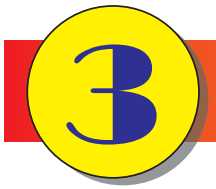


Basic Constructs and Operations

In this Chapter:

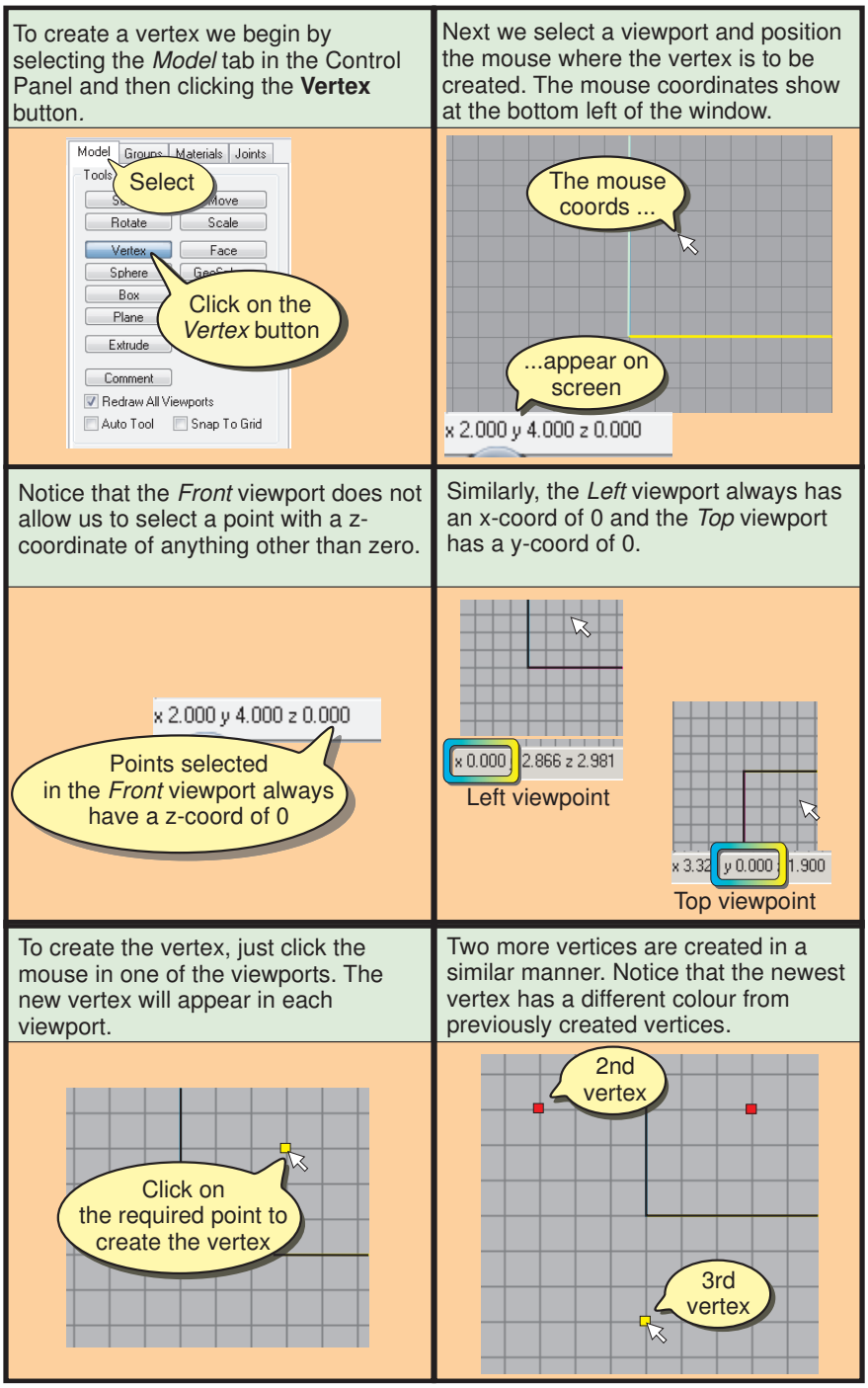
- Basic Mesh Editing
- Creating a Vertex
- Creating a Face
- Creating a Multi-Face Model
- Creating an Edge
- Editing Vertex Data
- Exporting a Model
- Importing a Model
- Repositioning Vertices
- Rotating Faces
- Saving a File
- Selecting Vertices and Faces
- Scaling Edges and Faces
- Snapping a Vertex to the Grid
- Using Auto Save
- Viewing Backfaces

Creating Vertices and Faces

One way to produce a face is to first create three vertices and then join these together to give us a single triangular polygon. FIG-3.1 shows us how to make the three vertices.

FIG-3.1

Creating Vertices



In the book, the newest vertex is white (yellow in PDF format) to indicate that it is currently selected.

