DeskArtes
3Data Expert 10.0

Tutorial 2 - Working with Colors

First Edition

DeskArtes Tutorial: “3Data Expert 10.0: Tutorial 2 - Working with Colors”

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CHAPTER 1 – FOREWORD 4
CHAPTER 2 – FIXING THE LAMP MODEL 5
Operation Mode *6*
Basic viewing commands *7*
Fixing the Lamp *10*
Auto Repair *12*
Chapter 3 – Coloring the Lamp model *15*
Selecting shells, surfaces, and triangles *16*
Painting the Lamp *20*
Editing edge lines *23*
Texturing with chessboard bitmap *27*
Adding an engineering template *32*
Draw circle on surface *35*
Saving the file *38*
Transferring directly to 3D Printer *38*
CHAPTER 4 – CONCLUSIONS 39

Chapter 1 – Foreword

The *Tutorial 2 - 3Data Expert 10.0: Working with Colors* document provides an introduction to the basic automatic repair, coloring, and texturing functions available with 3Data Expert software for 3D Color Printers. Through this sequence, you will learn how to automatically repair, paint, and texture the *Lamp.wrl* model. In the final step, you will output the model for printing with 3D color printer.

This tutorial is the second in a set of two tutorials, each of which covers different aspects of model repair, coloring, and print preparation. The following tutorials or repair examples are available in the software distribution package through the *Help > Tutorial Documents* command:

- *Expert Series 10.0: Quick Start Guide* gives a short introduction to model repair and splitting for 3D Printing with 3Data Expert, 3Data Expert Lite and Dimensions Expert modules. Estimated completion time 15 minutes.
- *Expert Series 10.0: Tutorial 1 – Working with 3D Models* introduces basic viewing, measuring, automatic repair, split, connect, hollow, offset, 3D Text, Boolean, cut, reduce, surface triangulation and other model manipulation functions available for STL files for Additive Manufacturing. Applies to All Expert Series modules. Estimated completion time is 3 hours.
- *3Data Expert 10.0: Tutorial 2 – Working with Colors* introduces basic automatic repair and coloring for 3D Color Printer users. For 3Data Expert only. Estimated completion time is 60 minutes.
- *Expert Series 10.0: STL and VRML repair examples* document includes more advanced model repair operations with 3Data Expert. Applies to 3Data Expert module and partly to 3Data Expert Lite, Dimensions Expert and Sim Expert modules. Estimated completion time with 3Data Expert 2 hours.

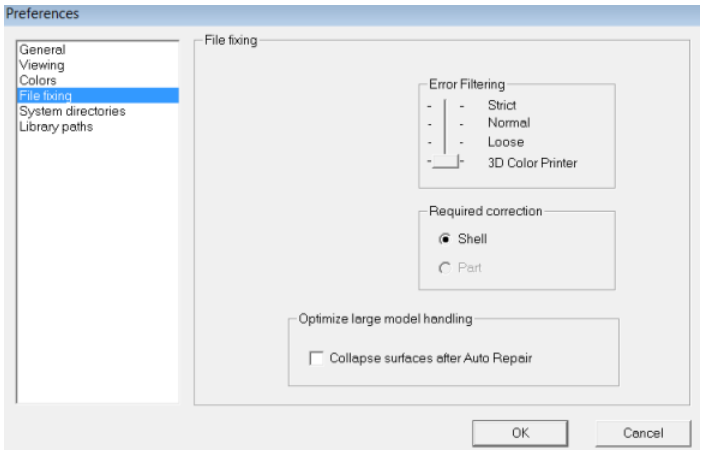
The tutorial documents and the geometry files for the tutorial examples are found in the *Tutorials* folder and its sub-folders (*Tutorial 1*, *Tutorial 2,* etc.) in the 3Data Expert installation directory.

The **boldface** and *italics* used in this tutorial have designated meanings. A **boldfaced command** is a command or operation that alters the model or is otherwise necessary to reach results similar to the example. A statement in *italics* denotes the different parameters and their values; menu commands; mouse clicks; file names; Model Tree items; or any new terms introduced to the reader.

Chapter 2 – Fixing the Lamp model

In this example, you will go through the steps required to fix a simple *Lamp* model. The *Lamp* model is available in VRML format (.wrl) on the 3Data Expert installation directory *Tutorials/GeomFiles*. You will start with a VRML model that has no color or textures attached. After completing model repair, painting, and texturing, you will save and store the model in ZPR or VRML format for 3D color printing.

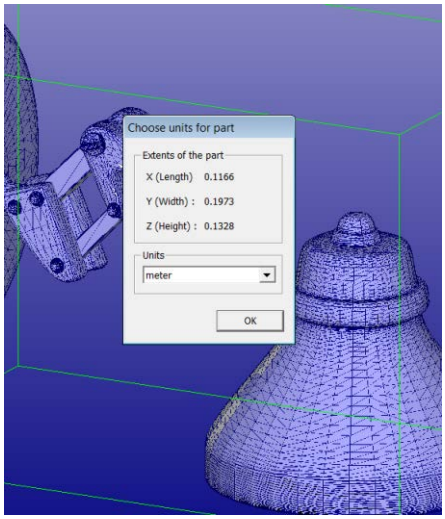
Before inputting the model make sure that you have set the correct File Fixing settings for 3D Color Printers. The File Fixing settings are set through the *Edit* > *Preferences* command, as seen below:



Now you can

- **input the *Lamp* model (*File > Open*)** from the *Lamp.wrl* file.

You should see the following result on your computer screen:

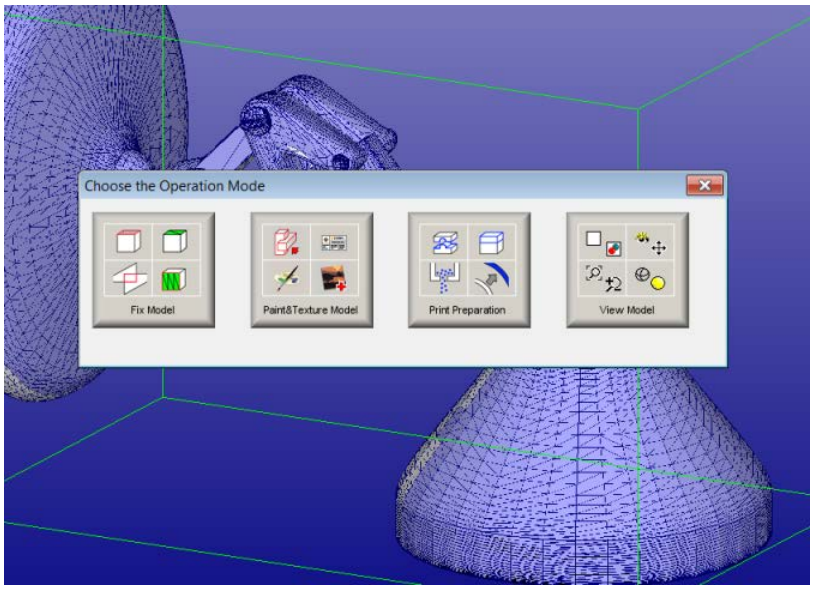


The first 3Data Expert dialog allows you to check and set the units for the inputted part. 3Data Expert uses the following default values for different input file types:

- VRML (.wrl, .wrml) files are in meters.
- STL (.stl) file units are set according to the size of the model, most likely in inches.
- PLY file units are set according to the size of the model, most likely in inches.
- 3DE (.3de) files include the unit information (3DE is a DeskArtes proprietary format that allows you to transfer models easily into other Expert Series software, including transfer of real surface data along with faceted triangle data).
- ZPR (.zpr) files include the unit information.

The *Choose units for part* dialog allows you to set the correct unit if the default value is incorrect. The unit will be saved in the 3DE (or ZPR) file when you save and store the file.

