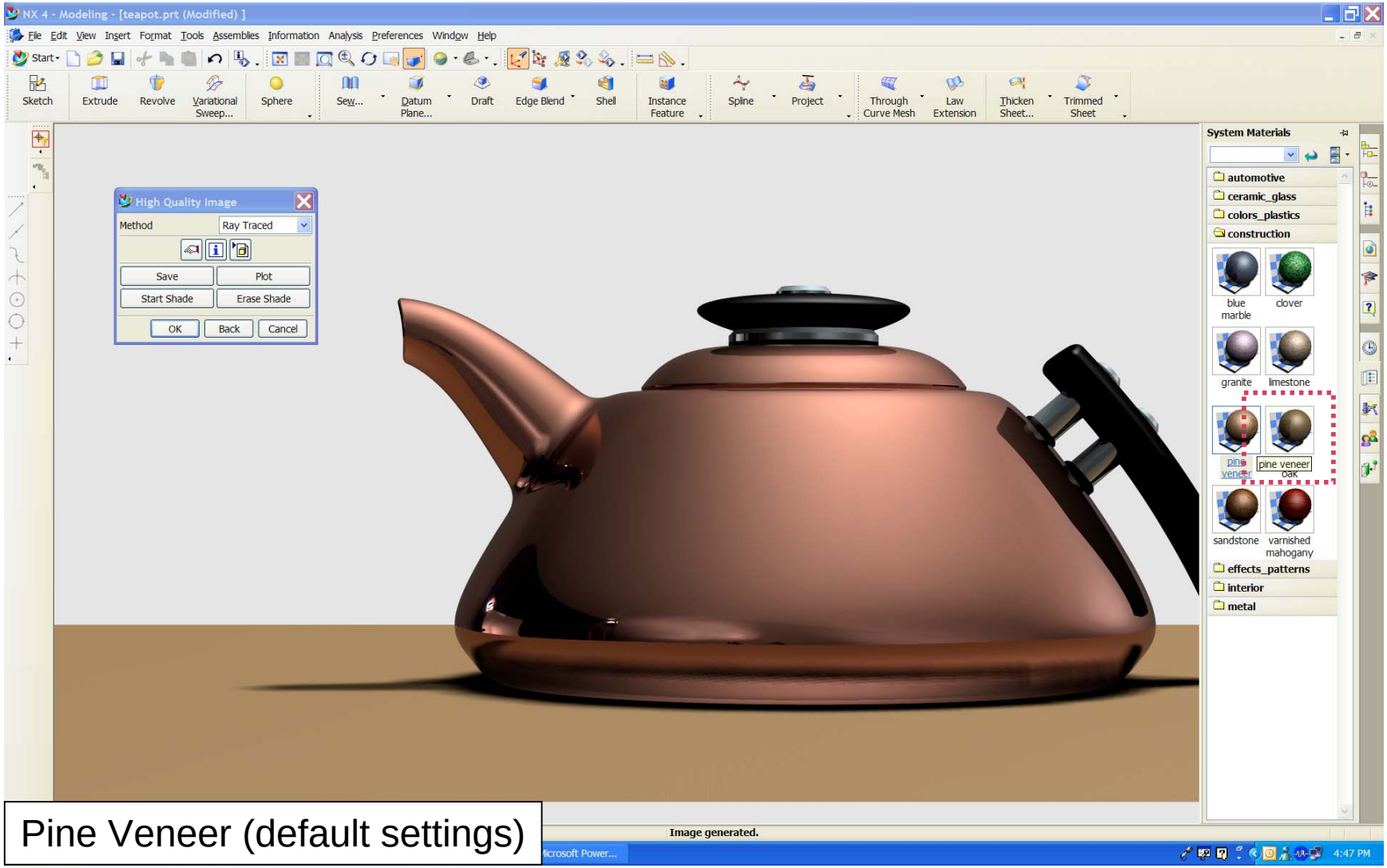
Floor in Pine Veneer (default)



Pine Veneer (default settings)

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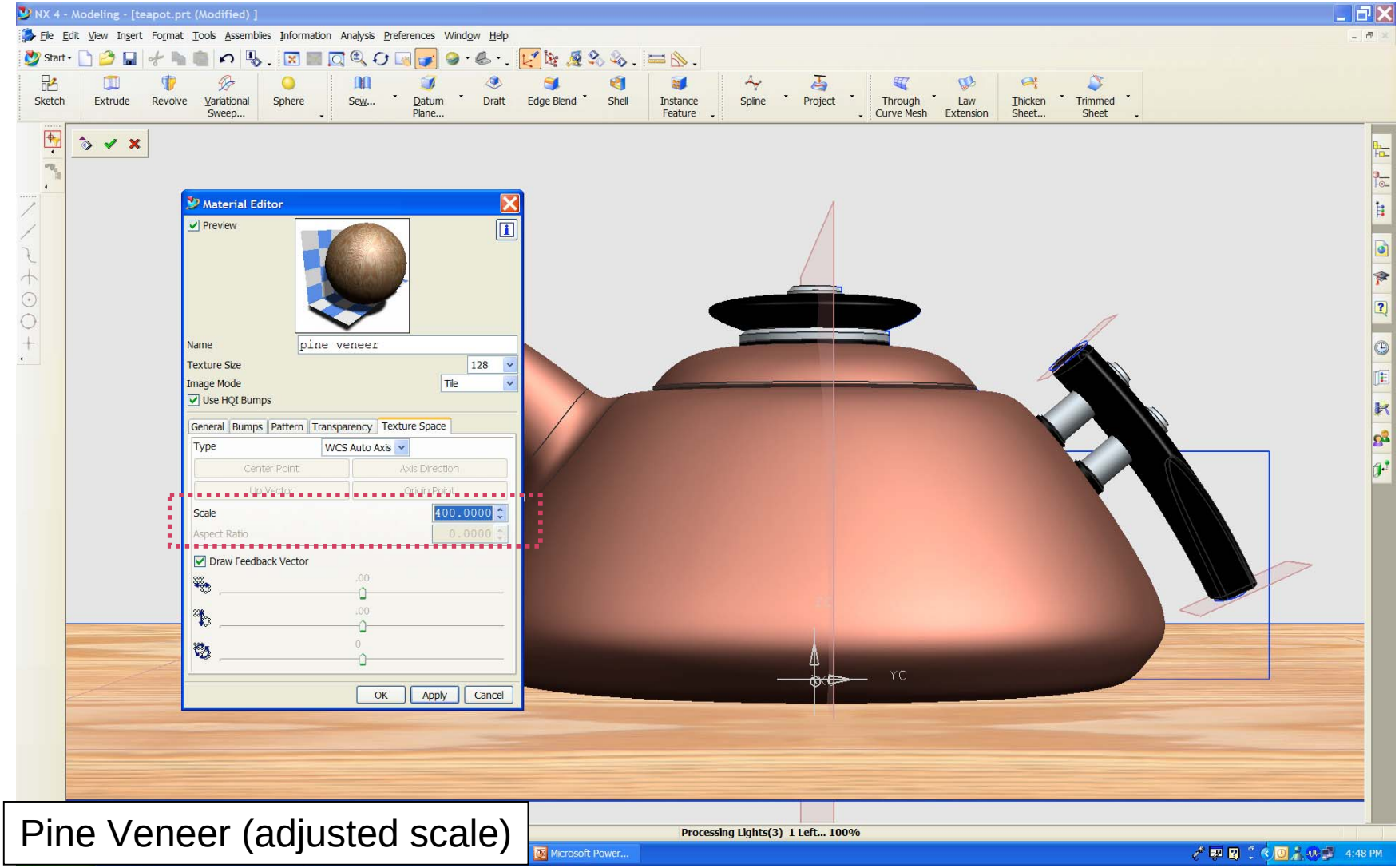
Floor in Pine Veneer (adjusted)



Pine Veneer (adjusted scale)

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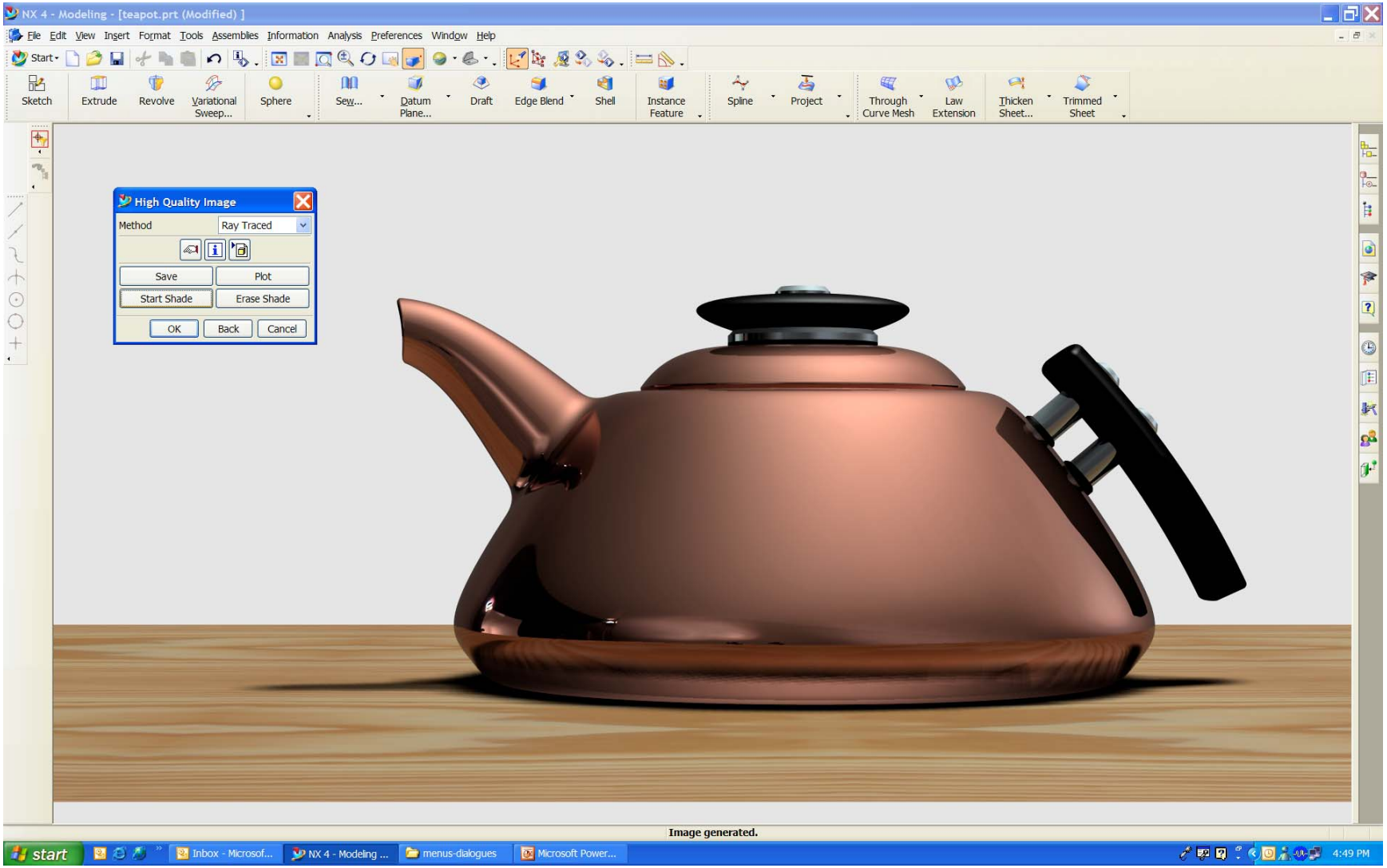
Floor in Pine Veneer



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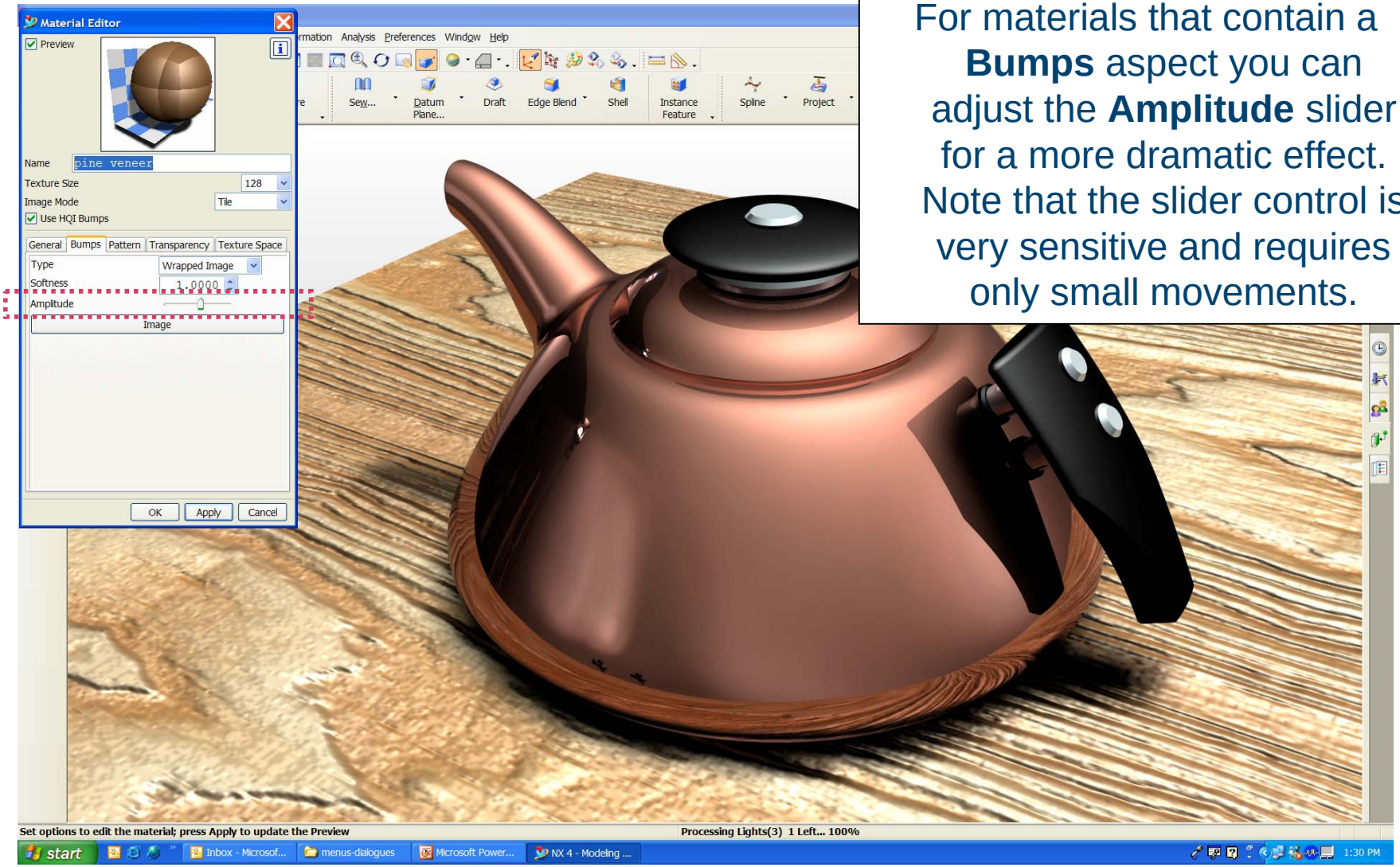
Editing the Bumps Amplitude



For materials that contain a **Bumps** aspect you can adjust the **Amplitude** slider for a more dramatic effect. Note that the slider control is very sensitive and requires only small movements.