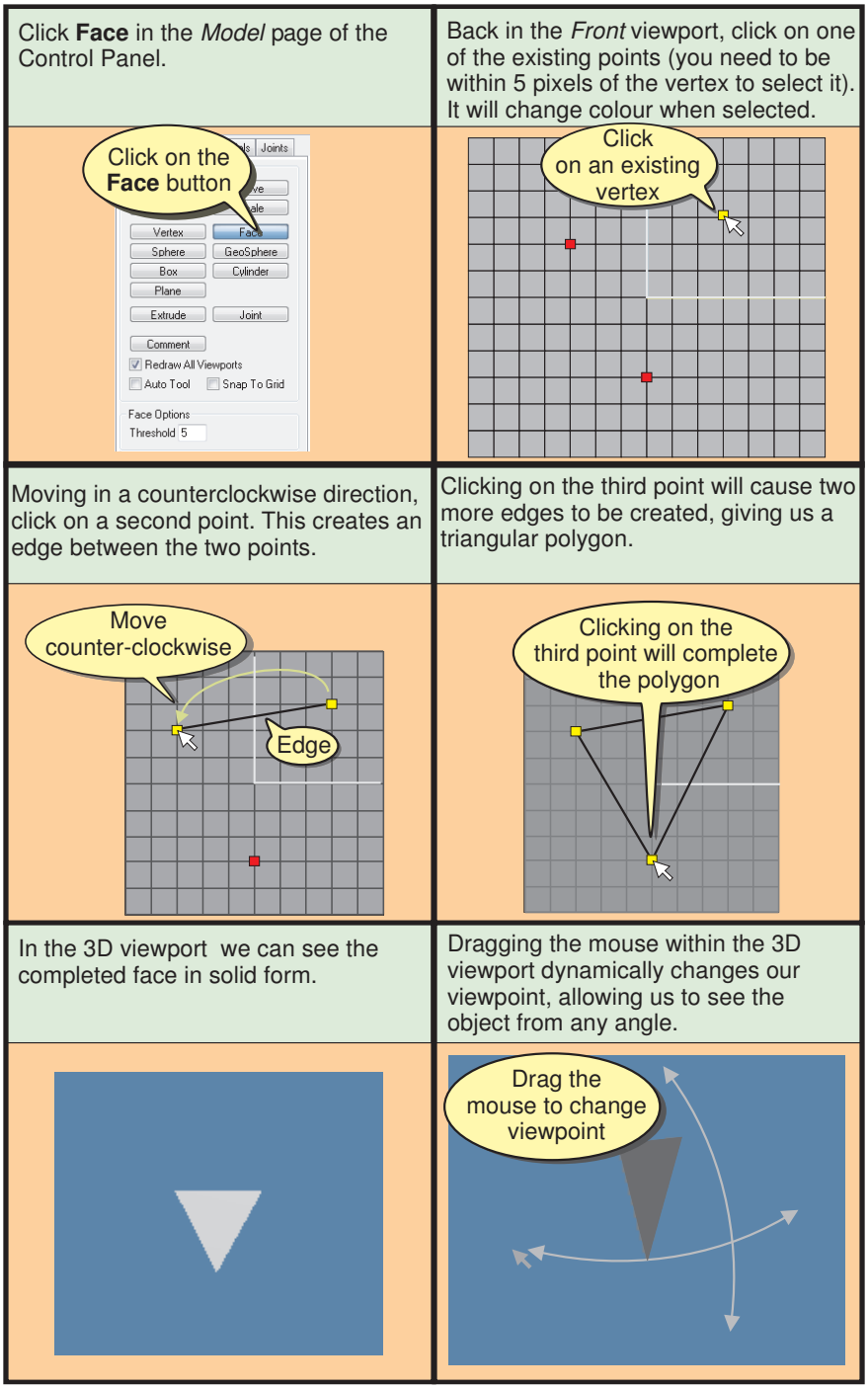
Activity 3.1

In the *Front* viewport, create three vertices with approximately the following coordinates (3,3,0),(-3,2,0),(0,-3,0).

To create an edge, we click the **Face** button and then tell Milkshape which two vertices are to be linked by clicking on them. When a third vertex is selected Milkshape adds two more edges to complete the triangle and produce a single face (see FIG-3.2).

FIG-3.2

Completing the Face



Activity 3.2

Join the vertices you created previously to produce a face. What colour shows on the back of the triangle in the 3D viewport?

Use the zoom feature to first reduce and then magnify the apparent size of the triangle within the 3D viewport.

Zoom in until only a small part of the face is visible. Now, by repositioning your viewpoint, move, in turn, each of the face's vertices into view within the 3D viewport.

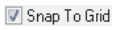
Use **Reset View** to return the 3D viewport to its default setting.