The *Extents of the part* information in the dialog indicates that the *Meters* setting is correct. **Press OK** to continue. The *Operation Mode* window will appear:

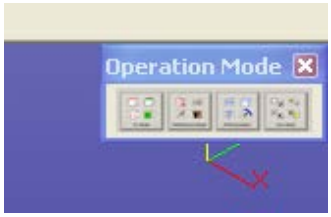


Operation Mode

3Data Expert has four main operation modes: *Fix Model*, *Paint & Texture Model, Print Preparation*, and *View Model* mode. The different modes are used for different tasks:

- Fix Model takes you to automatic model verification and repair, and shows shortcuts to the main tools used for repair work.
- Paint & Texture Model displays the tools for painting and texturing. These tools check the model for errors and set it to “What you see is what you get” display color mode.
- Print Preparation shows tools for model manipulation, such as hollowing and splitting. These tools also check the model for errors.
- View Mode allows you to temporarily view the model and then return to Operation Mode.

Now **press View Model** button to get familiar with the basic viewing commands. The Operation Mode window is minimized on the upper right corner of the screen. This allows you to return to the Operation Mode window to select another mode when necessary:



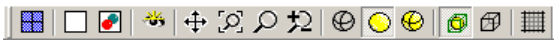
Basic viewing commands

Try the following commands to become familiar with viewing operations. Note that the commands below do not alter the model’s 3D coordinates. They only alter the eye-point location:

- *Rotate* the model on the screen by pressing the *middle mouse* (*MMB*) and moving the cursor. *Left mouse button* (*LMB*) rotation is also available most of the time except when working with painting, texturing, curve editing, and transformations.
- *Rotate* the model around a selected surface point by pressing the *right mouse button* (*RMB*) and moving the cursor. A blue cross indicating the rotation middle point appears on the part surface if the cursor is on top of the model when the *RMB* is pressed.
- *Pan* the model by dragging with the *MMB* (or *LMB* most of the time) while pressing the *Shift* key down.
- *Pan with rubberband* by dragging with *RMB* while pressing the *Shift* key down.
- *Zoom in/out* by rotating the *mouse wheel*.
- *Zoom in/out* with *MMB* (or *LMB*) while pressing the *Ctrl* key.
- *Zoom to box* with *RMB* while pressing the *Ctrl* key.

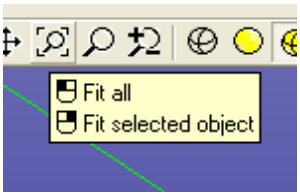
- *Hide all* by pressing the icon with *LMB* (or *F5*).
- *Show all* by pressing the icon (or *F6*).
- *Fit* the model by pressing the icon (or *F7*).

The main viewing command icons reside in the Viewing Toolbar:

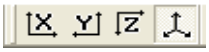


Try them out now. For example, turn on the *Shaded* render mode as seen in the image above. Also, set on the *3D Color Printer* mode to see the actual model colors by pressing down icon.

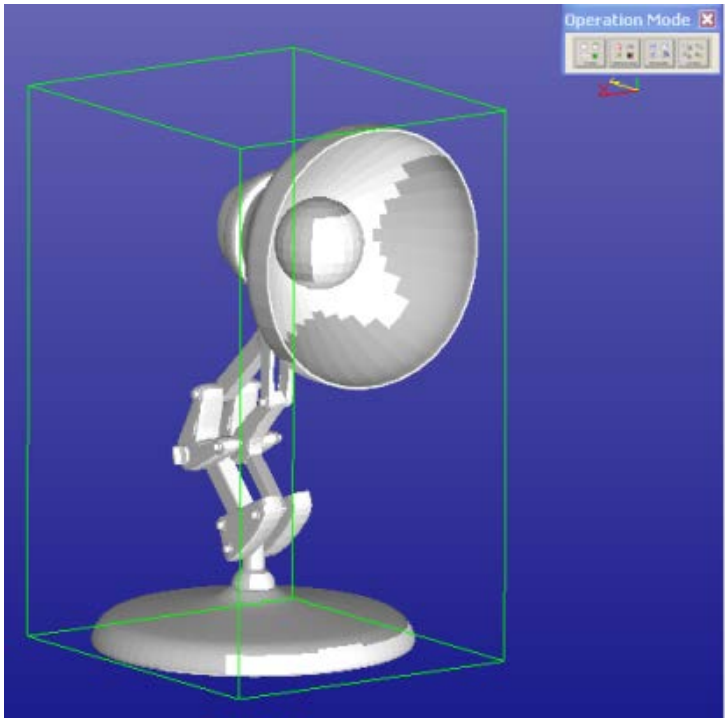
The tooltips provide a short description of each icon (let the cursor remain on top of the icon for a couple of seconds to see the tooltip). Please note that some icons will perform slightly different operations when is pressed with *RMB* or *LMB*:



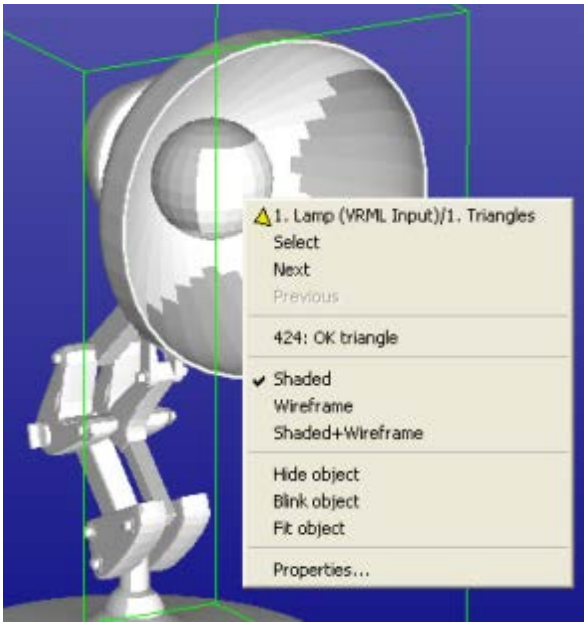
Also, the Viewing Planes toolbar allows you to select any projection direction as the viewing direction (try both *LMB* and *RMB* clicks):



During viewing, you will notice that some of the surface areas are white when some areas are darker (see the image that follows). The differences in the displayed surface colors are due to surface (triangle) normal direction. In the white area the triangle normals are pointing towards the viewer and in the gray area the inverted normal side of the surface is visible (the normal points into the part). One of the tasks in fixing the model is to turn all surface normals to a consistent orientation and to align them to point out of the material side of the part (to the outside).

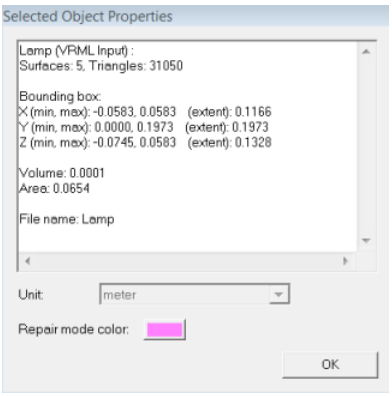


You can also use the *right mouse menu* on the display area to show, hide, and investigate the model on the screen. Make sure the cursor is on the model while **pressing the RMB**:



For example, you can

- display the **model properties by selecting the *Properties* command**:

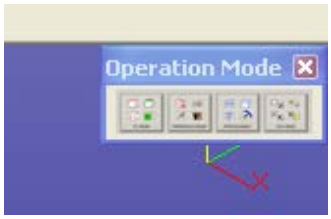


Object Properties give basic information about the part (e.g., the bounding box or the number of triangles). Note that some information (e.g., volume) is incorrect because you have not yet repaired the model.

- **Press OK** to close the window.

Now

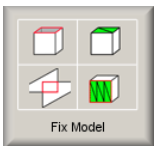
- **press on the minimized Operation Mode** dialog to return to the operation mode.