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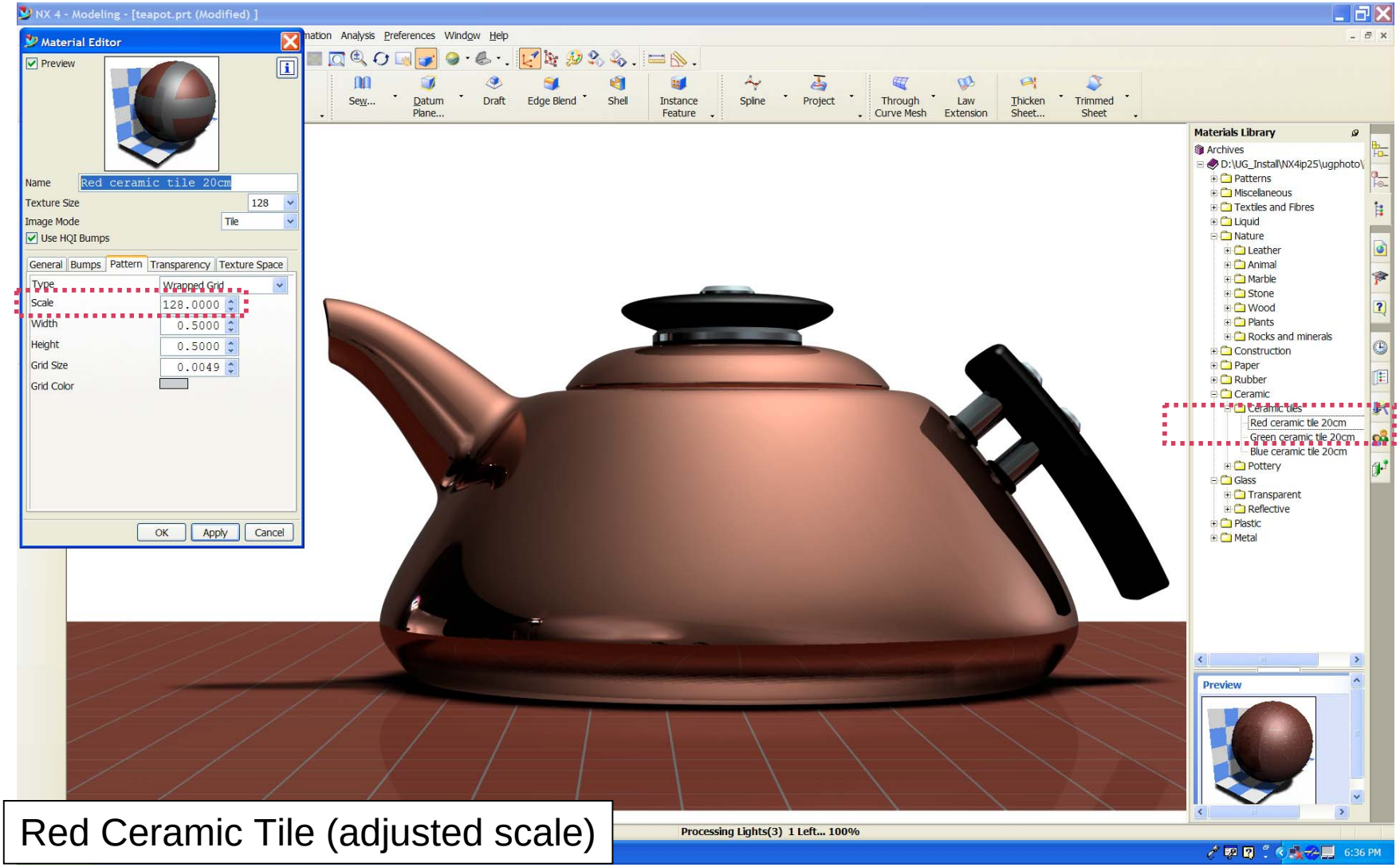
Floor in Red Ceramic Tile



Red Ceramic Tile (adjusted scale)

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Adding more realism with a background

Techniques for using a Shadow Catcher and Backgrounds

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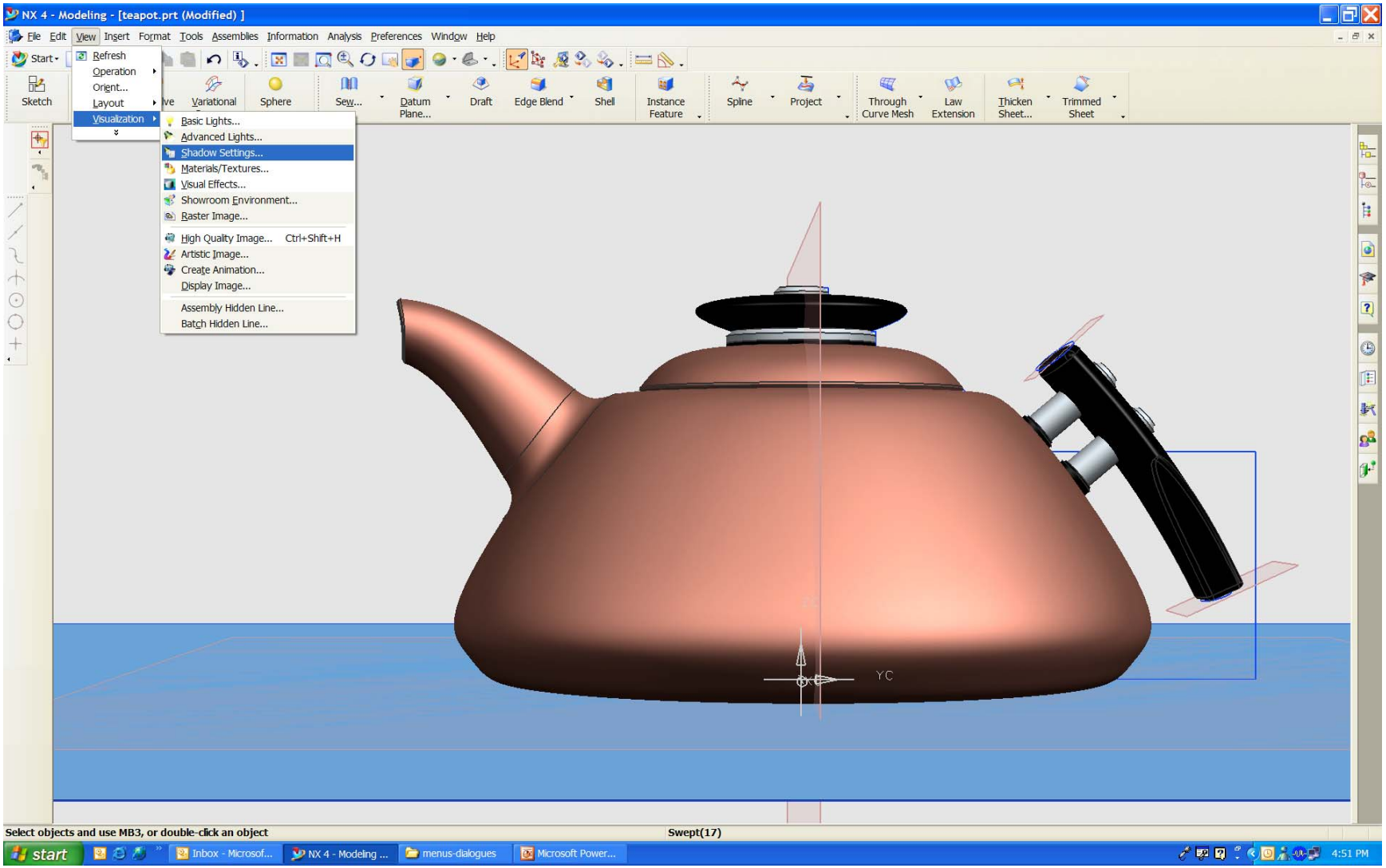
Accessing Shadow Settings



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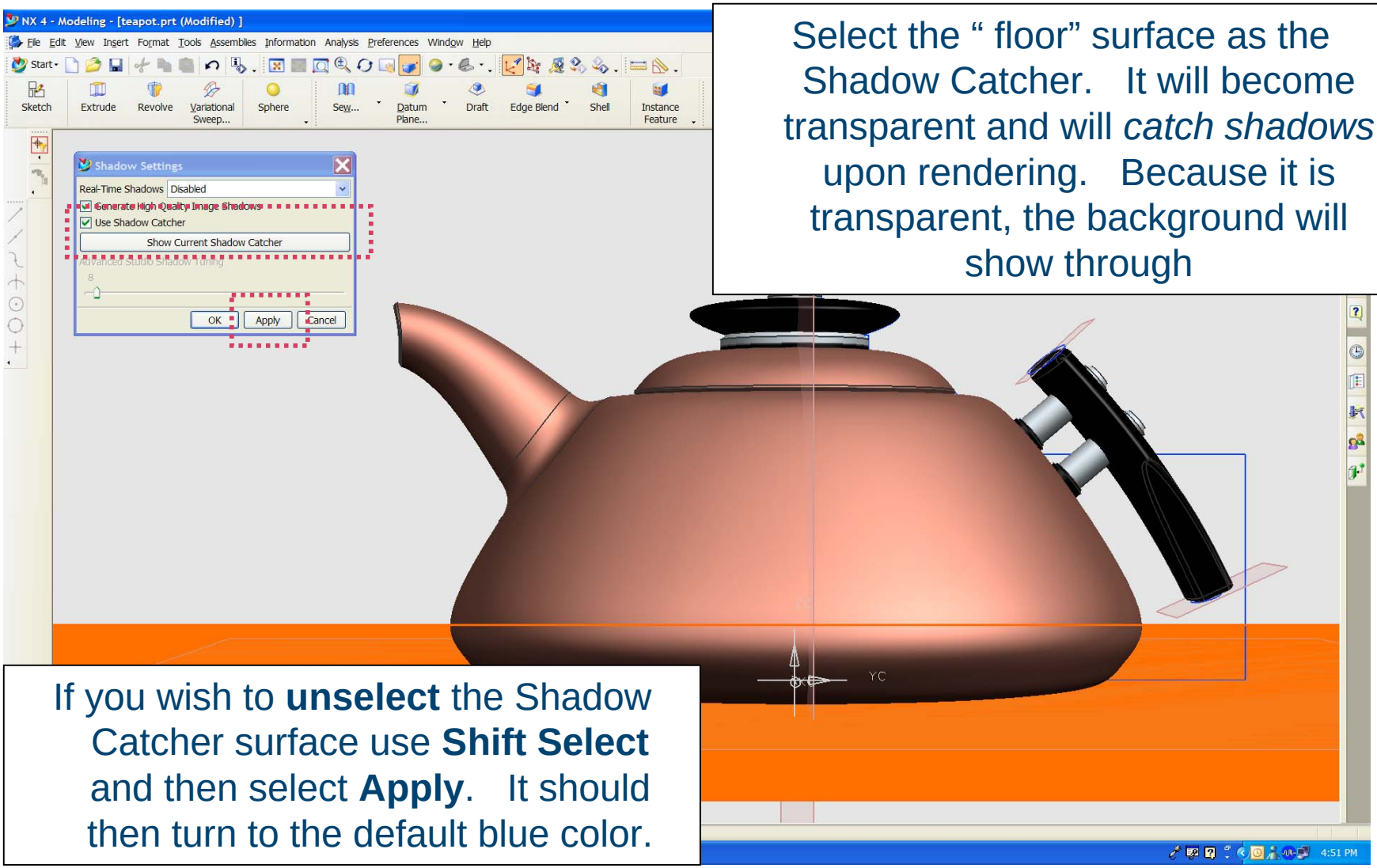
Turning on the Shadow Catcher



Select the " floor" surface as the Shadow Catcher. It will become transparent and will *catch shadows* upon rendering. Because it is transparent, the background will show through

If you wish to **unselect** the Shadow Catcher surface use **Shift Select** and then select **Apply**. It should then turn to the default blue color.

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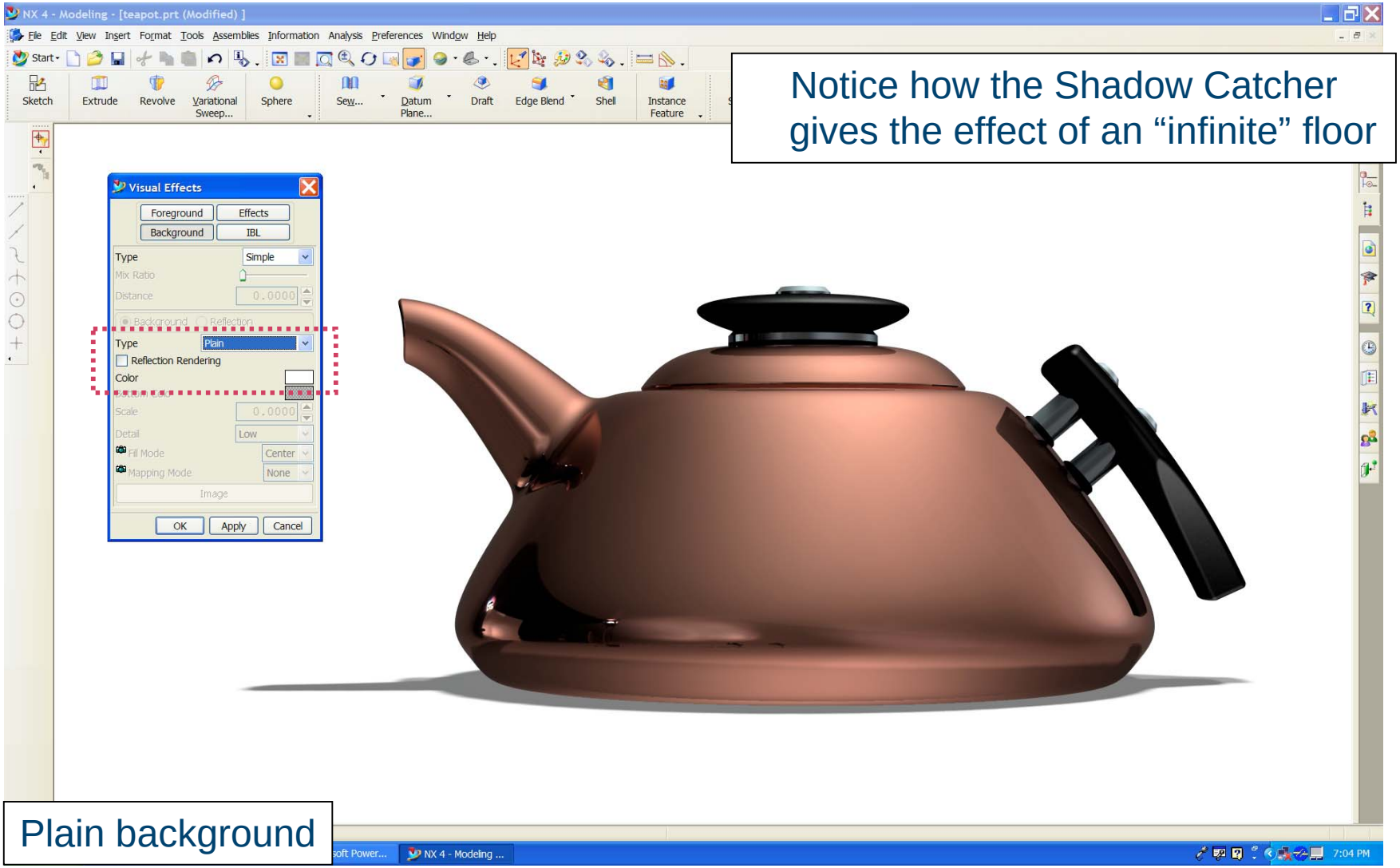
Rendering on Plain Background