Other Options on the Model Page

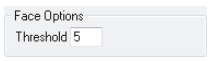
The *Model* page contains a few other options which affect our interaction with Milkshape. These are:

With ***Redraw All Viewports*** checked, every change made to the model is automatically shown in each viewport. This option should remain checked at all times.

The ***Auto Tool*** option, when checked, causes a return to select mode after performing another operation such as adding a vertex. Return to select mode is indicated by the **Select** button being highlighted. Normally this option remains unchecked.



The ***Snap to Grid*** option forces each vertex to be added at a grid intersection point. With the grid spacing set to 1, this means that the coordinates of any point will always be whole numbers. For total freedom in positioning vertices, this option should be unchecked.



Beneath these three check box options a panel appears which is relevant to whichever main operation has been selected from the *Tools* panel. For example, when the **Face** button is clicked, a panel titled *Face Options* appears. This panel contains a box with the legend *Threshold*. The value in this box determines the accuracy with which the mouse must be positioned when selecting a vertex. The default value is 5, meaning that the mouse pointer must be within 5 pixels of the vertex being selected when it is clicked. There should be no need to change this value under normal circumstances.

See below on how to select a vertex.

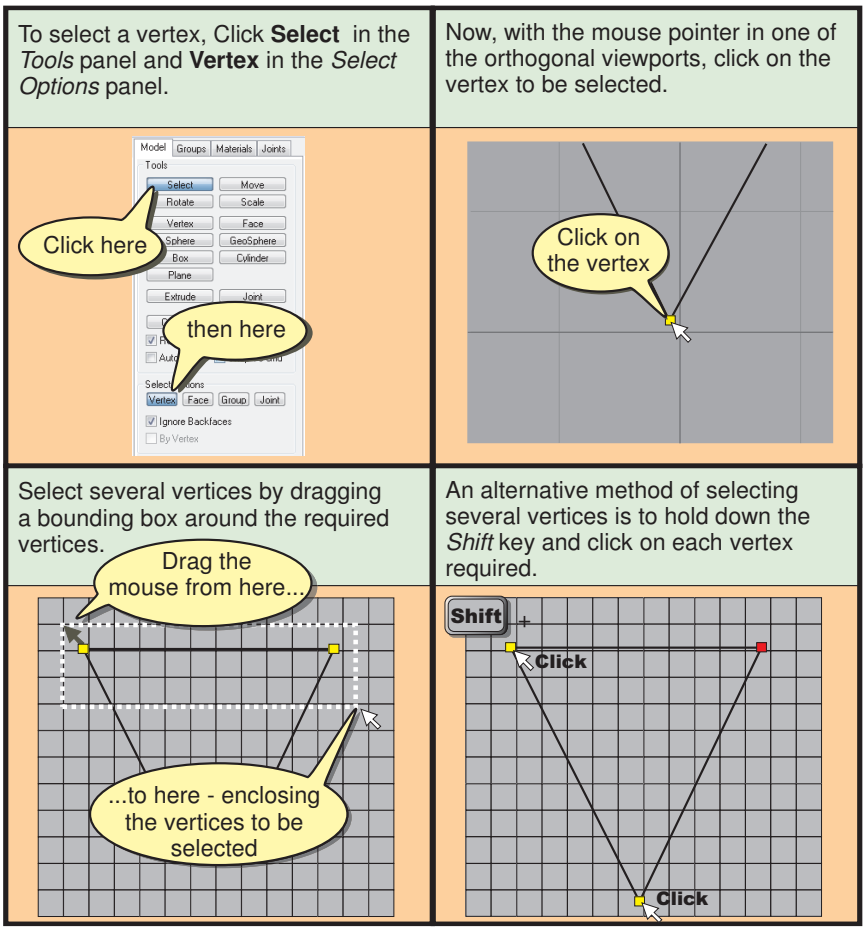
Selecting a Vertex

To select an existing vertex, click on the **Select** button in the *Tools* panel of the *Model* page then, in the *Select Options* panel that appears underneath, make sure the **Vertex** button is selected. Now move the mouse pointer over the required vertex within one of the orthogonal viewports and left click. The selected vertex will change colour.

If you want to select more than one vertex, either hold down the *Shift* key and click over each vertex required or drag a bounding box around all of the vertices you need to select (see FIG-3.3).

FIG-3.3

Selecting A Vertex



An Alternative Way of Creating a Face

Once we've created three vertices, rather than click on each in turn to create a face, we can select all three vertices and then choose **Face|Create Face** from the main menu. This option automatically links the vertices to create the required face. Even easier, just select the three vertices and press F - the shortcut for this menu option.

Undoing An Operation

If you make a mistake while creating your model, all you have to do is select **Edit|Undo** or press **Ctrl+Z**; this will undo the last operation you performed. Keep on selecting this option if you want to undo several operations. If you step back too far, use **Edit|Redo** (**Ctrl+R**) to redo the last undone operation.