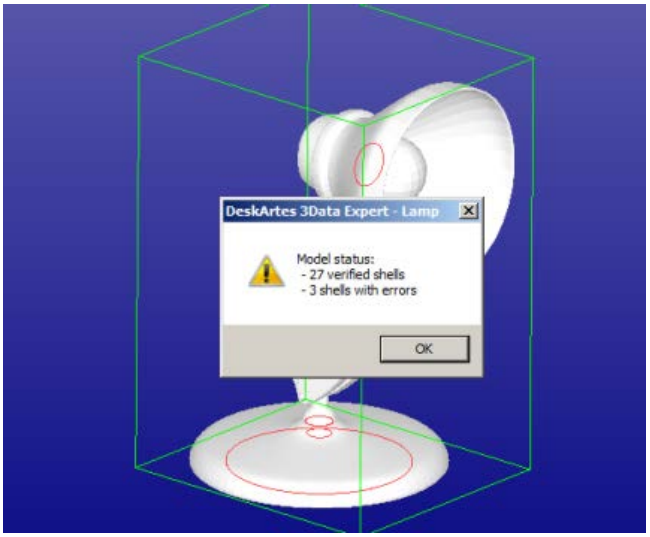
Fixing the Lamp

The normal way to begin repairing a model is to start with the Fix Model mode. To start fixing

- **press the Fix Model button** in the Operation Mode dialog now**.**



3Data Expert will begin automatic model verification (*Fix Model > Verify Shells command*). The screen is erased and a progress toolbar appears. When the analysis is ready, a *Model status* message box displays:

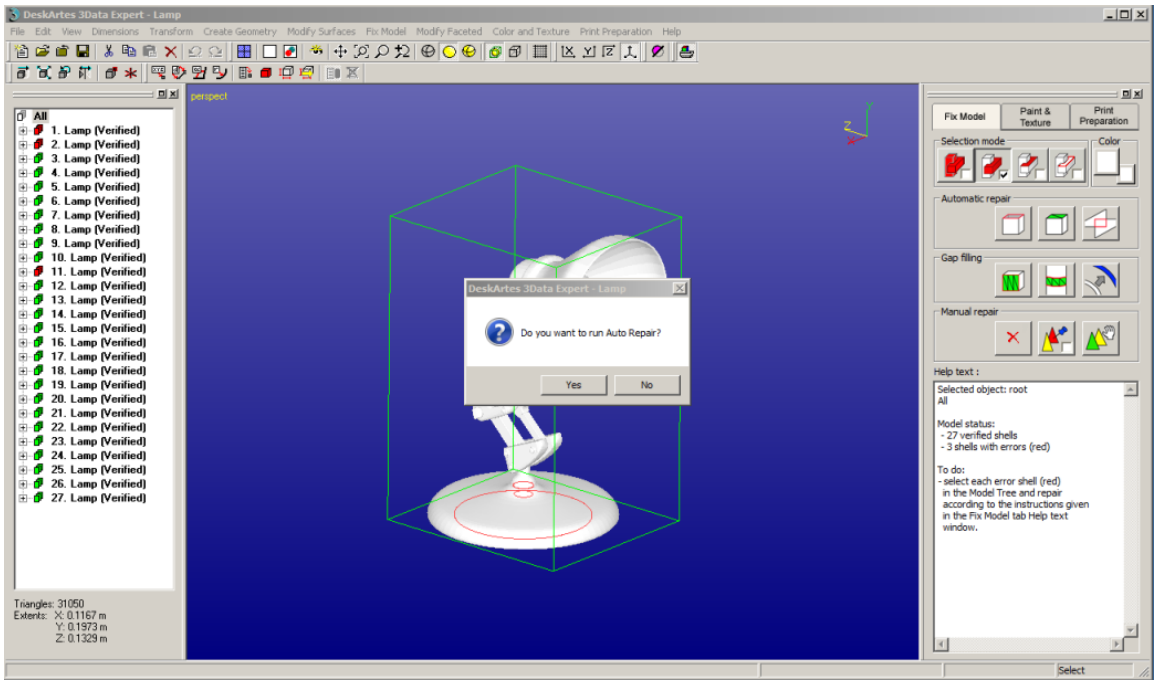


The message indicates that there are 27 verified shells, of which three shells contain errors. The display also shows red *Gap curves* through the surfaces. Gaps are an error type you must fix during the repair process. Note that the model is now displayed completely in white. This color indicates that the normals are already oriented consistently and correctly outwards.

The model is divided into separate shells during verification. In the case of this Lamp, shells include the shade, bolts, and different joints.

- **Press the *OK* button** in the *Model status* dialog to see the full model structure with different shells in the *Model Tree* (on the left-hand side of the image that follows).

The error shells have red icons and the correct shells have green icons in the Model Tree. The *Fix Model Tab* on the *Tools Window* (on the right-hand side) provides shortcuts to the commands available for repair. The *Help text* window at the lower part of the Fix Model Tab also contains information for repair actions.



You are now in the middle of the automatic verification and repair process. 3Data Expert now asks if you wish to continue with *Auto Repair*:

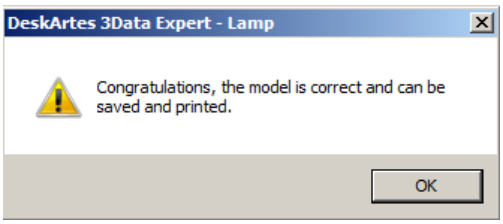
Auto Repair is the best path to follow when repairing everyday models so

- **press the *Yes* button** to initiate Auto Repair.

Auto Repair will attempt to fix all shells with errors in the Model Tree.

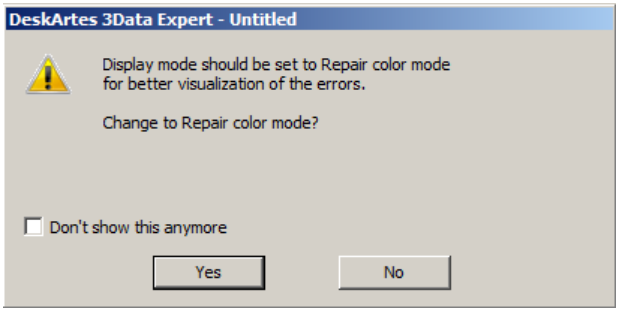
Auto Repair

When Auto Repair is started each shell is run through the automatic repair command (*Fix Model* > *Repair Shells* command) using automatically calculated parameters. For each shell, a progress bar shows the progress of the repair (and this may cause some flickering on the screen when shells with only a few triangles are repaired). You will then receive the following message:



This indicates the model is fully repaired and ready to output for printing. After

- **pressing the OK button**, you will receive a prompt for the *Repair color* mode:



- **Press the No button** because there are no errors to fix anymore and to continue on with model painting and texturing.

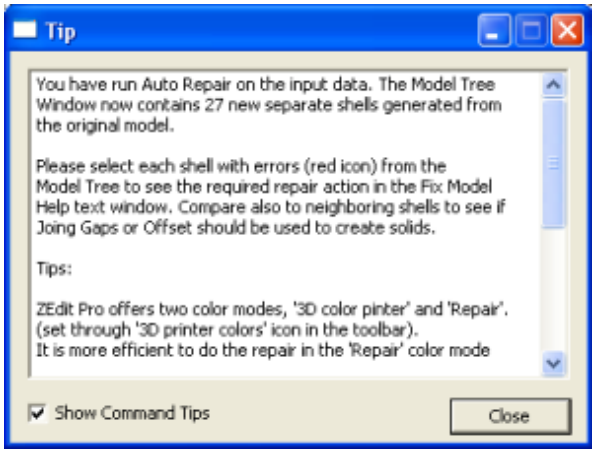
In *Repair color* mode the model is displayed with colors beneficial to repair work (pink outer surface, red error triangles, etc.) and in the *3D Printer* color mode ("What you see is what you get") the model is displayed as it will show when printed with *3D Printer color* (the *Color Display Mode* can be changed by pressing the icon).

You will now receive the final status report.

- **Press the OK button** to close the *Model status* window,

containing the final status report, after Auto Repair.