Notice how the Shadow Catcher gives the effect of an “infinite” floor

Plain background

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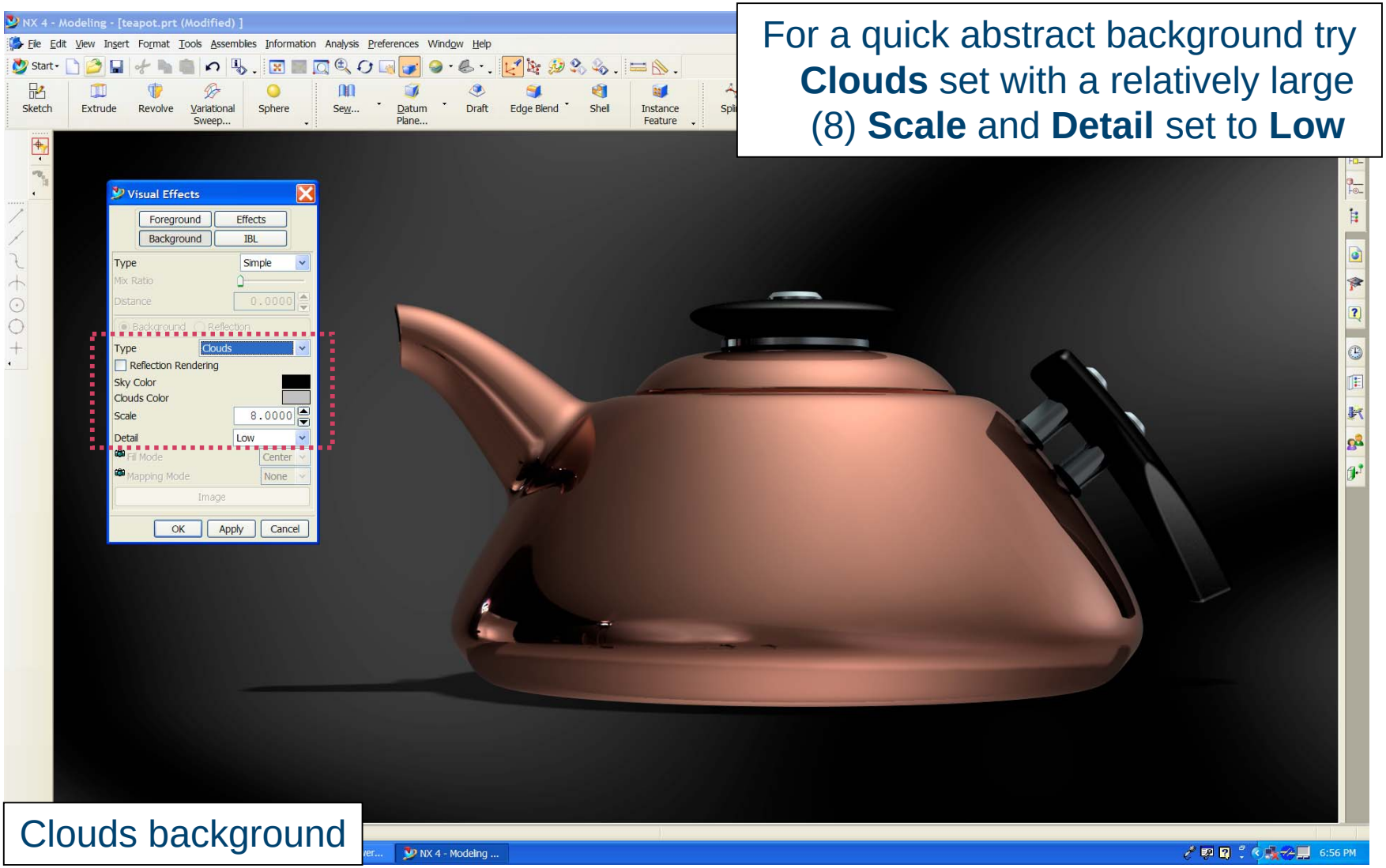
Rendering on Clouds Background

For a quick abstract background try **Clouds** set with a relatively large (8) **Scale** and **Detail** set to **Low**



Clouds background

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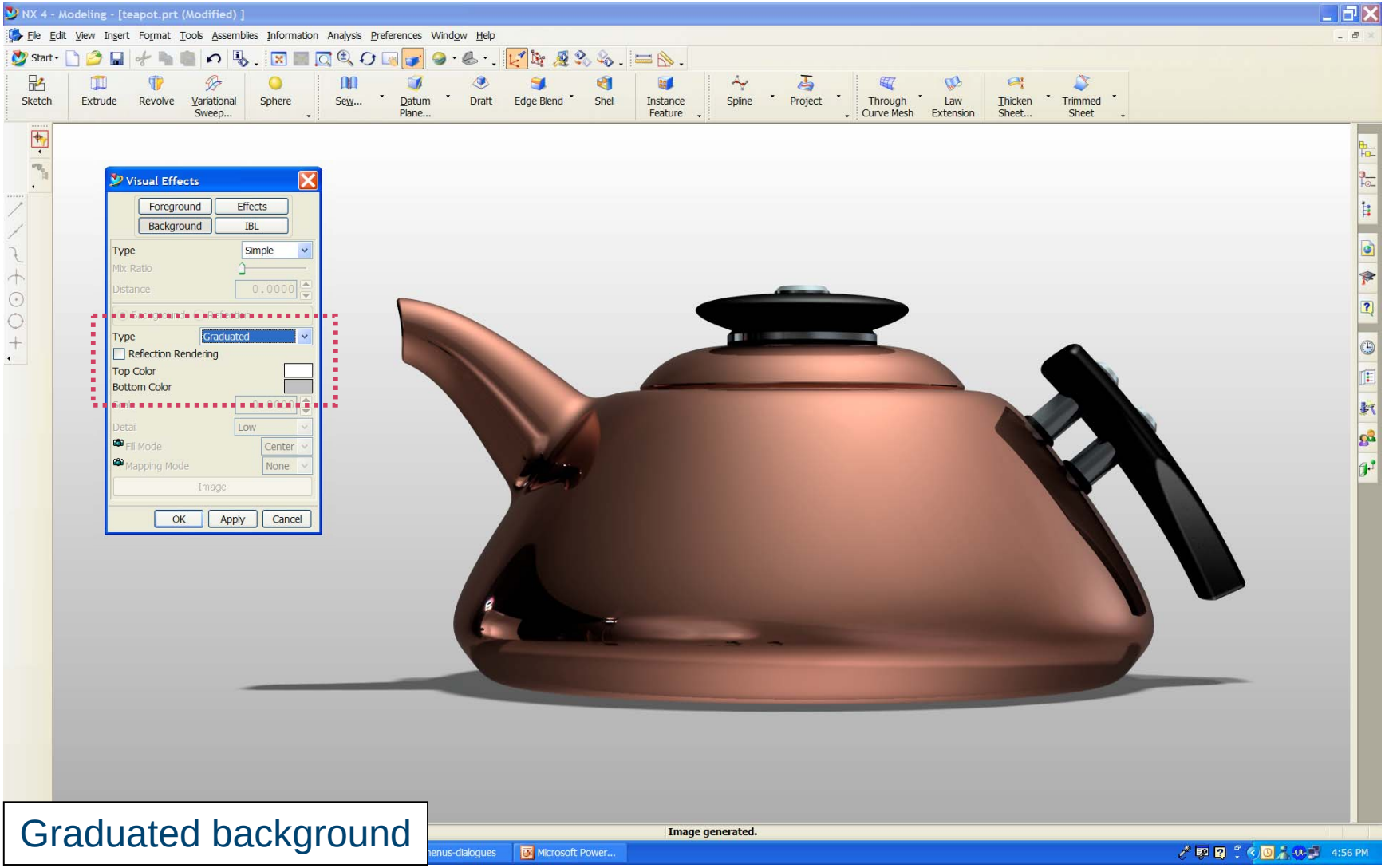
Rendering on Graduated Background



Graduated background

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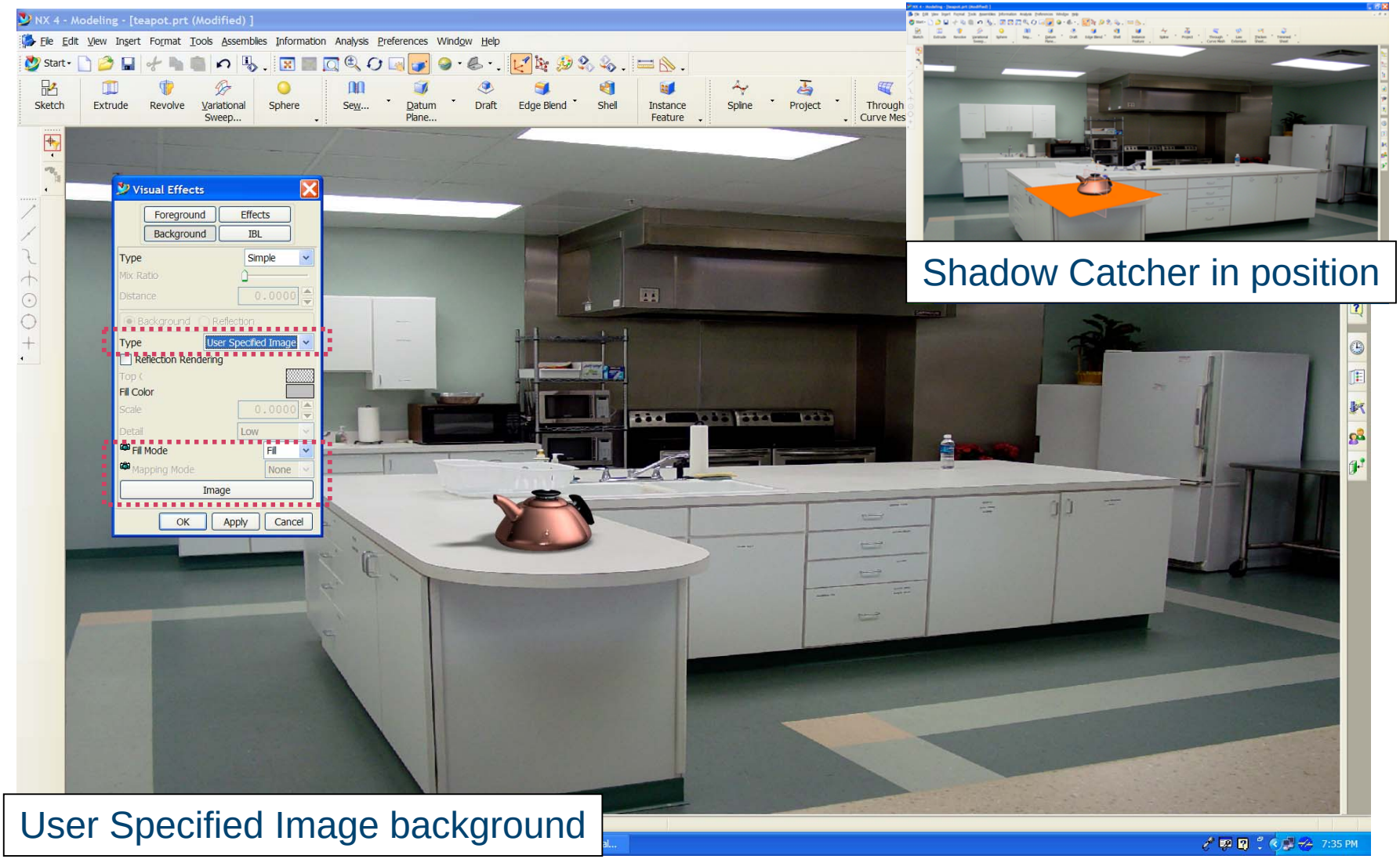
Rendering on User Specified Image



Shadow Catcher in position

User Specified Image background

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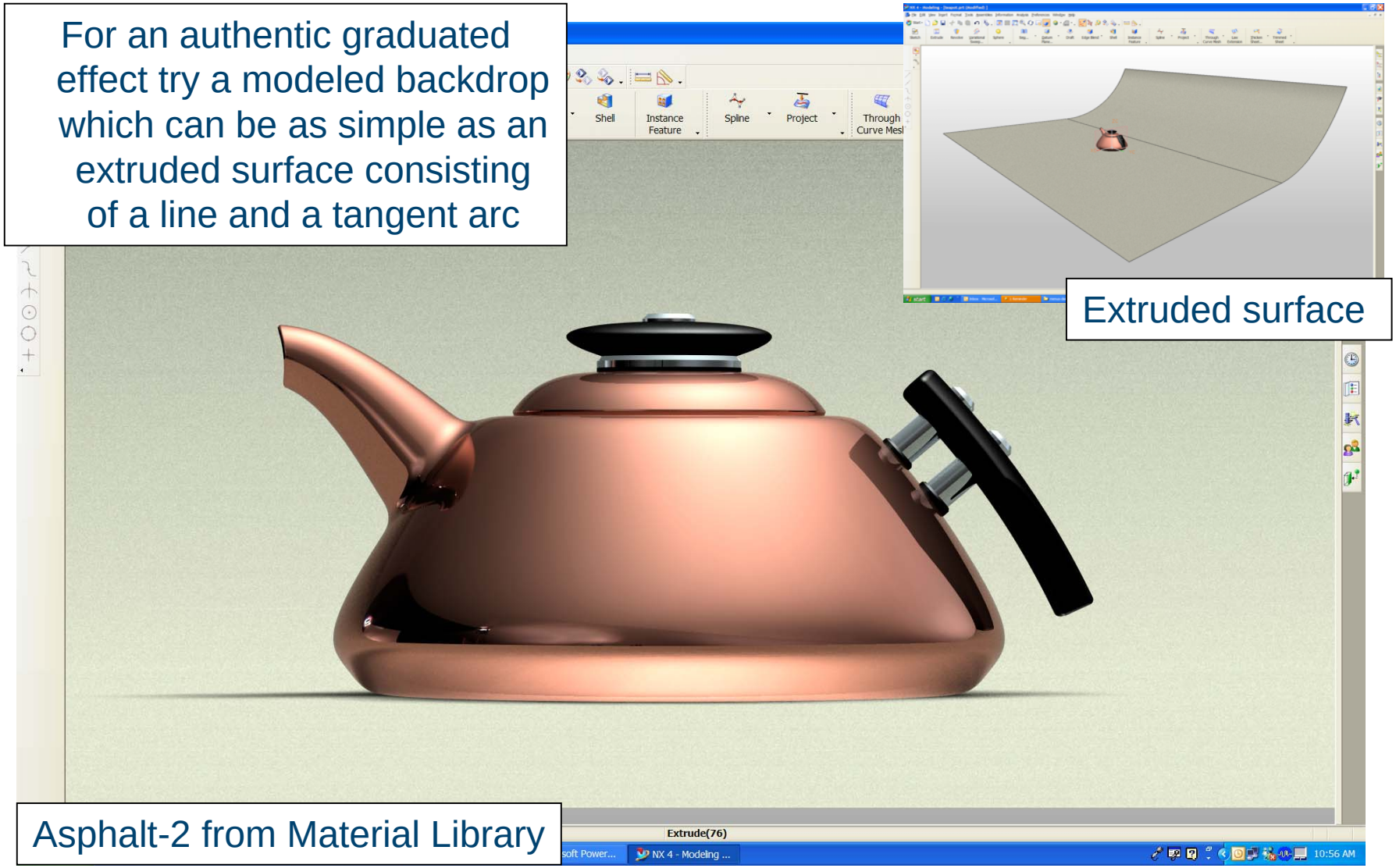
Modeled Floor and Backdrop