Activity 3.3

Use **Edit|Undo** to backtrack, removing the face you created earlier, and return to the point where only the three vertices exist.

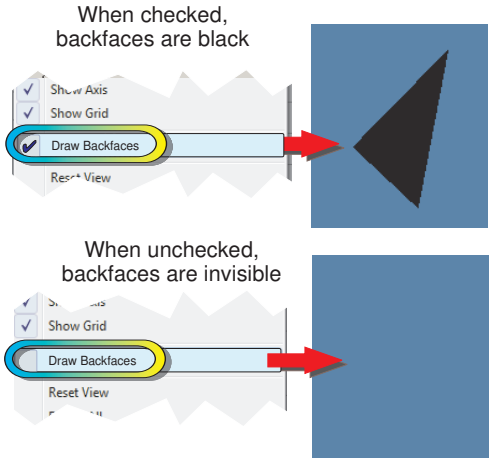
Select all three vertices and use **Face|Create Face** to recreate the face.

Viewing the Back of a Face

As we change our viewing position in the 3D viewport and the back of a face comes into sight, we can see the back is much darker - or even invisible. This is because the surface and vertex normals which are used in calculating the light reflected from a surface are now facing away from us. Therefore no light calculations are performed for the polygon, which results in it being displayed in black or not being visible at all. Exactly how the back appears within the 3D viewport is determined by the **Draw Backfaces** option in the viewport's pop-up menu (see FIG-3.4).

FIG-3.4

Showing/Hiding Backfaces



Activity 3.4

Check out the effects of selecting and unselecting the **Draw Backfaces** option when viewing your triangle.

Saving the Model

If we intend to work on a model over an extended period, or are just afraid of a power cut several hours into our work, then we'll need to save our model to a file.

We can either do this manually using the **File| Save As** or **File|Save** menu options, or we can get the program to perform automatic saves. Milkshape models are saved with an *.ms3d* extension.

Activity 3.5

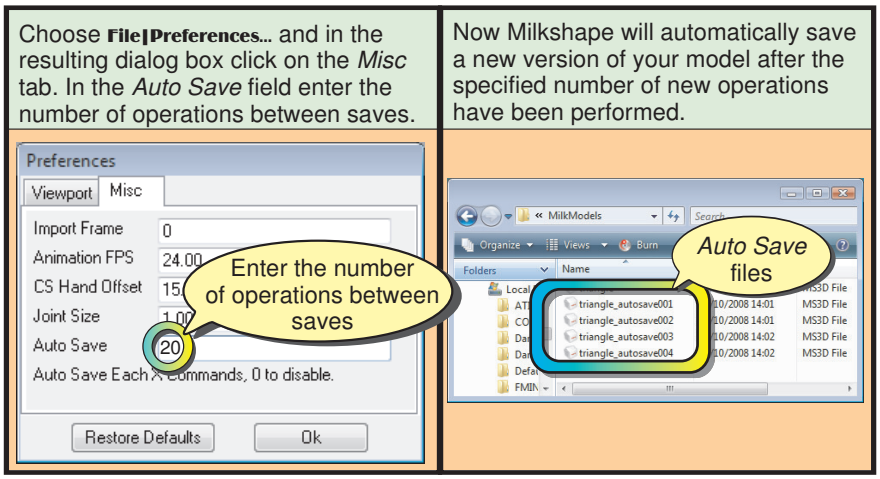
Within the *Hands On Milkshape* folder create a sub-folder called *MyMilkModels*.

Save your model as *Triangle.ms3d* in your new folder.

Once a file has been saved for the first time, Milkshape can perform automatic saving each time a specified number of new operations are performed on the model. Automatic saving does not overwrite the original file but, instead, creates a new file every time it performs a save. These new files are given program-generated filenames based on the name used when you saved the first version. The steps required to activate auto-saving are shown in FIG-3.5.

FIG-3.5

Using Auto Save



Setting the *Auto Save* value to zero disables automatic saving.

Activity 3.6

Switch on auto-saving for your *Triangle.ms3d* model. Use an *Auto Save* value of 5 so that saving will occur on every fifth operation.

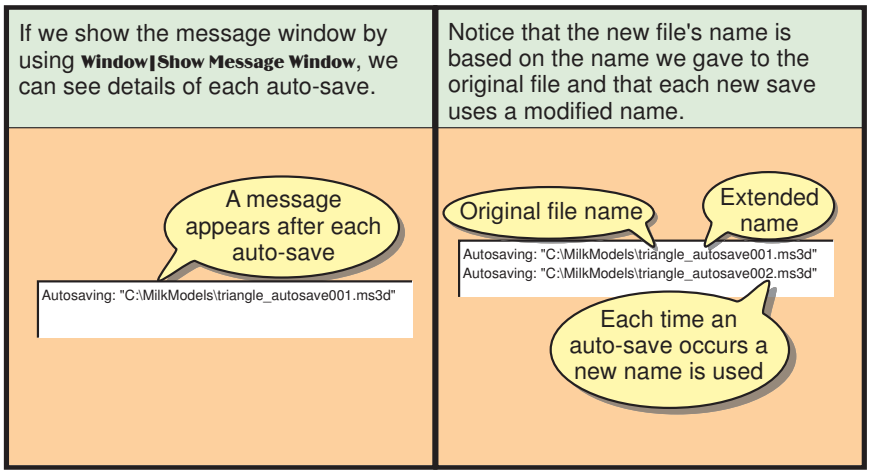
Make the *Message* window visible. In the *Model* page of the Control Panel, click on **Vertex** and add 20 new vertices at random positions.