A *Tip Window* with useful tips on viewing and selection mechanisms is also displayed after Auto Repair:



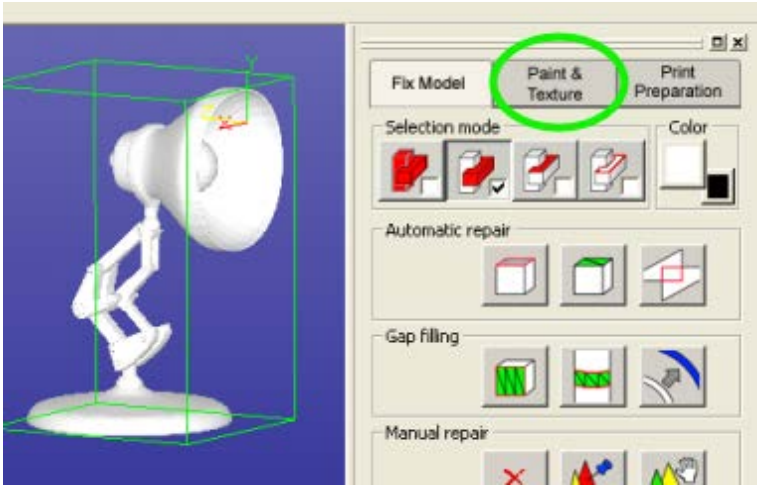
You can just **Close** or **Minimize** the *Tip Window* and the “Introduction to File Fixing” page for later reference during the repair session. You can also permanently turn off these windows when you become more familiar with the use of the repair tools in 3Data Expert through the *Show Command Tips* and *Don't show the window after Auto Repair* settings in the dialogs. You can restart both windows through the Help menu.

During Auto Repair, 3Data Expert attempts to fill all gaps and remove non-manifold triangles (overlapping triangles, multiedge triangles, duplicate triangles, triangles having less than three neighbors, etc.) from the model (to see more about triangle errors, please access the “Triangle errors” page in the Online Help chapter “Handling Faceted Models”). The Lamp model only has simple errors, like inverted triangles and gaps, which are all fully repaired during the Auto Repair process. You can now continue on to painting and texturing the model.

Chapter 3 – Coloring the Lamp model

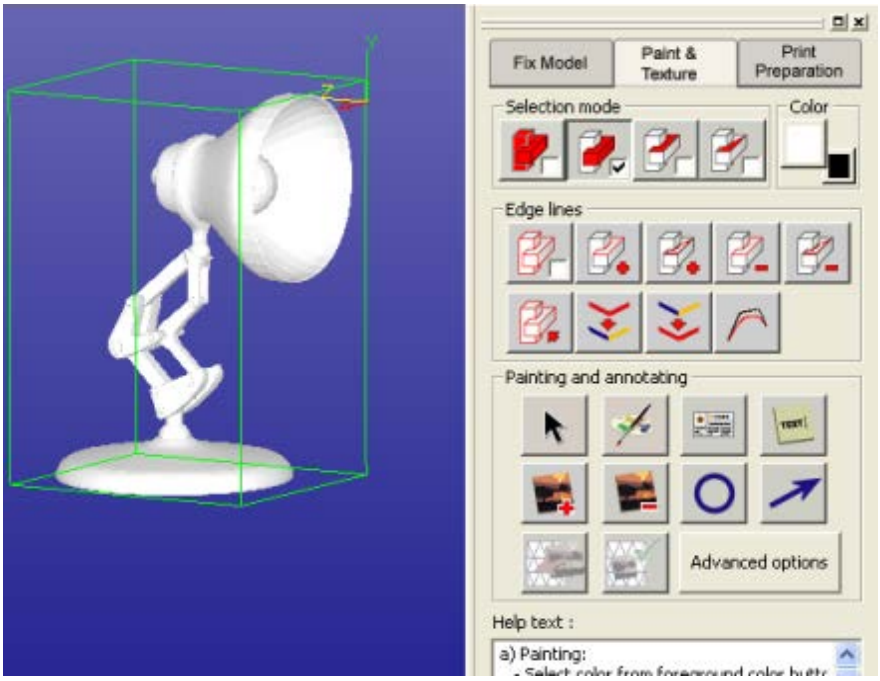
You should now have the fully repaired Lamp available (if not you can input the *Lamp-repaired.zpr* file from the *Tutorials/Tutorial 2 – Working with Colors* directory in the 3Data Expert installation). To start coloring the model you will use the tools in the *Paint and Texture mode*. Paint and Texture mode is activated by opening the *Paint & Texture Tab* in the Tools Window.

- **Press the Paint & Texture Tab** now (green circle below):

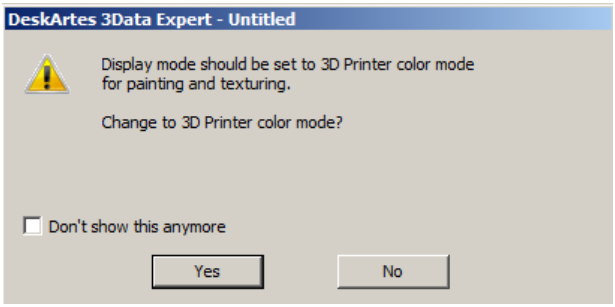


This will open the Paint & Texture Tab with the shortcuts to the tools for painting and texturing. The lower most window provides Help text on different operations, including Painting, Texturing, and Edge line editing. You can always refer to the Help text to find the correct operation and mouse/keyboard sequences (please see the image that follows).

The Model Tree Window closes because it is not required for model coloring (you can hide/show the Model Tree with the *F8* key at any time, the Tools Window with Shift+F8 key). The window layout should now look as follows: the Tools Window with the Paint & Texture Tab on top displays on the right-hand side:



If the *Repair color* mode was previously set, the color mode should be set to *3D Printer* color mode now (you should **press the Yes button** if the dialog below appears):



Selecting shells, surfaces, and triangles

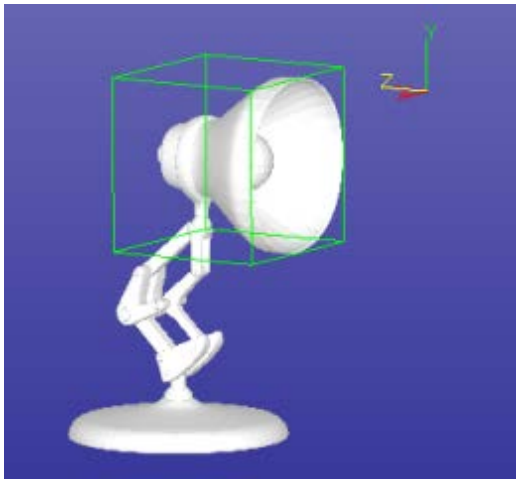
During model coloring, you will select target objects (whole model, individual shells or surfaces, and triangles) to color from the display area. The selection is done with the *left mouse button* (*LMB*), and the selection target is controlled by the *Selection mode* buttons in the Paint & Texture Tab:

The four *Selection mode* buttons refer to selecting the whole model, one shell, one surface, or one triangle. Now try to select a shell from the display area, such as the Lamp cover. The *Selection mode* is on *Shell selection* by default but if not

- **press the**

button to turn on the Shell selection. Then

- **click with the LMB on the Lamp cover:**



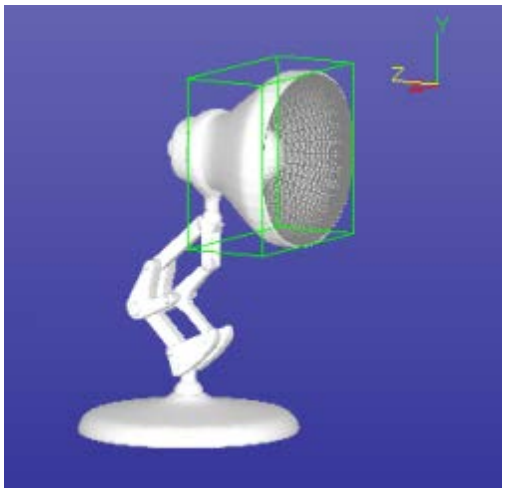
You have now selected the lamp cover, which is a separate shell (if you do not see the green selection box make sure that the show bounding box is turned on with icon).

Now try to select a surface in the shade shell. **First**

- **press the**

button to turn on the *Surface selection* mode. Then

- **select the inner surface** from the Lamp cover **by clicking with the *LMB***:



The inner surface of the shade is selected in the image above and also displayed in wireframe mode for clearer visibility of the selection (for wireframe display of the selected surface press wireframe icon with *RMB*).