For an authentic graduated effect try a modeled backdrop which can be as simple as an extruded surface consisting of a line and a tangent arc



Asphalt-2 from Material Library

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Fine Tuning Lighting Color

Adjusting Lighting Color Saturation to achieve desired results

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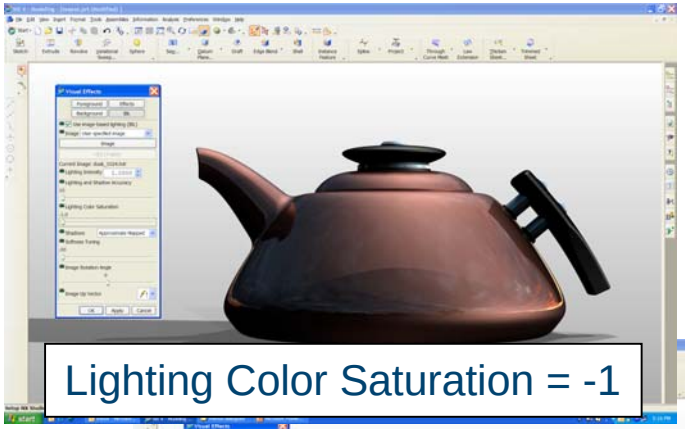
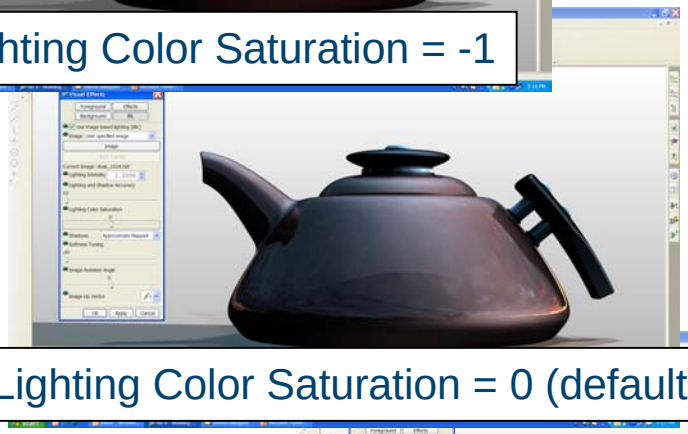
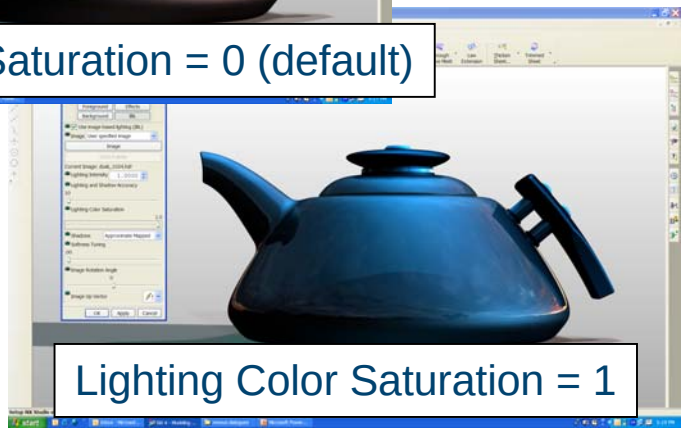
Lighting Color Saturation



Lighting Color Saturation = -1

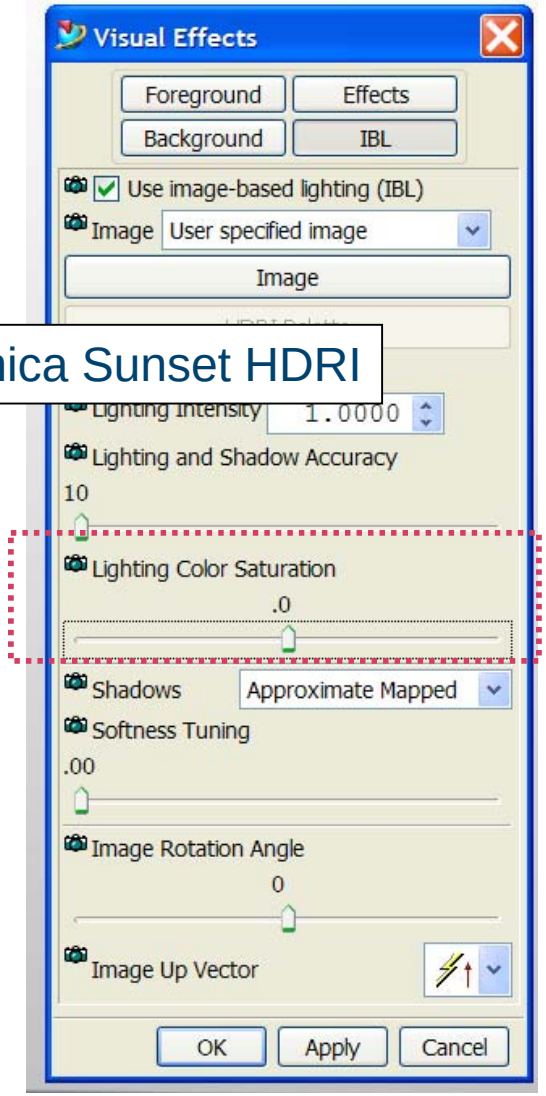


Lighting Color Saturation = 0 (default)



Lighting Color Saturation = 1

Santa Monica Sunset HDRI



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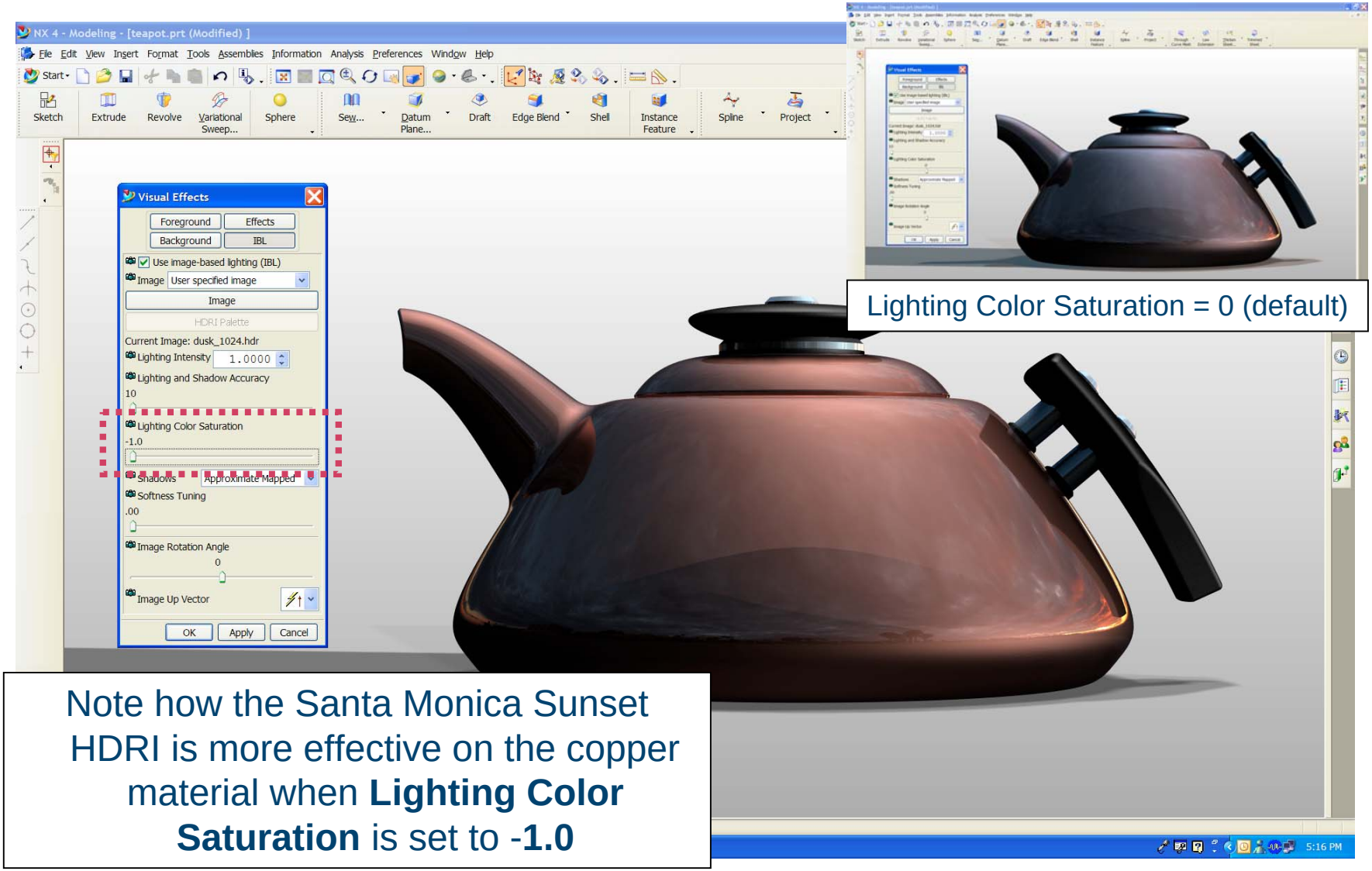
Lighting Color Saturation



Lighting Color Saturation = 0 (default)

Note how the Santa Monica Sunset HDRI is more effective on the copper material when **Lighting Color Saturation** is set to **-1.0**

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Fine Tuning Lighting Intensity

Adjusting Lighting Intensity to achieve desired results

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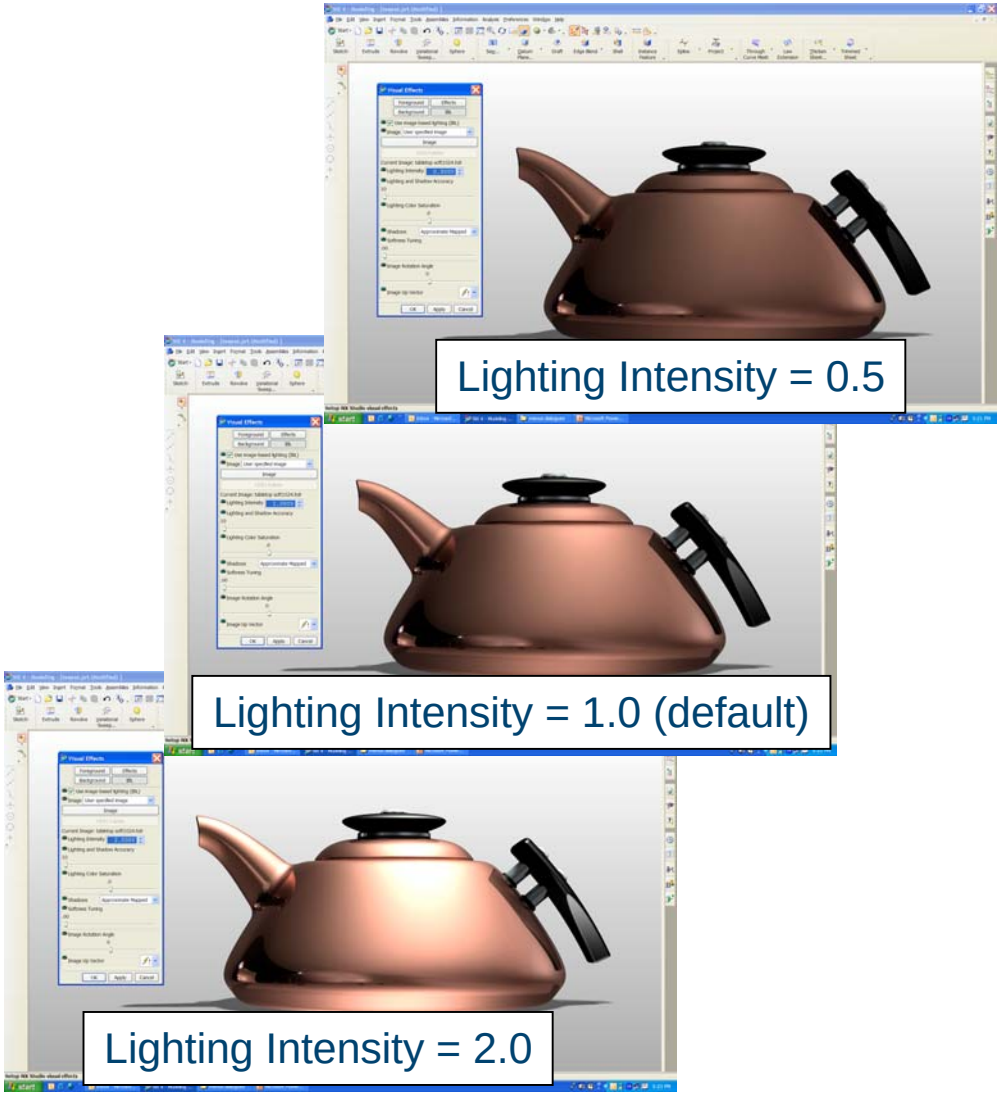
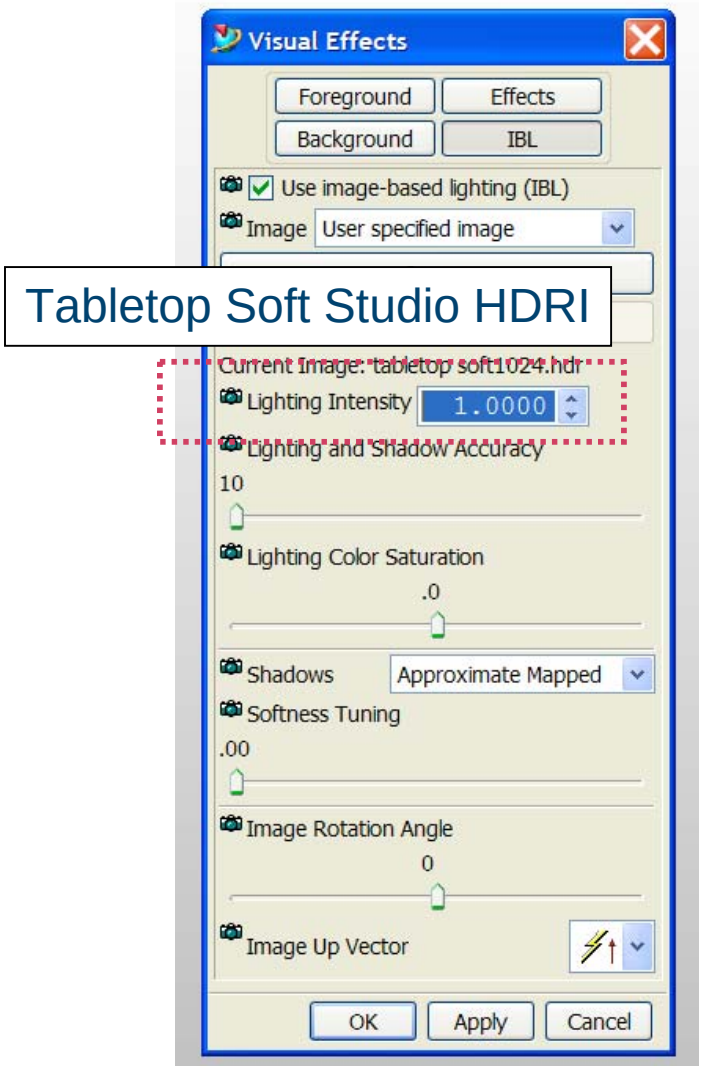
Lighting Intensity