(This task continues in the next Activity.)

With the changes specified in Activity 3.6, for every 5 new vertices created you should see a new auto-save message appear (see FIG-3.6).

FIG-3.6

Milkshape Displays a Message on each Auto-Save.



Don't use auto-saving as a substitute for normal saving.

Activity 3.7

After the 20 vertices have been added, hide the *Message* window and exit the program without resaving *Triangle.ms3d*.

Use Windows Explorer to examine the contents of the *MyMilkModels* folder. You should find each of the auto-save files as well as your original *Triangle.ms3d* file.

Loading a Model

We have already loaded an existing model using the **File|Open** menu option. However, files can also be loaded using **File|Recent Files**. This option will create a sub-menu which lists all the recently used *.ms3d* files.

This list will not include any auto-saved files unless that particular auto-save file has been opened in the recent past. Previously unloaded auto-saved files should be loaded using the normal **File|Open** option.

Activity 3.8

Load up the first of your auto-saved files (*triangle_autosave001.ms3d*).

Replace this by loading up the original *Triangle.ms3d.*

Since we have no further use for them, delete the auto-save files from your folder and reset the auto-save option so that a save occurs after every 50 operations.

Merging Models

Only one model file can be open at any time, but other saved models can be incorporated in the current project using **File|Merge**.

Activity 3.9

Load the file *ABC.ms3d.*

Use **File|Merge** to add the model stored in the file *Platform.ms3d*.

Save the model as *Underlined.ms3d*.

Exporting a Model

If we are to make use of our model in another application, then it needs to be exported. Exporting a model simply means saving it to a file in a format that can be understood by the other application.

One of the main strengths of Milkshape is that it can export models in so many different formats. For example, we could save the model for use in the games Half-Life, Quake III or The Sims2. We can also export the model for use in other modelling packages such as Lightwave, 3D Studio, or SoftImage XSI. The stages required to export a model in DirectX format are shown in FIG-3.7.

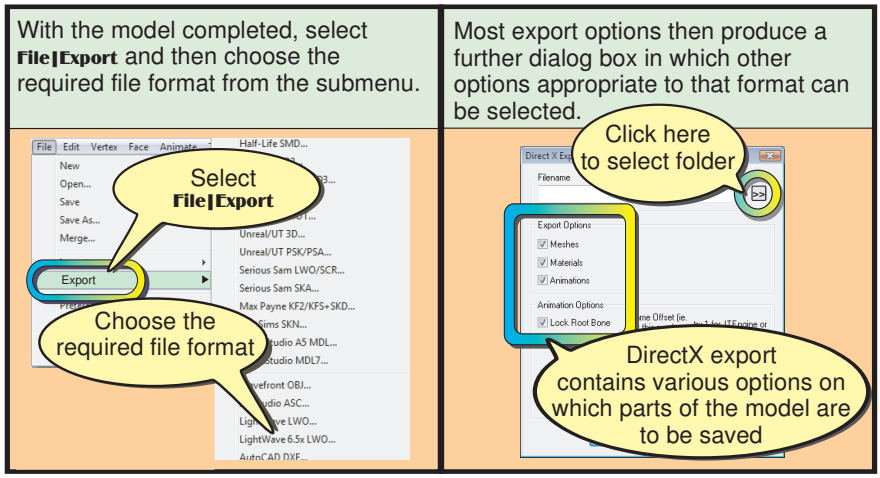
Activity 3.10

Export the model you created in the last Activity.

Use the sub menu option **DirectX8.0 File** and name the file to be saved *UnderlinedText.X ,* storing it in your *MyMilkModels* folder. (Leave all export options checked).

FIG-3.7

Exporting a Model



Importing A Model

It may well be that you'll come across existing models stored in other formats (there are thousands available on the Internet) and these can be imported and edited within Milkshape by using the **File|Import** option.

All that is necessary is to specify the format of the file being imported from the sub-menu. Once imported, the model can be modified and saved in Milkshape format or exported in some new format.

We'll have more to say about importing and exporting in later chapters.