Now

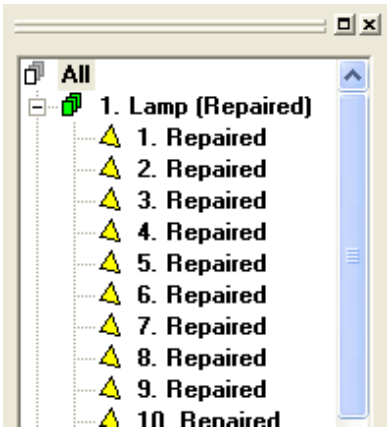
- **press the part selection**

button to select the full part and then press the shaded icon with the *LMB* to restore shaded color to the whole model.

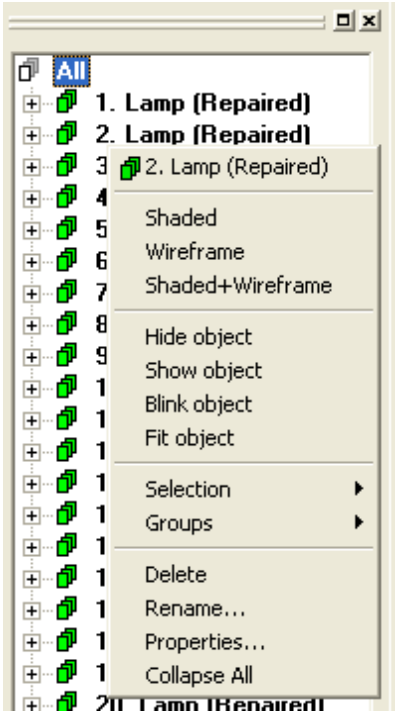
You can now

- **press the *F8* key** to display the Model Tree Window again.

All previous selections (whole model, shell, and surface) have a corresponding node in the Model Tree. The Model Tree root *All* should be selected in this instance (i.e., the whole model):



The Model Tree contains the full breakdown of the repaired Lamp model: whole model (*All*), shells (*1. Lamp (Repaired), 2. Lamp (Repaired),* etc.) and surfaces making a shell (*1. Repaired*, *2. Repaired,* etc.). You can select objects freely in the Model Tree with the *left mouse button* (*LMB*), you can open/close shell nodes by pressing the +/- icons and you can use the *RMB* menu to display, hide, and investigate objects in the Model Tree:



Now retry the different graphical *Selection modes* (shell, surface, and part) and see how the selection changes in the Model Tree when corresponding objects

are selected from the display area. For example, when hiding shells in the Model Tree they disappear from the display area and their icon turns gray.

- P**ress *F8* to close the Model Tree** when finished and
- **turn the *Part selection* mode on** to select the full part again.

Painting the Lamp

Now you know how to select objects for painting. Your next task is to add new colors and textures to the Lamp. You will start by giving a light-blue coloring to the Lamp frame.

- **Turn the *Part selection* mode** on first and
- **set the light-blue color as the Foreground color** (click with *RMB* on the circled Foreground color button and select the color with a standard Windows color palette):

Then

- **press the Paint**

button on the Paint & Texture Tab to color the whole part with the light-blue color (shown in the left-hand image below). Now

- **turn on the *Shell selection* mode** and
- set the **green *Foreground*** color:

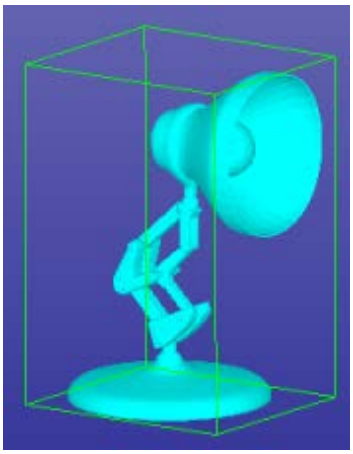
- **Press the Paint button** in the Paint & Texture Tab again and

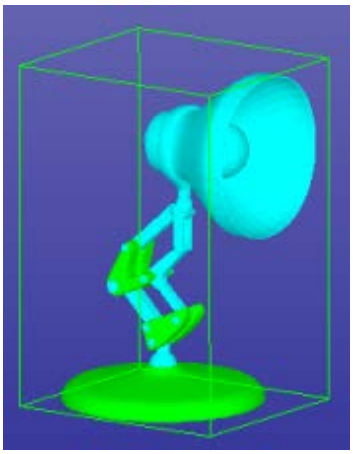
- **select** the joints in the steel frame and the base **with the *LMB***.

Every time you select a shell, it is painted with green color. When ready

- **press the RMB** on the display area to finish the Paint command for shells.

If you selected the wrong shell, you can **press the ESC key** to undo the last shell painting. Your lamp should now have the following appearance (right-hand image):

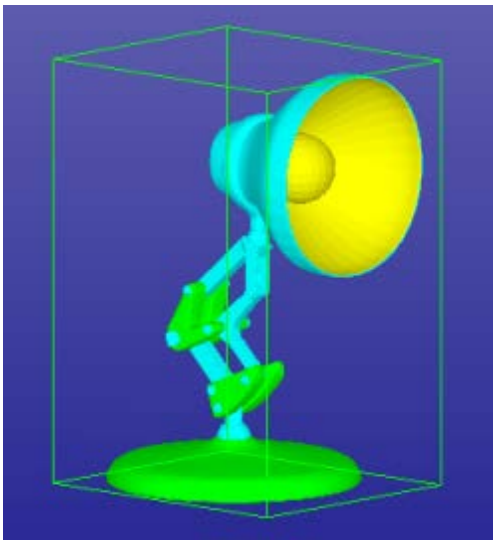




Now also

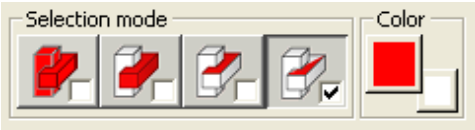
- **paint the light bulb yellow and the inner cover surface** (in *Surface selection* mode) to grayish-yellow

to set the color for the inner side of the cover:



Now paint a few triangles in the bulb red to provide the final touch.

- **Turn the *Triangle selection* mode on** and select the **red Foreground color**.



Then

- **Press the Paint command**

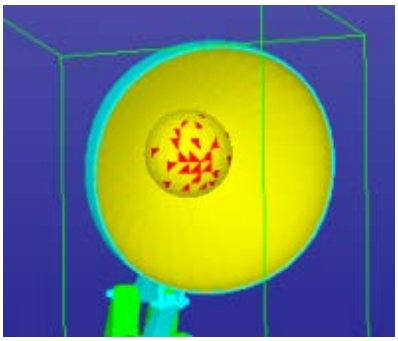
button and

- **select individual triangles from the screen with the *LMB***.

Each triangle immediately changes to red. If the wrong triangle is selected, **press the ESC key** to undo triangle painting. When you are

- ready **press the RMB** to accept and finish painting triangles.

The result should look similar to the result on the image that follows.



Editing edge lines

During model verification and repair, shells are divided into surfaces. Sometimes these surfaces are insufficient for correct coloring or texturing of the model. In a case such as this, use the *Edge lines* commands to show, add, delete, and sketch new edge lines on shells. The main purpose for editing edge lines is to define new surface areas on the model for accurate texturing and painting.

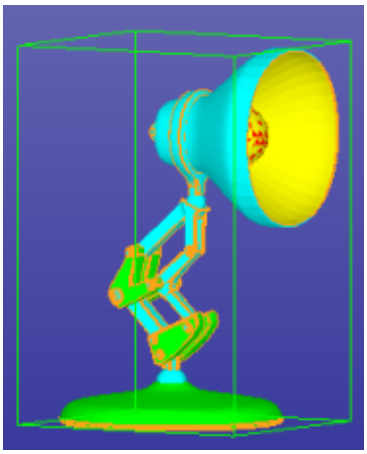
To see the surface edges you must

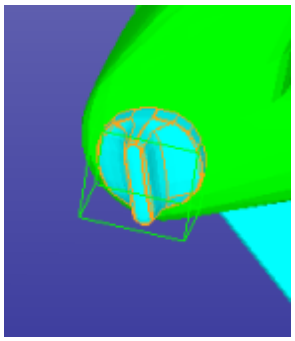
- **turn on *Show edge lines*** in the *Edge lines group*:

The edge lines are always displayed for the selected object (i.e., the whole model, shell, or surface). Now try to

- **select the whole model** (*Part selection* mode) and then
- **a small knob shell** (*Shell selection* mode) in the frame.