Tabletop Soft Studio HDRI

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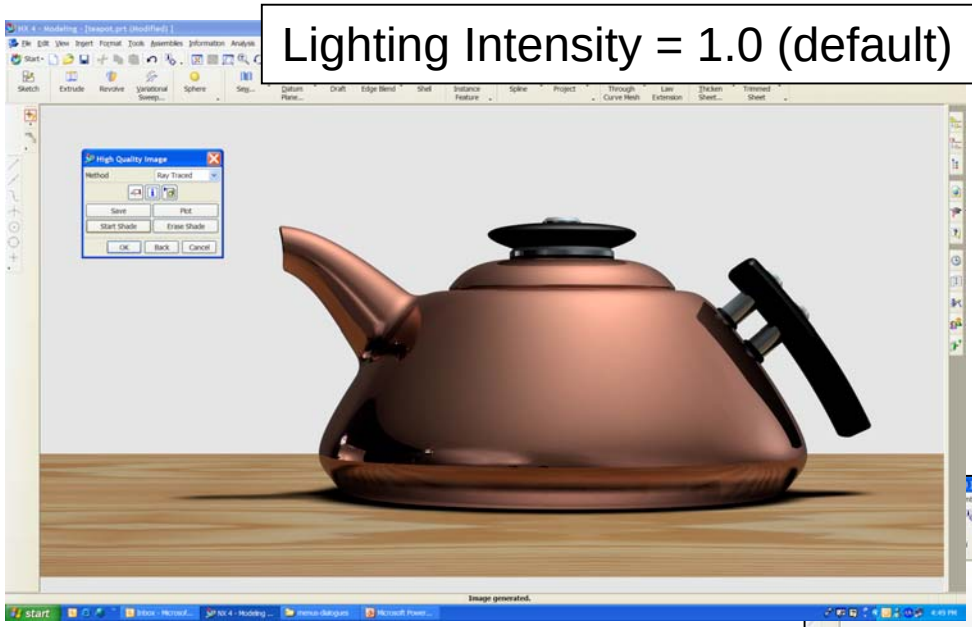
Lighting Intensity



Lighting Intensity = 1.0 (default)

Lighting Intensity = 1.5

Note the improved appearance of the Pine Veneer “floor” with a small increase in Lighting Intensity.

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Shadows

Using Shadows and Softness Tuning to achieve desired results

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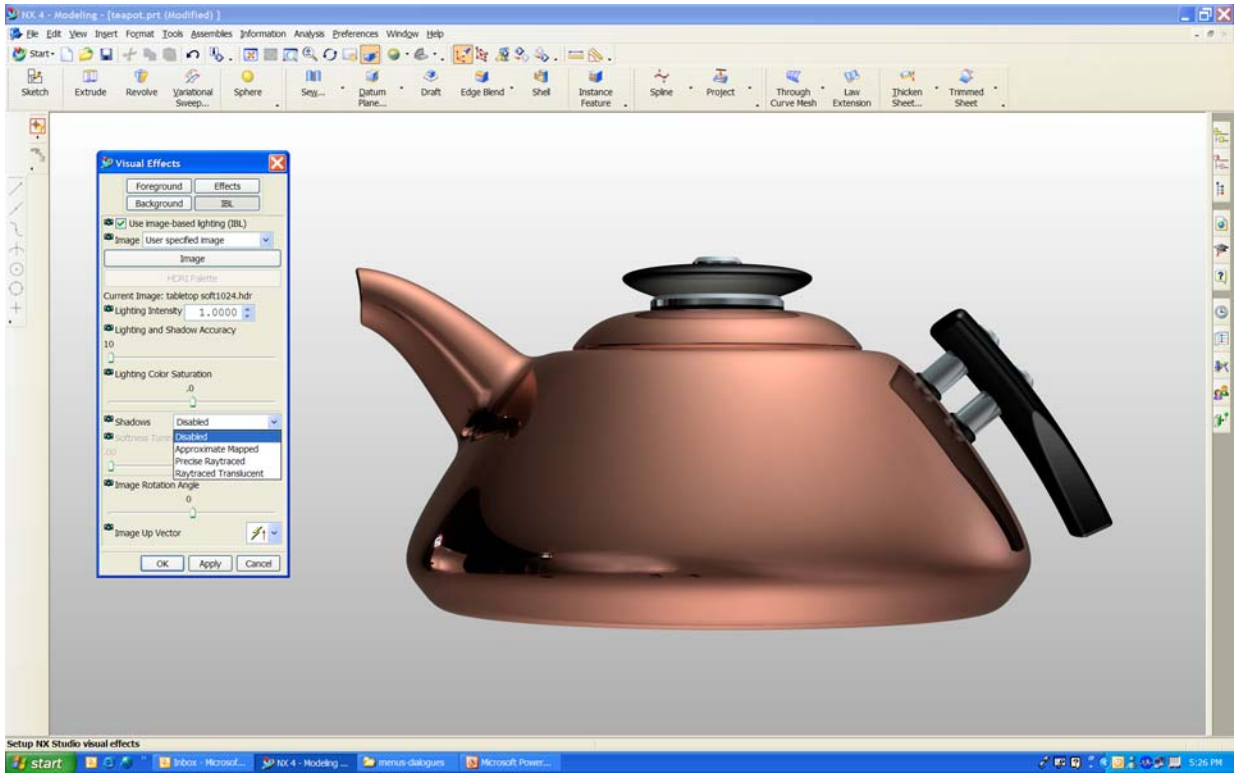
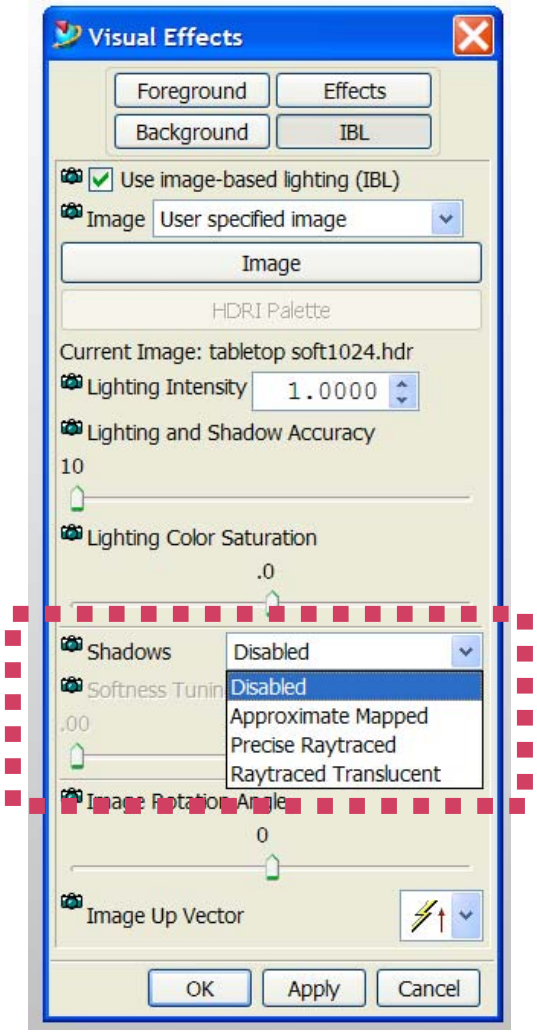
Shadows Dialogue Box





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Shadows – Options

Approximate Mapped

Precise Raytraced

Raytraced Translucent

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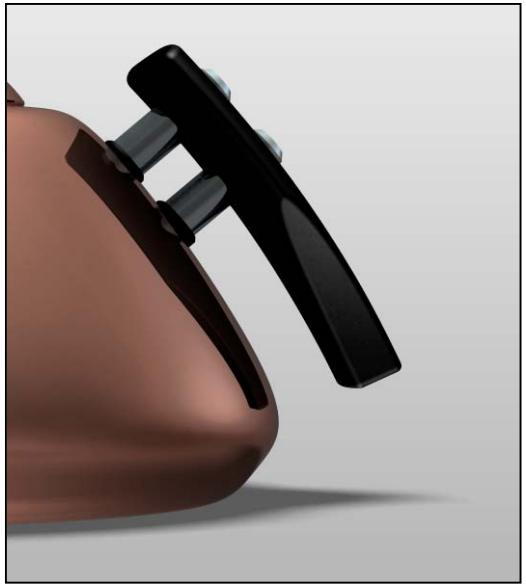
Shadows – Softness Tuning

Approximate Mapped

Softness Tuning = 0

(default)



Softness Tuning = 1

(maximum)

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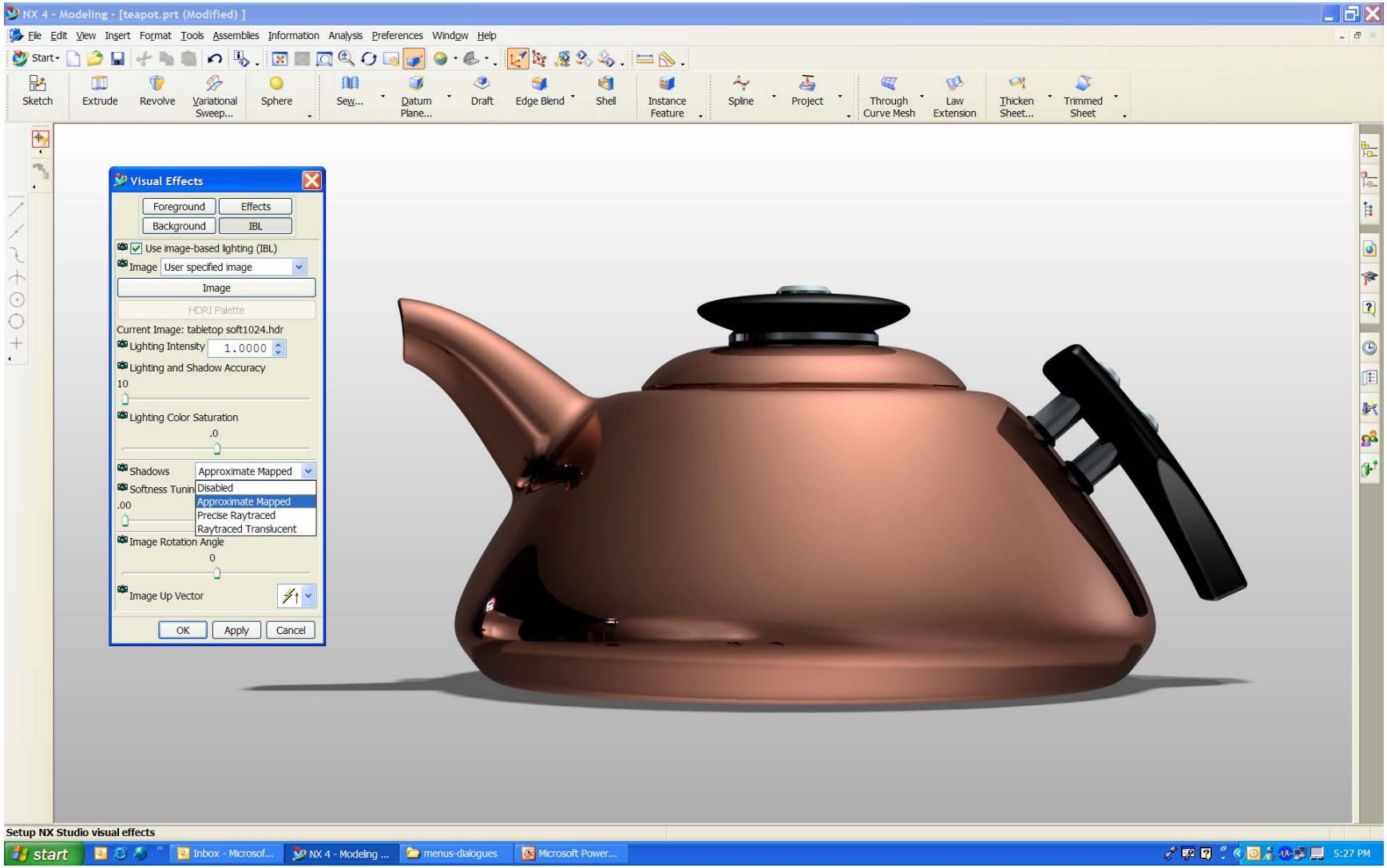
Shadows – Approx. Mapped (default settings)



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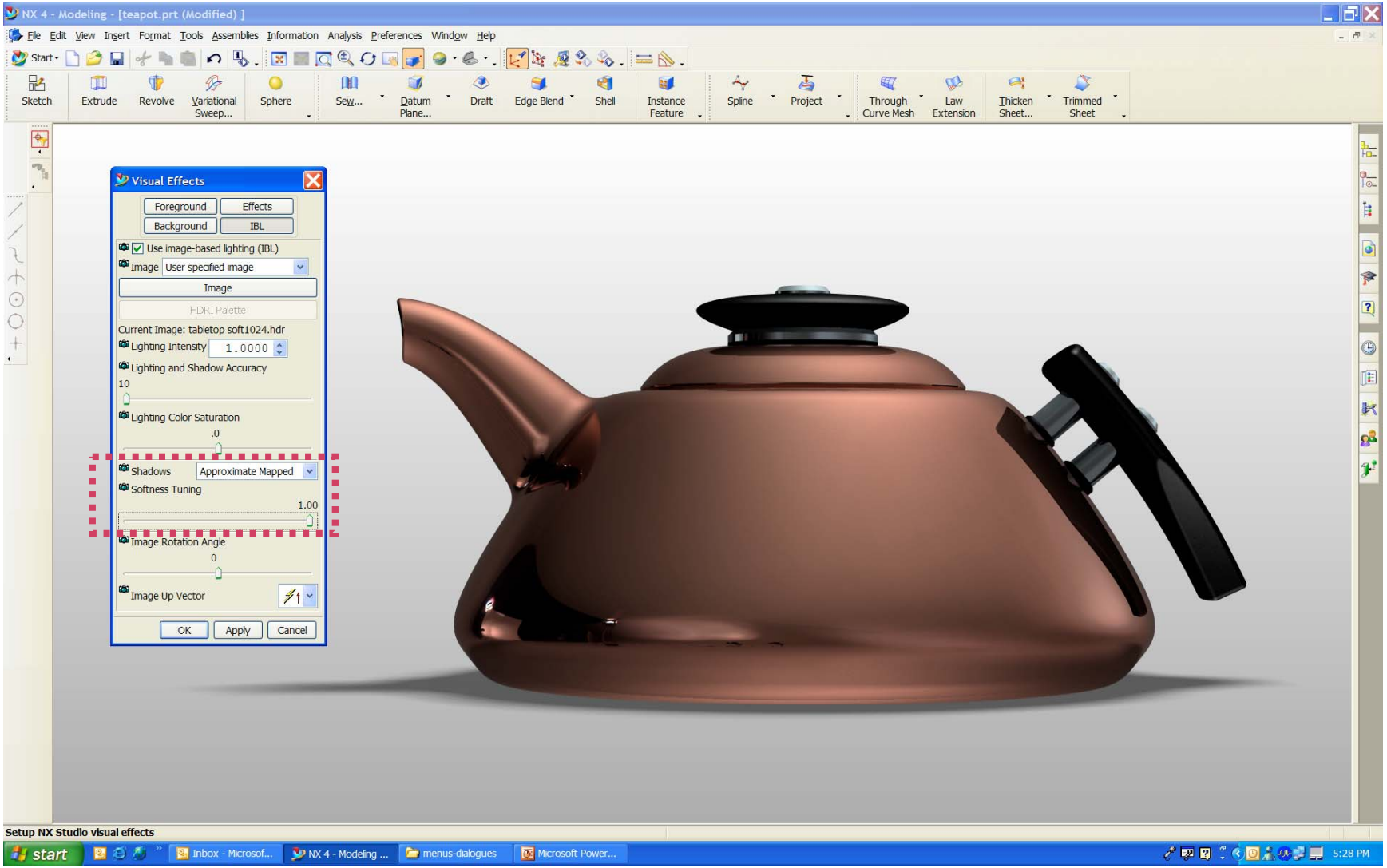
Shadows – Approx. Mapped (softness tuning = 1)