Summary

- The position of the mouse pointer in 3D space is displayed at the bottom left corner of the Milkshape window.
- When in the *Front* viewport the mouse can be moved in x and y directions only.
- When in the *Left* viewport, the mouse can be moved in y and z directions only.
- When in the *Top* viewport, the mouse can be moved in x and z directions only.
- To create a vertex:

  Click on **Vertex** in the *Model* page of the Control Panel.
  Move the mouse pointer to the appropriate orthogonal viewport.
  Move the mouse pointer to the location at which the vertex is to be created.
  Click the left mouse button.

- To create an edge:

  Make sure at least three vertices have already been created.
  Click on **Face** in the *Model* page of the Control Panel.
  Select an existing vertex by
  Moving the mouse over the vertex.

Clicking the left mouse button.
Moving in a counterclockwise direction, select another vertex.

- To create a face:

  Make sure at least three vertices have already been created.
  Create an edge between two vertices.
  Click on a third vertex.

- To select a vertex:

  Click on the required vertex.

- To select several vertices:

  Click on the first vertex.
  Hold down the *Shift* key while clicking on the other vertices.
  OR
  Drag a bounding box over the required vertices.

- To create a face (second method):

  Select all three existing vertices.
  Choose **Face|Create Face**.

- Make a backface visible by checking the **Draw Backfaces** option in the pop-up menu of the appropriate viewport (normally the 3D viewport).

- Saved Milkshape files have the extension *.ms3d*.

- To activate automatic file saving:

  Make sure the file has been named by saving it manually.
  Select **File|Preferences...**
  In the *Misc* page of the *Preference* dialog box enter the number of changes between each save in the *Auto Save* field.
  (Each file created by the auto save has a unique name.)
  (A message is displayed in the *Message* window each time the file is saved.)

- Recently opened files can be reloaded using **File|Recent Files**.

- One or more existing models can be added to the current model by using **File|Merge**.

- Milkshape can create models that can be used in various games and other modelling packages. To do this the model must be exported in the appropriate file formats using **File|Export**.

- Models stored in formats other than Milkshape can be imported using **File|Import**.

Basic Mesh Editing

Moving Vertices

More About Selecting Vertices

Switch on the **Wireframe Overlay** option from the 3D viewport's pop-up menu.

When dealing with complex models where the required vertex can be difficult to isolate, it is possible to select the vertex from the 3D viewport where your viewpoint can be adjusted to give easier access. To select a vertex from within the 3D viewport, first switch on the **Wireframe Overlay** and then press the *Alt* key while the required vertex is being clicked. To select multiple vertices from within the 3D viewport, use *Alt* + *Shift* while clicking on each vertex or hold down *Alt* while dragging a bounding box around the required vertices.

Using **Edit|Select All** from the main menu selects every component within a model. This option can be used at any time - even when the **Select** button on the *Model* page is not pressed.

You may find on occasion that it is not possible to select a vertex from one viewport while that same vertex can be selected in another viewport. For example, although we can select all of the vertices from our triangle model in the *Front* viewport, it's impossible to select any in the *Top* viewport. This problem arises because of the *Ignore Backfaces* check box in the *Selection Options* panel. When this option is checked, vertices belonging to polygons which are facing away from the viewpoint, cannot be selected. Deselecting the checkbox should solve the problem.

Deselecting a Vertex

To deselect all currently selected vertices, just mouse click in any unoccupied area of a viewport. When a group of vertices have been selected and you want to deselect only one of these vertices, hold down the *Shift* key and right click the vertex to be deselected.

In the 3D viewport, use *Alt* and a left or right mouse click in an empty space to deselect all vertices. To deselect a specific vertex in that viewport, press *Alt* + *Shift* and right click on the vertex. Deselecting everything can also be achieved using the menu bar's **Edit|Select None**.

Activity 3.11

Load your triangle model (*Triangle.ms3d*) and perform the following actions:
Select and deselect each of the vertices individually in the *Front* viewport.
Select all three vertices together from within the 3D viewport.
Deselect all vertices using **Edit|Select None**.

Make sure that the *Ignore Backfaces* box is checked then try selecting a vertex of your triangle from the *Top* viewport. *(You should be unable to select the vertex.)*