The *orange edge lines* appear according to the selection (see the image that follows).





Any edge line editing command (add, remove, split, or merge) operates on a *single shell* until you end the command with a *RMB* click. The shell to operate is set when you pick the first edge from the displayed shells. After completing an Edge line command and before starting a new command, you need to select the shell to operate again (this can be the same shell as the previous shell).

Now imagine you want a red area on the small knob (seen on the right-hand image above).

- **Select the shell** (if not already selected) and
- **Fit it on the display area** by pressing the icon with a *RMB*.

It also may be a good idea to show the model in Shaded and wireframe mode by

- **pressing the Shaded+wireframe** icon

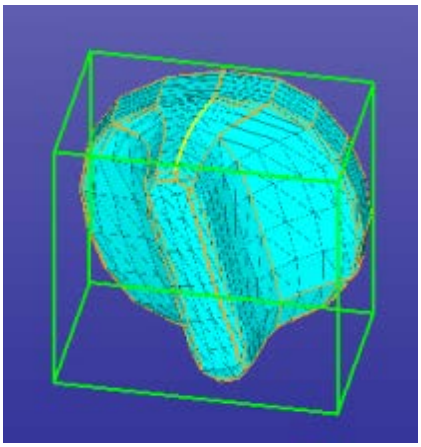
to see the individual triangles more clearly.

You can first investigate the length of the different surface edge lines with the *Pick edge* line command.

- **Press the Pick edge line**

button and then

- **pick the orange edge lines** displayed on the image below:



The picked edge lines are shown in yellow. Practice picking different edge lines and you will see that edge lines always end (after Auto Repair) at an intersection where more than two edge lines meet.

- When ready **press the RMB to quit** the edge-line picking.

Any set of connected edge lines with no internal edges define a surface in the shell. The edge lines can be separate (i.e., not merged) but must have common end points to close the loop defining a surface area.

Now you are ready to delete a few edge lines.

- Give the Delete edge lines command by **pressing the Delete edge lines**

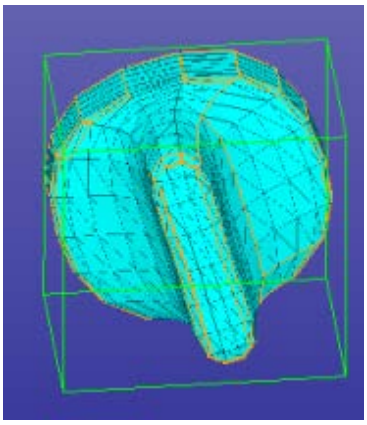
button.

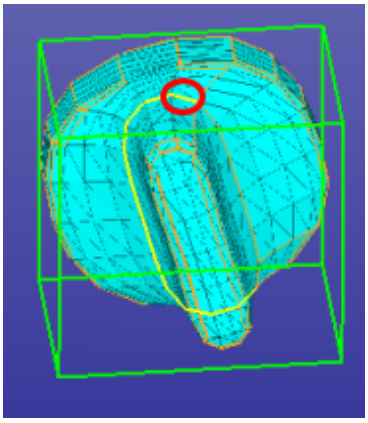
- **Pick the edge lines with the LMB** on the narrow side of the knob.

They are immediately deleted (do similar deletions on the other side of the shell).

- **Press the RMB when ready** or the **ESC key to cancel** an unintended deletion.

The result should look like the left-hand image below:





After deleting the necessary edges, you can

- **add new edges by pressing the Add edge line**

button and then

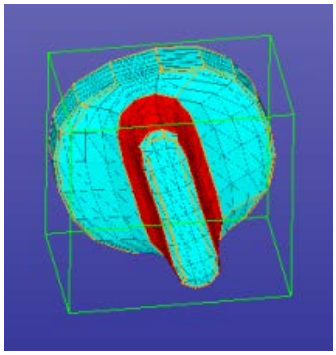
- **carefully picking triangle edges that provide the correct starting direction for the added edge**.

When a triangle edge is picked the edge line is extended until another edge line is crossed, following the most probable sequence of triangle edges. For example, you can create the correct edge line (yellow when picked) shown on the right-hand image by single picking on the triangle edge circled in red. When ready to pick new edges

- **press the *RMB* to accept the new edges** or the ***ESC* key to cancel** one edge at a time.

When the *RMB* is pressed, new surfaces are created (also in the Model Tree).

After creating a new surface, you can paint or texture it as a single entity. In the image below the new surface is painted with red:



You can now

- **turn off the *Show Edge lines*** and
- **turn on the *Shaded display* mode** **.**

Texturing with chessboard bitmap

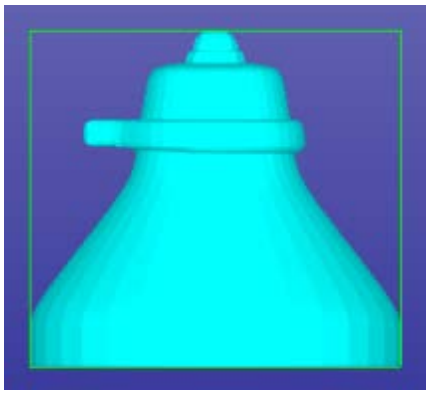
Texturing allows you to add images in different formats (.bmp, .gif, .jpg, .pcx, .png, .ras, .pic, .tga, and .tif) on top of faceted models. For example, you can use a cloth texture to make a garment look more realistic or you can add a text annotation to provide information on the required manufacturing tolerances.

The texturing commands are accessed through the *Painting and annotating group* in the Paint & Texture Tab:

Now you will add three textures to the Lamp model: a cylindrical chessboard texture around the lamp cover, an engineering template on the bottom of the part, and a drawn circle on the model.

To add the chessboard texture first

- **select the Lamp cover** from the screen in the Shell selection mode,
- fit it in the display area (+ RMB), and **view it from the X axis direction** (press icon):



Begin texture addition by

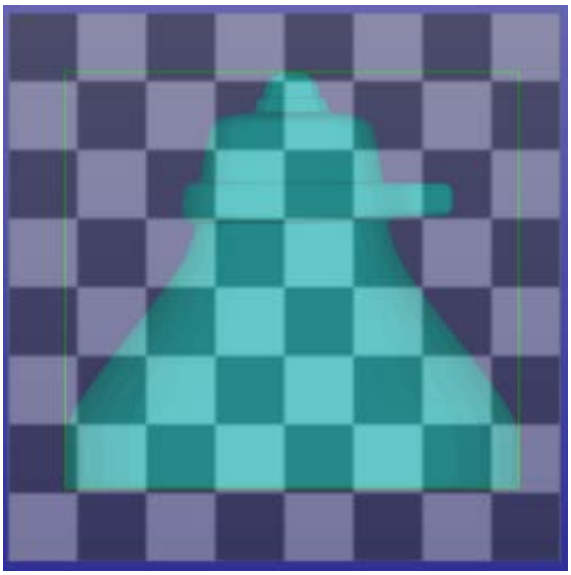
- **pressing the Add texture**

button which generates a *File Open* window so you can browse for the texture image file. The texture open dialog includes a preview window for the image files on the right-hand side of the window. This helps you to select the correct image for the texturing command easily.

Now you will

- select the *chessboard.bmp* in the *Tutorial/Tutorial 2 – Working with Colors* directory.
- **Press OK to input the image**.

Soon you will see the Lamp and the image in front of the lamp on the display area. The image may appear smaller or bigger than in the image below when compared to the lamp, we will soon scale it to correct size.



In this case, you want to generate a cylindrical projection around the cylindrical lamp cover.