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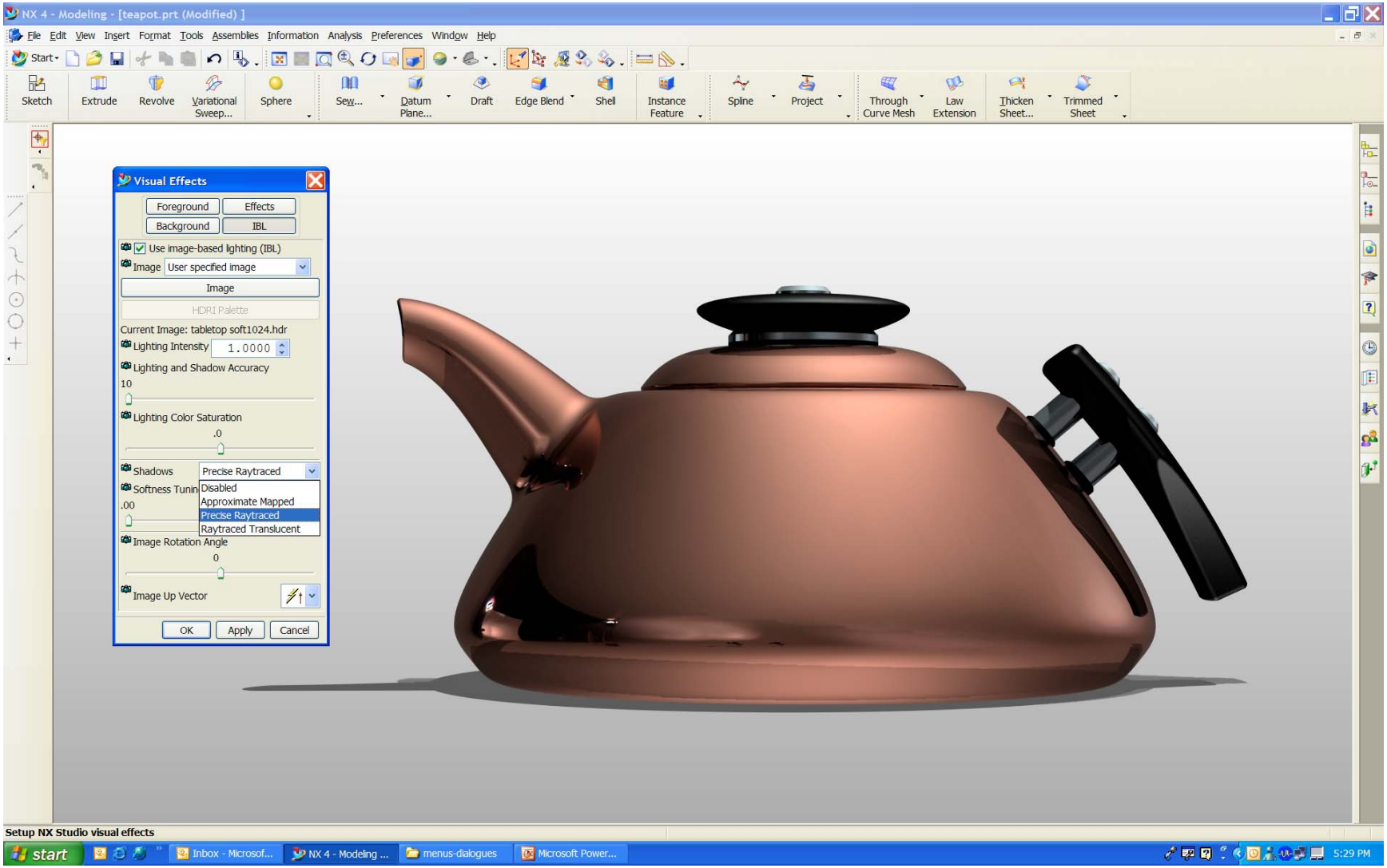
Shadows – Precise Raytraced



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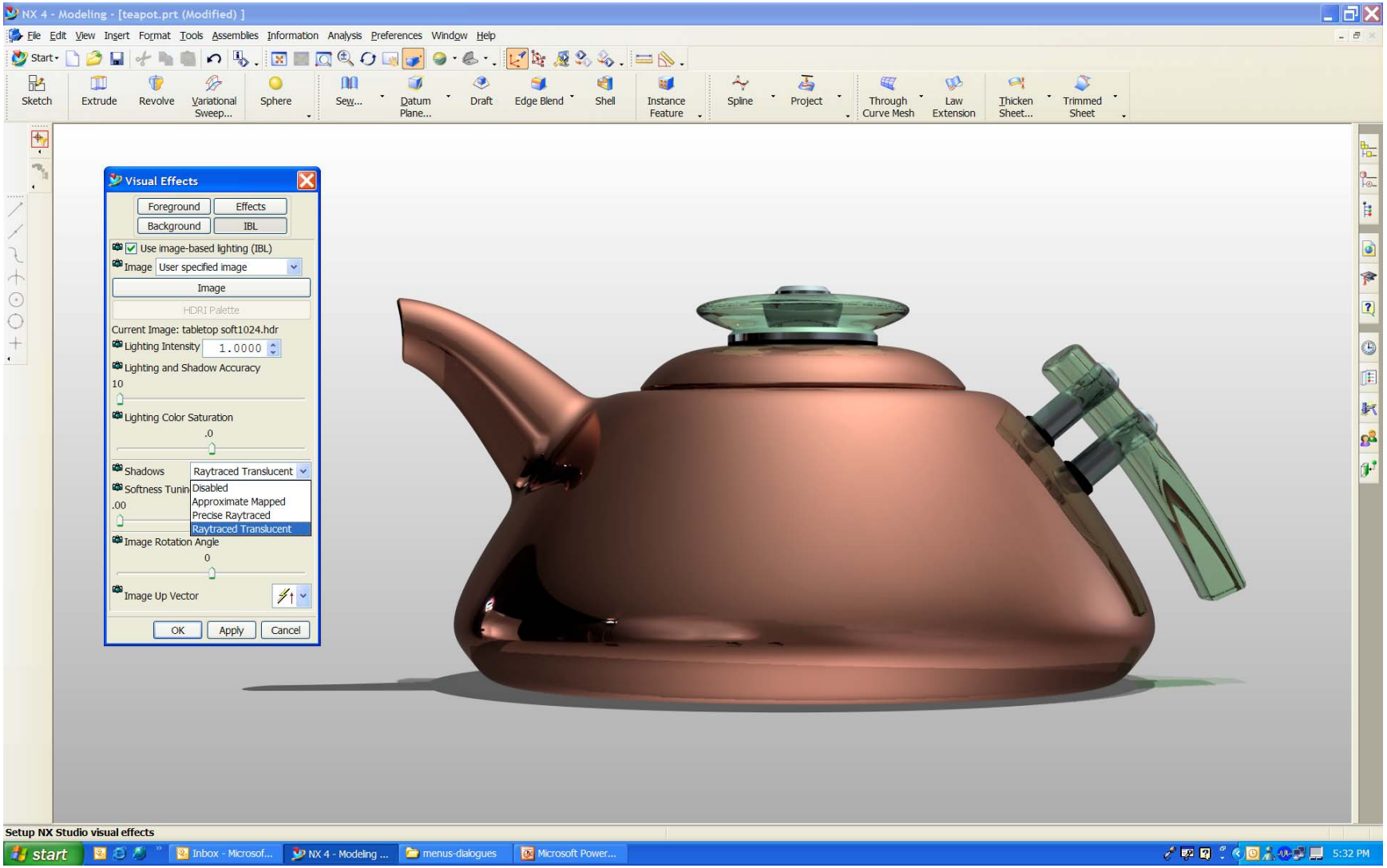
Shadows – Raytraced Translucent



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Fine Tuning Lighting and Shadow Accuracy

Adjusting Lighting and Shadow Accuracy to achieve desired results

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Lighting and Shadow Accuracy (LSA)

LSA = 10 (default)

Approximate Mapped Shadow (all)

LSA = 50

LSA = 300

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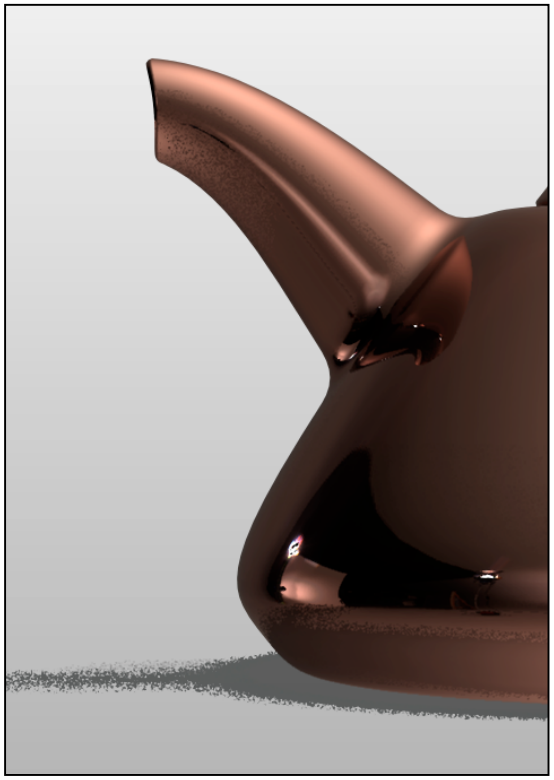
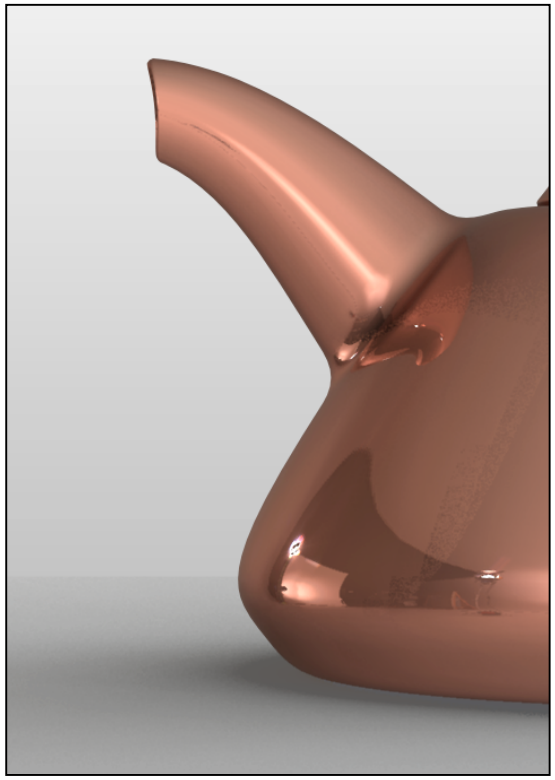
Influence of LAS on Softness Tuning

Precise Raytraced Shadow (all)

Softness Tuning = 1



LAS = 10 (default)



LAS = 500 (max)

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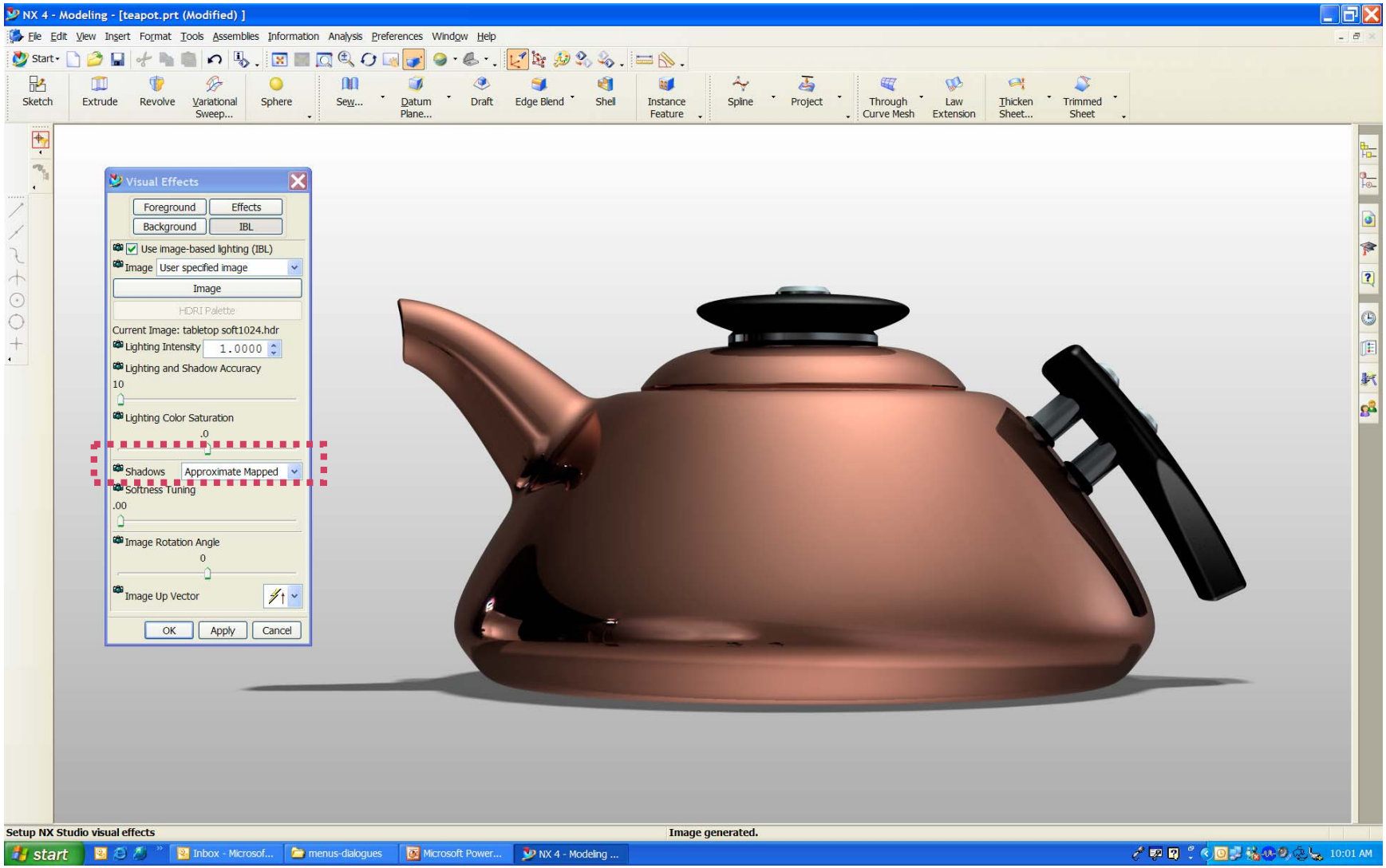
Lighting and Shadow Accuracy = 10