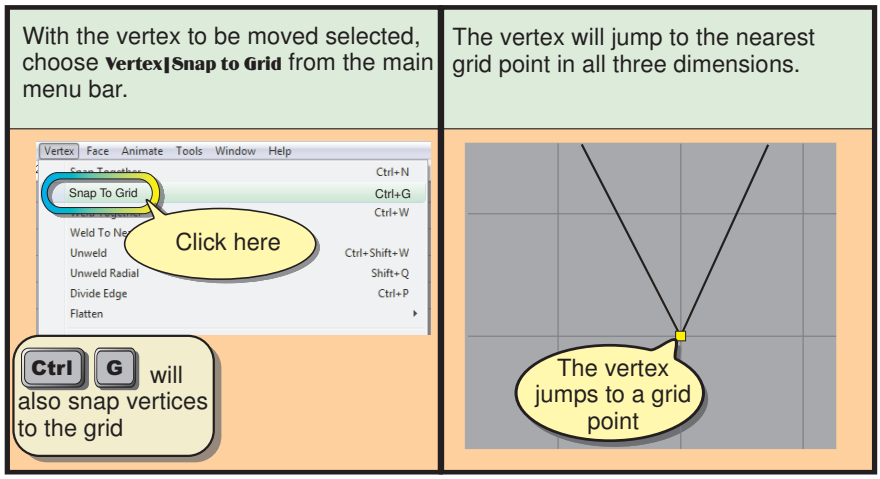
Uncheck *Ignore Backfaces* and attempt to select the same vertex again in the *Top* viewport. *(This time, it should be selected successfully.)*

Snapping Vertices to the Grid

When we zoom in on the three points that have become the vertices of our triangle, we'll see that, despite our best efforts, they are not exactly on the intersections of the grid. However, it is possible to force the points to move onto those intersections using the menu option **Vertex|Snap to Grid** or the **Ctrl+G** shortcut (see FIG-3.8).

FIG-3.8

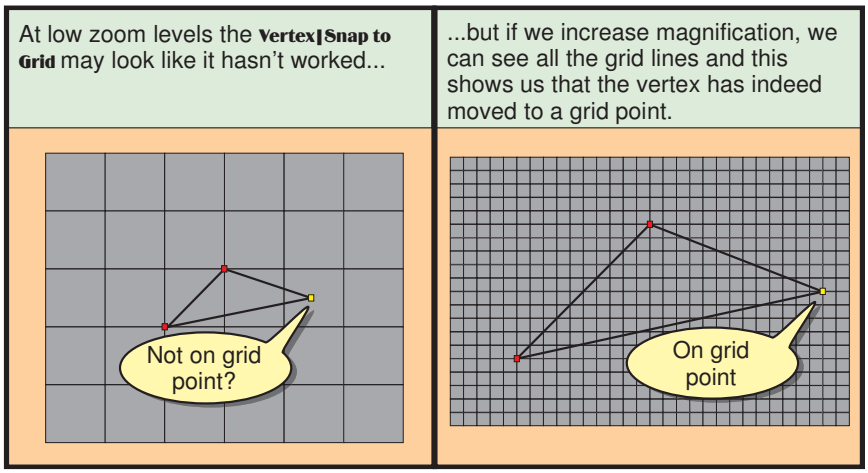
Snapping Points to the Grid



One thing to watch out for is that at zoom levels of less than 10 the viewport does not always display every grid line. For example, at a zoom level of four, only every 20th grid line is visible, even when the grid gap is set to 1 unit. At these settings you can get the impression that the vertex has not jumped to a grid point when you snap to grid, but in fact it has simply jumped to a grid point which is not visible - just increase your zoom level and you'll see that the snap operation has, in fact, worked (see FIG-3.9).

FIG-3.9

Snap to Grid may Jump to Invisible Grid Points



We can even get a group of vertices to jump to their nearest grid points in a single operation; just select the group of points and click the **Vertex|Snap to Grid** option.

Activity 3.12

Using your *Triangle* model, set all orthogonal views to a magnification of 30.

By using the **Vertex|Snap to Grid** option, ensure that the three vertices of your triangle model are exactly at the points (3,3,0), (-3,2,0) and (0,-3,0).

Freehand Movement

Using **Snap to Grid** limits movement of a vertex to the nearest grid point. However, if we want total control over vertex movement, we can select the vertex and then use the **Move** button on the *Model* page of the Control Panel. This allows us to drag the currently selected vertex to any position you wish using the mouse. After clicking the **Move** button, all we have to do is make sure we drag within the appropriate viewport for the direction the vertex is to be moved (use the *Front* viewport for x and y movement; the *Left* viewport for y and z movement; and the *Top* viewport for x and z movement).

With freehand dragging, it's all too easy to accidentally move a vertex in an unintended direction. For example, if we drag a vertex in the *Front* viewport intending to move it only in the y direction, it's likely that we'll also end up moving it (at least a little) in the x direction. We can stop this happening by using the buttons in the *Move Options* panel (which appears automatically when the **Move** button is pressed).

The three buttons labelled **X**, **Y** and **Z** determine which directions an object (in this case, a vertex) may be moved. Initially, all three buttons are pressed, so movement can be in any direction, but by "unpressing" a button we prohibit movement in that direction. For example, if we unpress the **X** button, and then drag a vertex in the *Front* window, we'll see that the vertex can only be moved in the y direction.

FIG-3.10 shows the steps involved in moving the point (0,-3,0) in our triangle to the new position (1,-5,-1) and then (3,3,0) to (4,3,0).