- **First, you will scale the chessboard image to the correct size on top of the cover.**

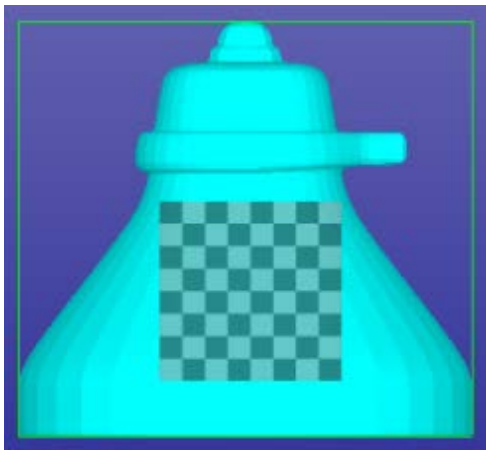
Immediately after inputting the image, the Help text window displays detailed information on how to zoom, pan, and rotate the image and the model.

Image transformations are performed by the following commands using the ***left mouse button (LMB)***:

- Move image: *left mouse button* (*LMB*)
- Scale image: *Ctrl+LMB*
- Rotate image: *Ctrl+Shift+LMB*
- You can also use Arrow keys (with the same modifiers)

You can rotate, pan, or zoom the model with the same modifiers **using the *middle mouse button* (*MMB*)**.

Using the above commands to position the image on top of the model as shown in the image below:



In this case, you want to position the image only on the outer surface of the Lamp cover. First,

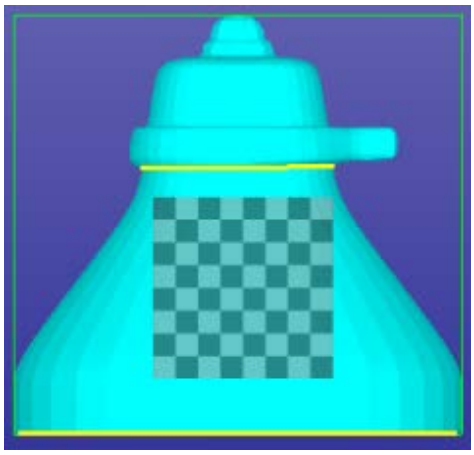
- **turn on the Surface selection mode**

and then proceed to selecting the correct surface after

- **pressing the select target**

button in the Paint & Texture Tab. Then

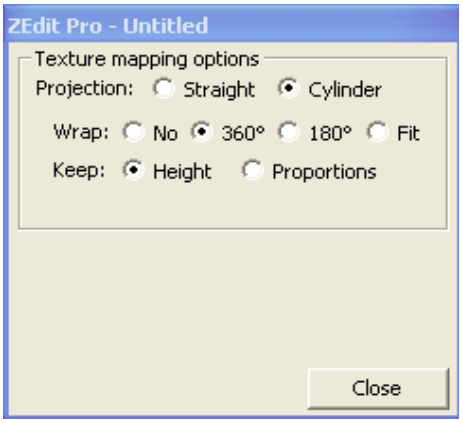
- **click on the cover with the *LMB*** to select the outer surface for the texturing operation (the surface edge lines are highlighted in yellow)



You can select any number of surfaces or shells for texturing but here you will work with the single selected cylindrical surface. If you select the wrong surfaces, **press the *ESC key* to cancel the last selection**.

You want to generate a cylindrical texturing for this model using *Advanced options* in the Painting and annotating group.

- **Press Advanced options** and fill in the parameters below:



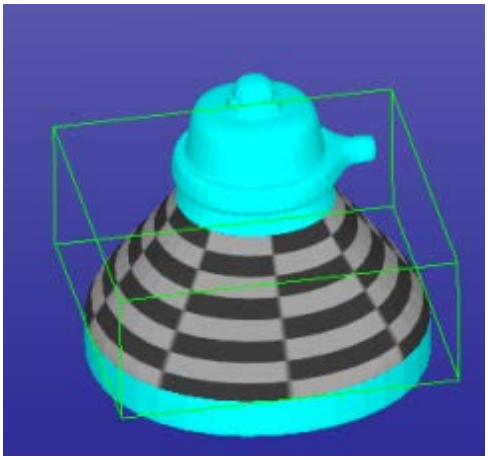
Now

- **press the *Preview***

button (or RMB) to see how the textures fit on the model. If you are not satisfied with the preview results, you can **press the ESC key to cancel** the previous operations one by one. If you are satisfied,

- **press the Accept texturing**

button (or *RMB* again**)** to see the final texturing on the model. After selecting the textures surface, the final texturing for the cover should look like the example below:



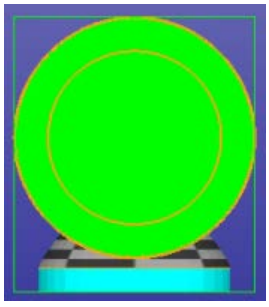
After clicking the *RMB* button, a larger selection box displays because the whole model is selected, although not yet displayed, after accepting a texture.

Adding an engineering template

Applying an *Engineering template* (and *Text*) represents a special case of the normal image texture operation described above. With normal texture addition, the texture image is read from the image file. With an engineering template, the image is first generated with the HTML editor that is built into the software.

- **Start by taking a view from the Lamp model bottom** (-Y axis direction,

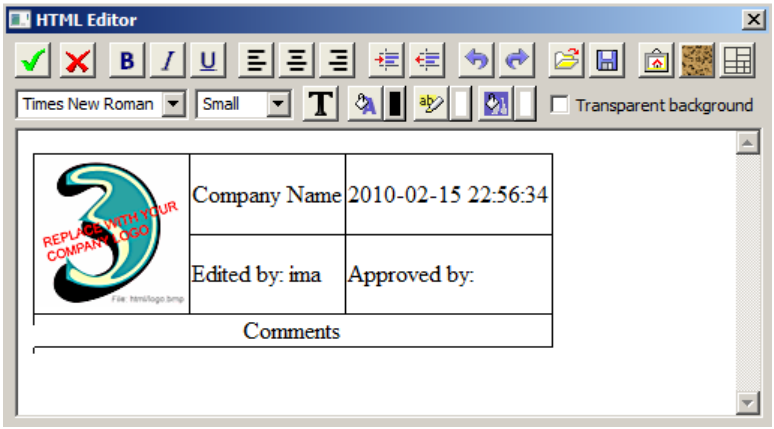
icon + *RMB,* make sure the *Show Edge lines* is turned on):



Then

- **press the Apply Engineering template**

button. This opens the HTML Editor for inputting text into predefined fields in the template:



When done editing the text

press the OK icon.

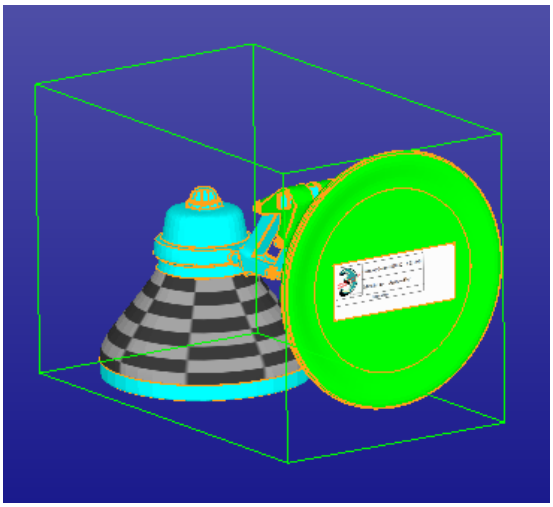
Now you will see a texture image in front of the model as you did with the previous exercise using the chessboard image.

- Use the **pan, rotate and zoom** commands (see Help Text) to position the texture correctly on top of the model, as shown below:

- **Pick the surface to add** the texture (in *Surface selection* mode):

After

- **pressing the *Preview* and *Accept* buttons**, you should see the following result on the screen when all is displayed:



User-defined engineering templates in HTML format provide ultimate flexibility and can be loaded by pressing the Open icon in the HTML editor. You can also generate a basic table template by pressing the Insert Table icon.

Draw circle on surface

Drawing a circle (or arrow) on a surface is once again a special case of the normal texture addition (see the chessboard example). To apply a circle the circle (arrow) is first drawn on the model. When ready the normal image texture commands apply to the positioning, surface picking, previewing, and completion of adding the texture on the part.