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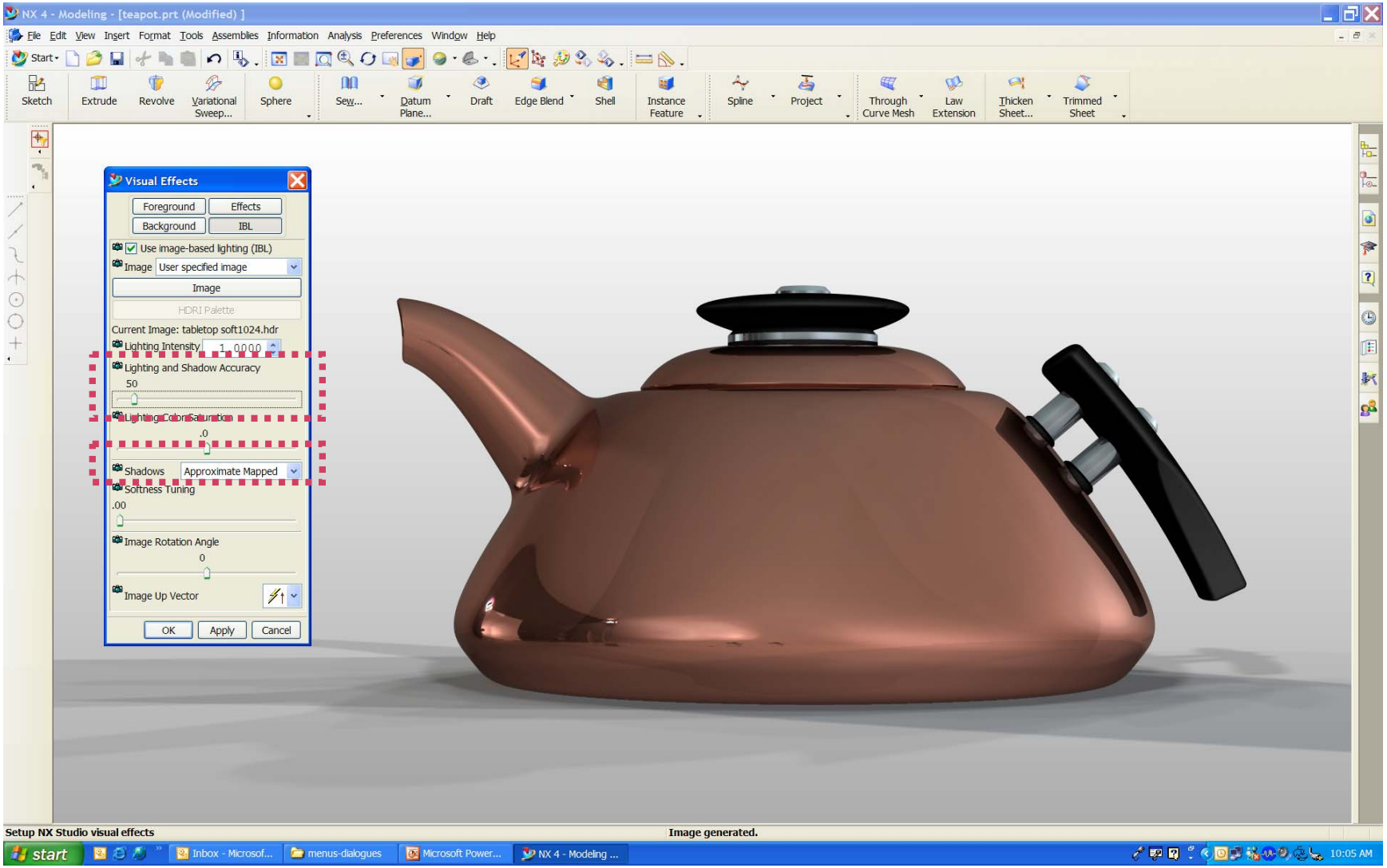
Lighting and Shadow Accuracy = 50



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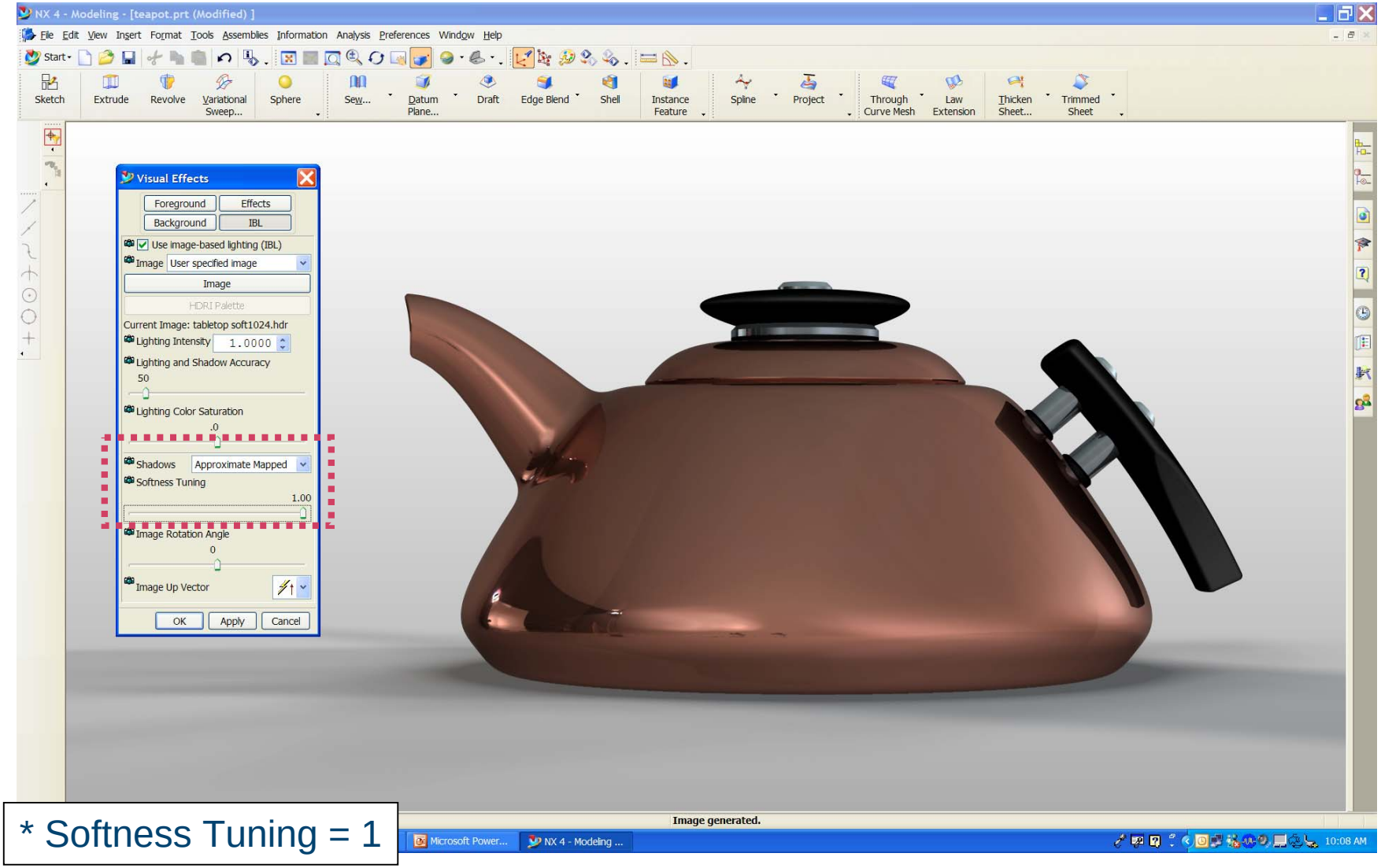
Lighting and Shadow Accuracy = 50*



* Softness Tuning = 1

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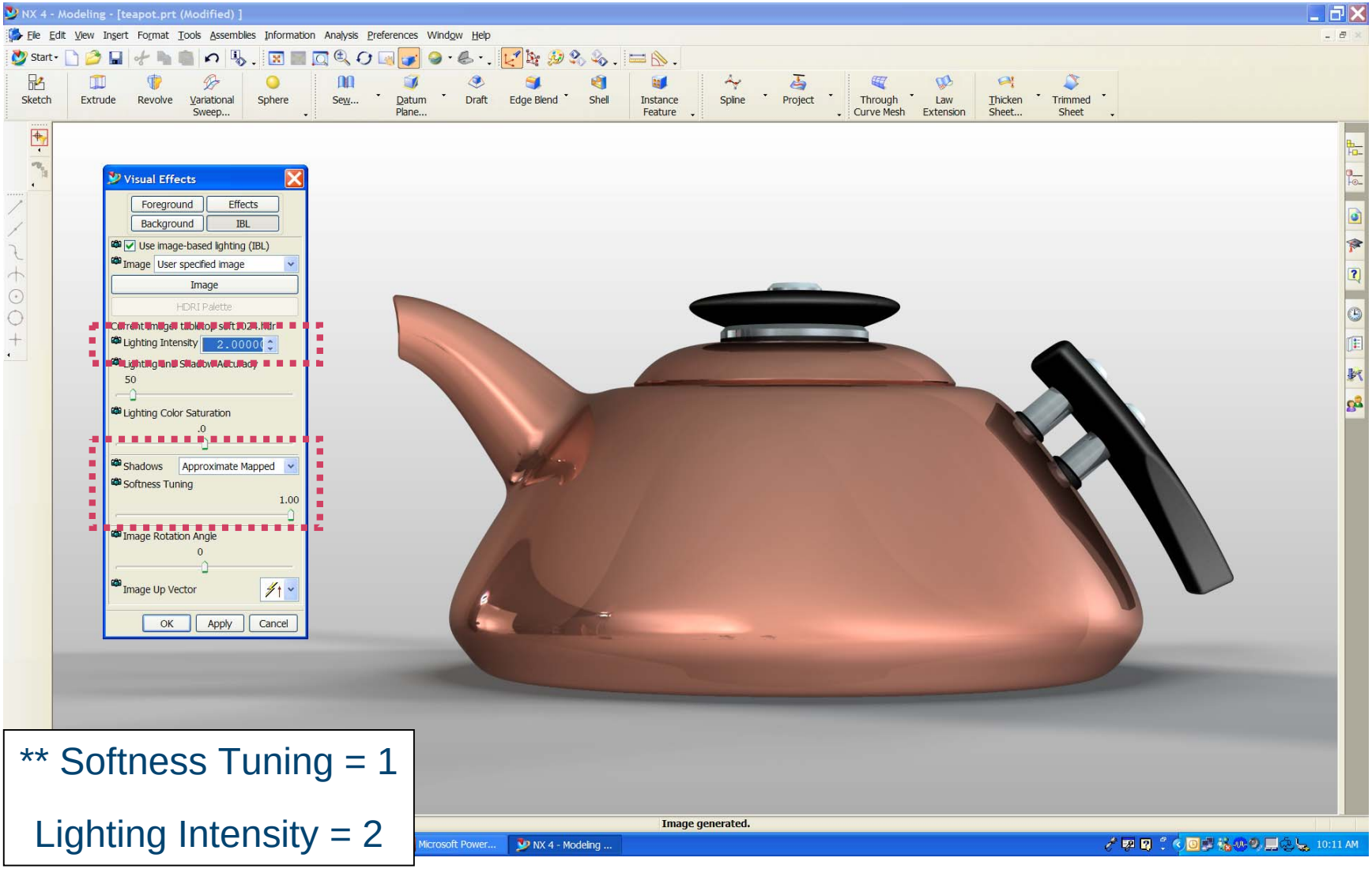
Lighting and Shadow Accuracy = 50**



** Softness Tuning = 1

Lighting Intensity = 2

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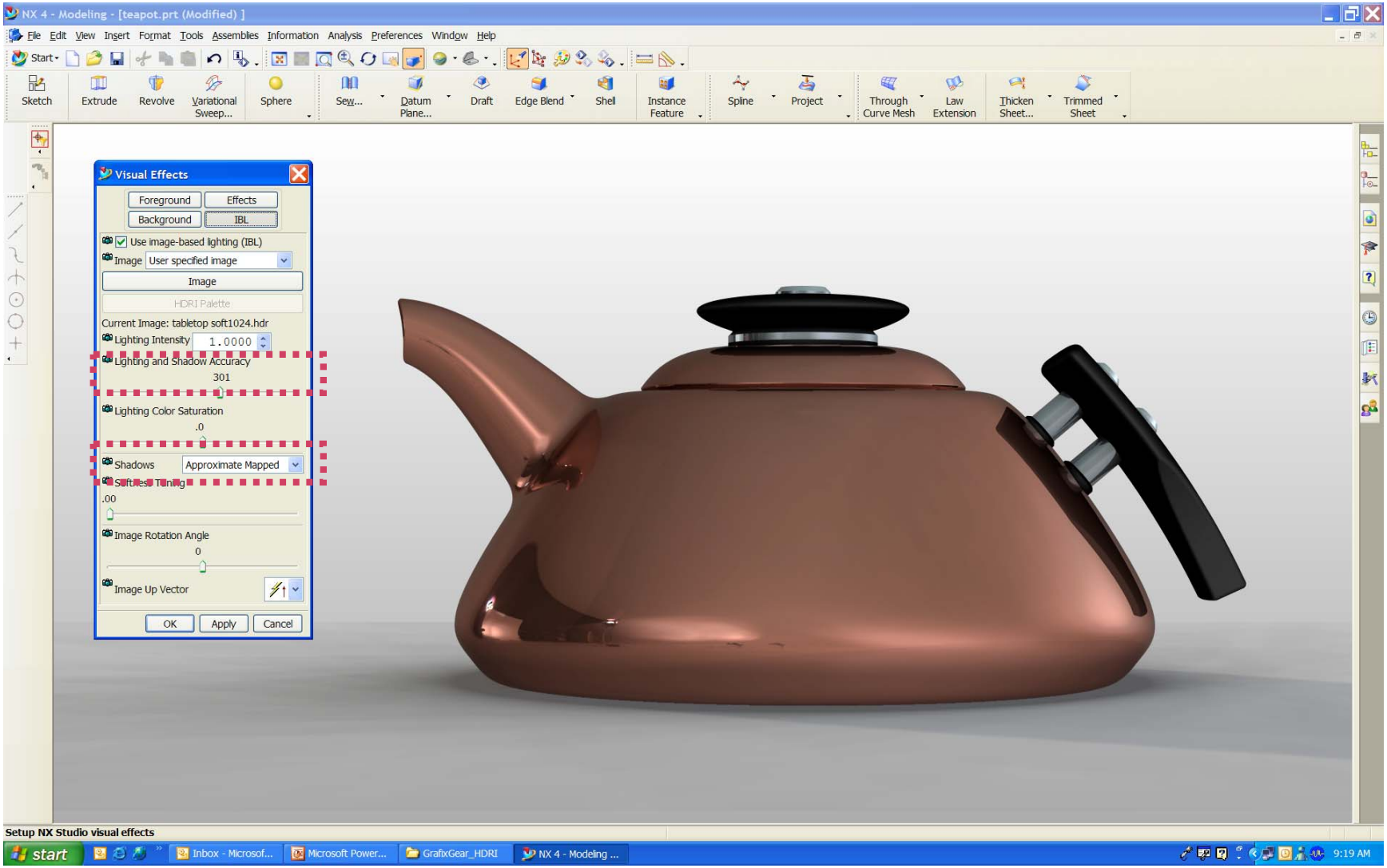
Lighting and Shadow Accuracy = 300