Now you will add a circle on the back side of the Lamp cover. **First,**

- **take a view from the Z axis direction** (icon and *LBM, Show Edge lines* turned *off*):

Then

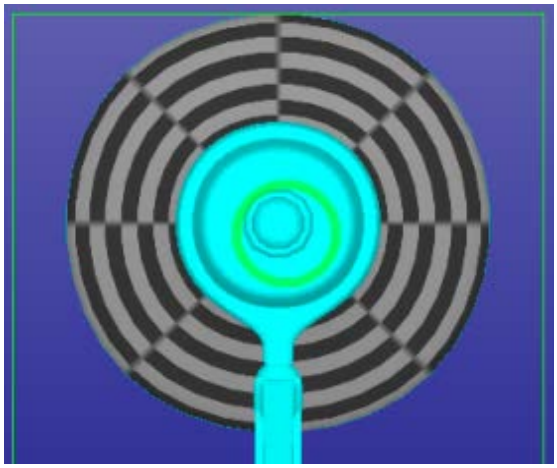
- **set the *Selection mode* and *Foreground color* as shown** in the image below:

Now

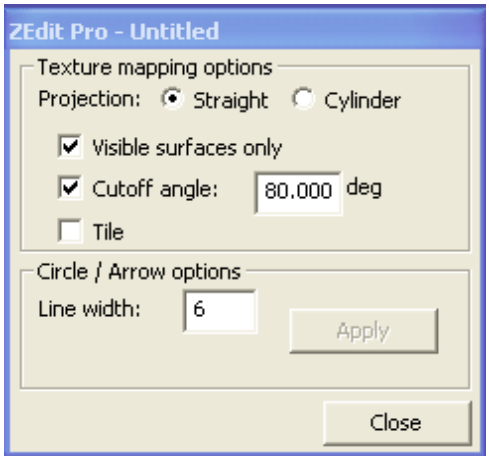
- **press the Apply Circle**

button. You can now

- draw the circle on the back side of the cover and position it in the middle near the top by dragging with the *LMB*:

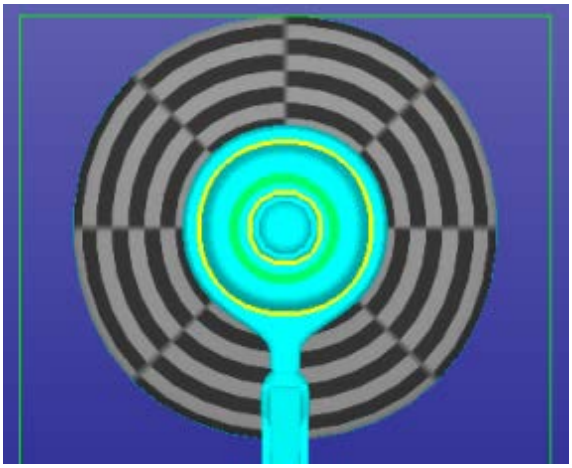


You do not need to place the circle in the exact location immediately; only the size and the thickness matter at this stage. You can change the *Line width* through the Advanced options if it is not correct already. The **Advanced** button must be pressed separately to invoke the options dialog:



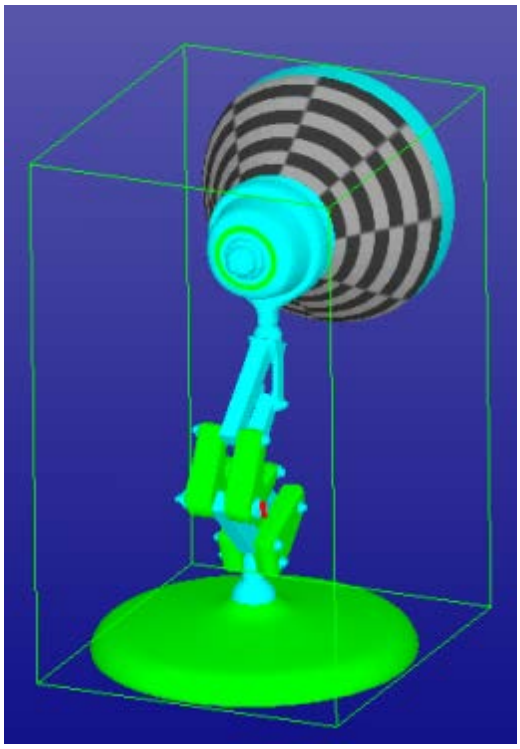
After the parameters are set, you can position the circle correctly (*Shift+LMB*) and then

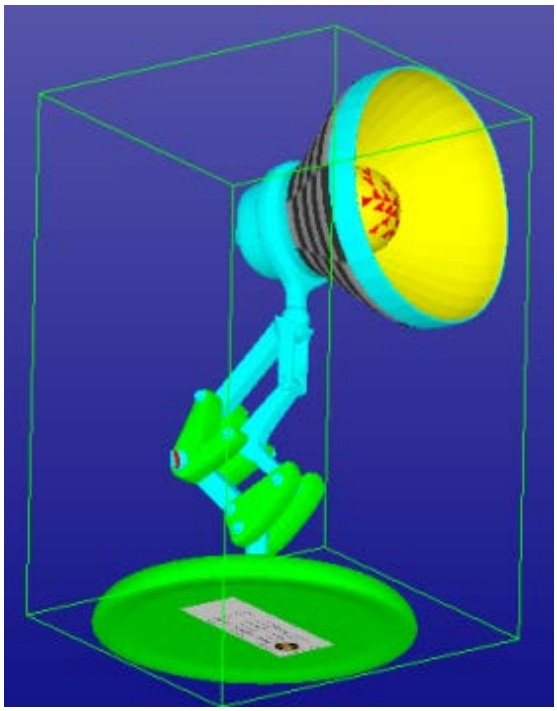
- **select the surface** as seen in the image that follows**:**



Now

- **press the *Preview* and *Accept* buttons** to add the circle texture to the model (the result appears in the left-hand image below):





The *Lamp-colored.zpr* file represents the final result.

Saving the file

When saving the file to VRML or ZPR format with the *File* > *Save As* command you must take some care. The final model contains several shells (27) that can all be outputted separately without making the whole model. The best practice is to display the Model Tree (*F8* key) and **select the whole model first**, (i.e., the Model Tree root *All*). When *All* is selected, every shell will be written to the output file. If something other than the *All* root is selected a warning is issued before the file is written.

If the model is to be outputted to some other than 3D Color Printer you must check that the receiving system will accept multi shell parts (= parts made of several shells intersecting in 3D space). If not, please use the *Modify Faceted* > *Boolean* and *Boolean Multiple* commands to connect the separate shells into a singe shell before outputting the part.

Transferring directly to 3D Printer

If your PC has some 3D Printer control software installed, you can most likely create a direct connection to it. *Print Preparation* > *New Plugin* command allows you to create direct links to third party software products. Please see the Online

Help page *Menus and Commands / Print Preparation / New Plugin* page form more info.

Chapter 4 – Conclusions

Congratulations for reaching the end of this tutorial! The process and commands you have just learned will help you through the automatic repair needed for the majority of 3D models with 3D Color Printers. Also, you are now familiar with most of the coloring and texturing commands. For more information on texturing and painting, please see the “Color and Texture menu” Help pages in the Online Help “Menus and Commands” chapter.

3Data Expert is part of the DeskArtes Expert Series software suite. To learn more about the capabilities of other Expert Series software for 3D data fixing, coloring, preparation, or 3D model generation, visit www.deskartes.com:

- 3Data Expert for full model repair and manipulation, including 2D Dimensioning, texturing and coloring, triangle reduction and refining, support generation, model slicing, etc.
- Dimensions Expert for basic file repair, splitting, connecting and dimensioning.
- 3Data Expert Lite adds 3D Text generation and Boolean operations to add 3D Text to your parts.
- Sim Expert includes special set of tools for reducing triangle count and to improve triangle aspect ratio for simulation applications.
- Import Package for importing native surface models from Pro/ENGINEER®, Unigraphics®, and Catia® 3D CAD systems, and STEP files for 3D Printing.
- Design Expert for generating your own free-form 3D geometries with an easy-to-use and powerful 3D CAD system.
- View Expert for easy 3D model viewing, verification and measuring.
- ZEdit Pro for 3D System 3D Printers