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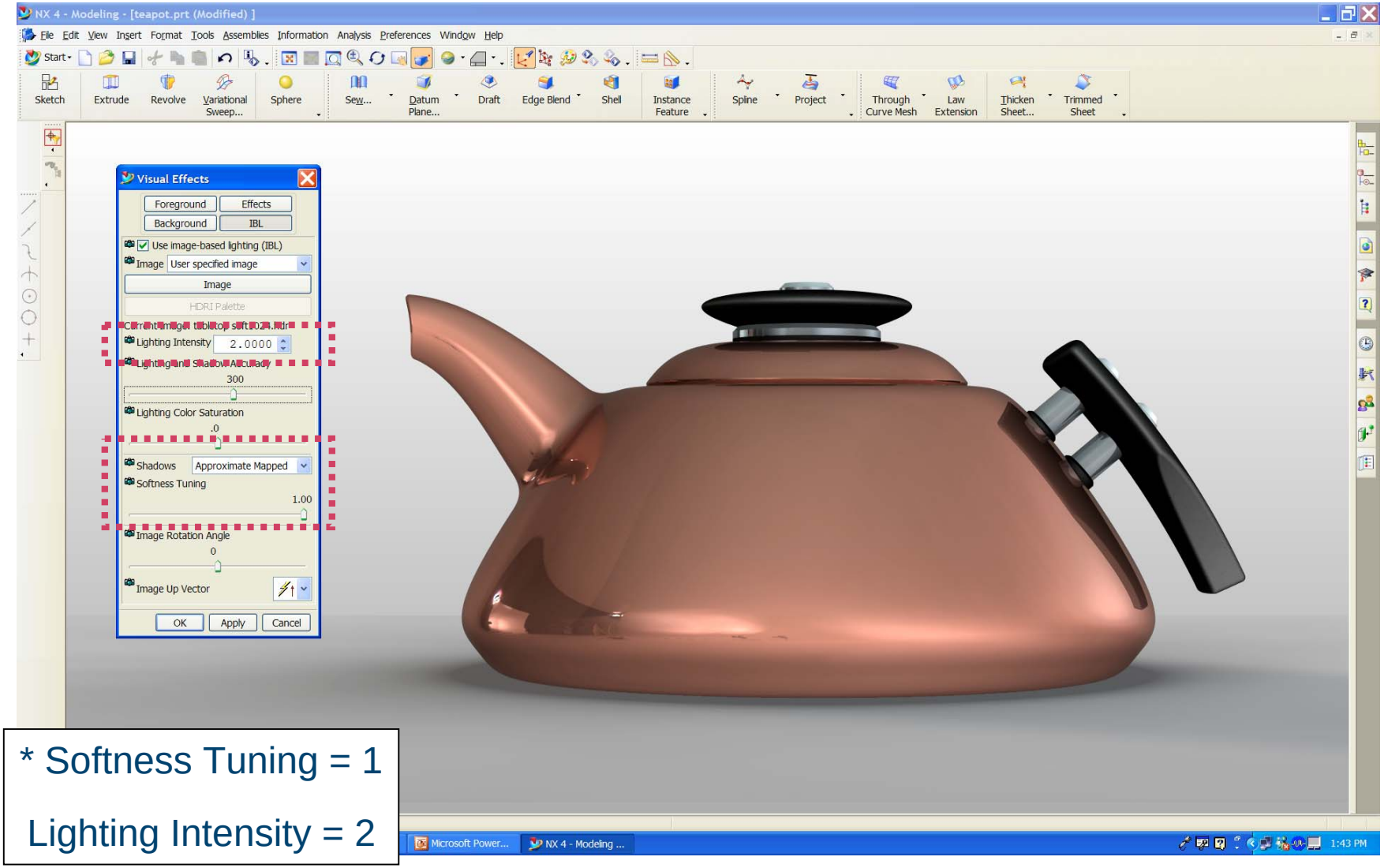
Lighting and Shadow Accuracy = 300*



* Softness Tuning = 1

Lighting Intensity = 2

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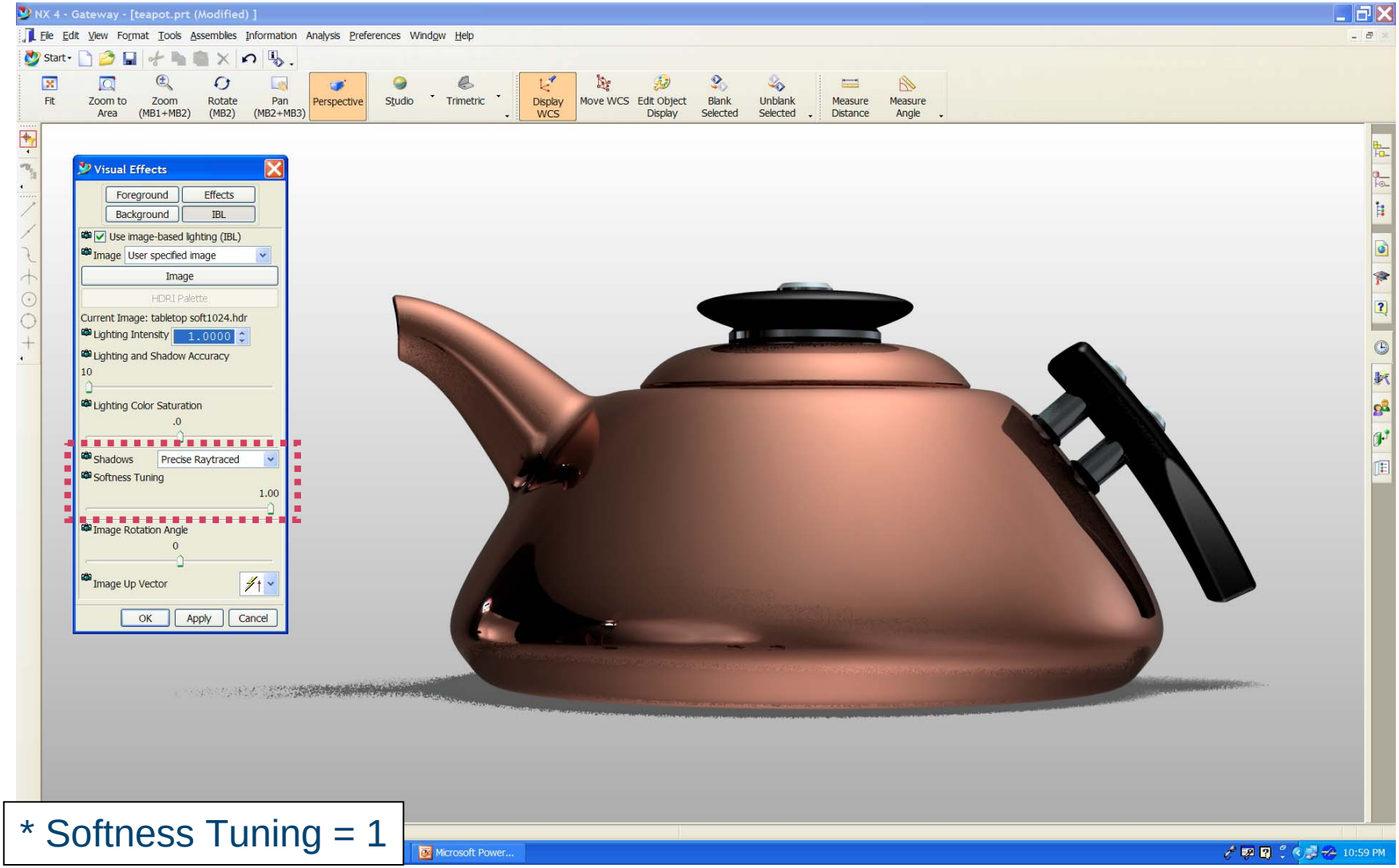
Lighting and Shadow Accuracy = 10*



* Softness Tuning = 1

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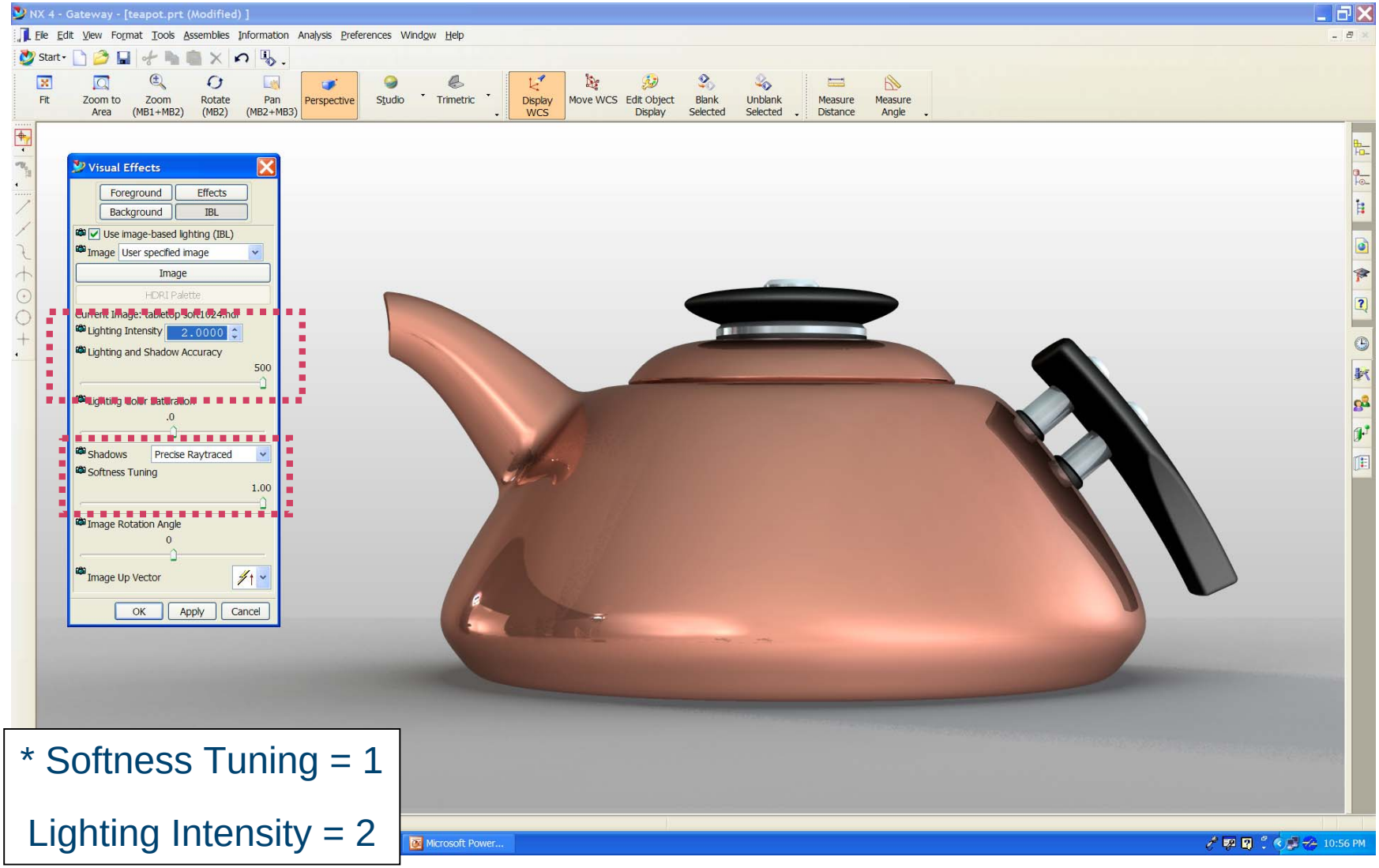
Lighting and Shadow Accuracy = 500*



* Softness Tuning = 1

Lighting Intensity = 2

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HDRI Gallery

Renderings created using NX 4 IBL and HDRI

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NX Cell Phone

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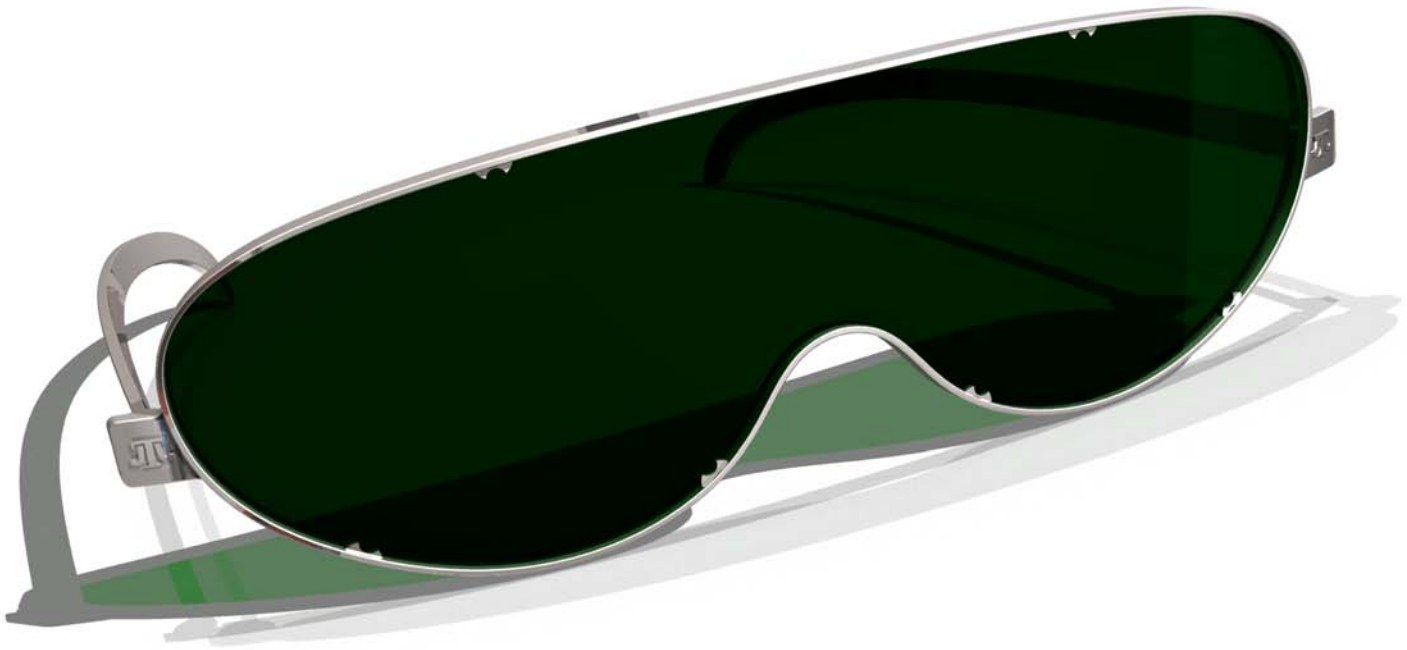
NX Eyewear



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NX Timepiece

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Questions or Comments

- If you have questions or comments regarding this **NX Visualization Tutorial**, then please contact:

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