FIG-3.10

Moving a Vertex Freehand

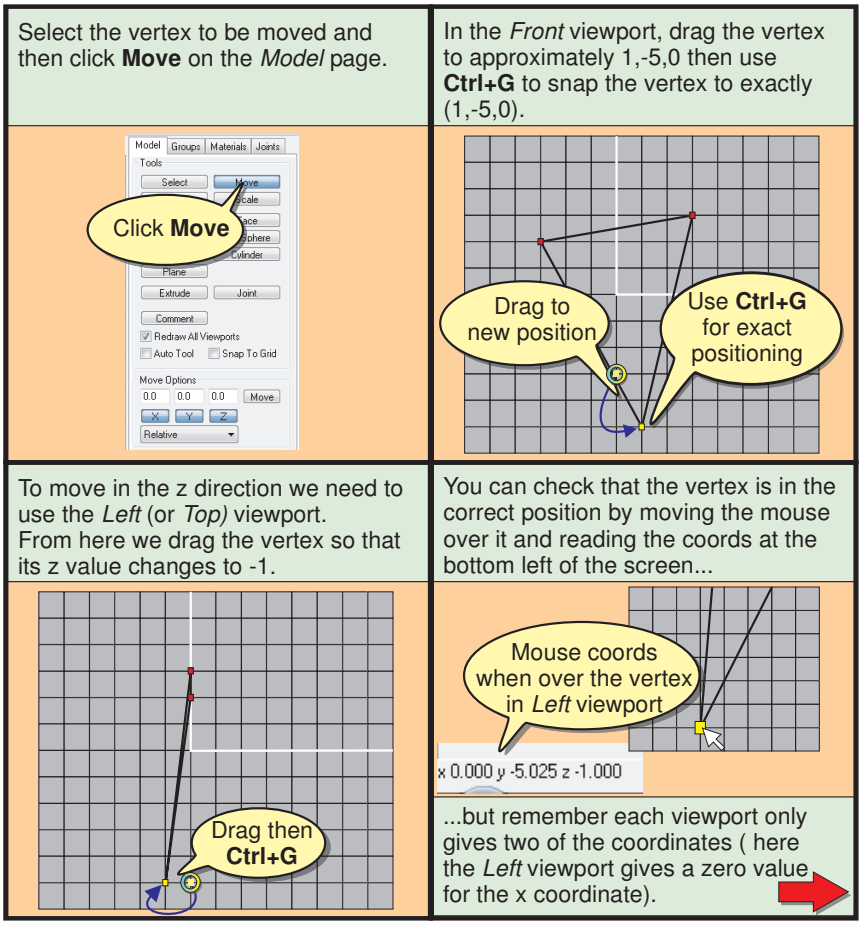
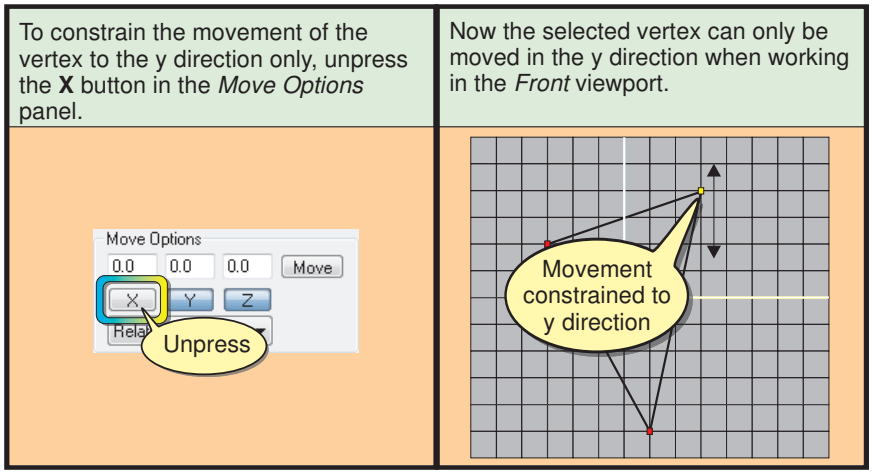


FIG-3.10
(continued)

Moving a Vertex Freehand



Activity 3.13

Make sure your *Triangle* model is loaded and move the vertices as follows:

Old position	*New position*
(3,3,0)	(4,3,3)
(-3,2,0)	(-2,4,-2)
(0,-3,0)	(1,-5,-1)

Save the new version of the model.

Absolute Positioning

If we know the exact coordinates at which the vertices of a face are to be placed, perhaps the easiest approach is to use absolute positioning when moving the vertices.

To position a single vertex, we start by selecting it then entering its new coordinates in the X, Y, Z boxes in the *Move Options* panel. Next we choose *Absolute* from the drop-down list and press the **Move** button. FIG-3.11 shows the steps involved in the operation.

FIG-3.11

Using Absolute Positioning

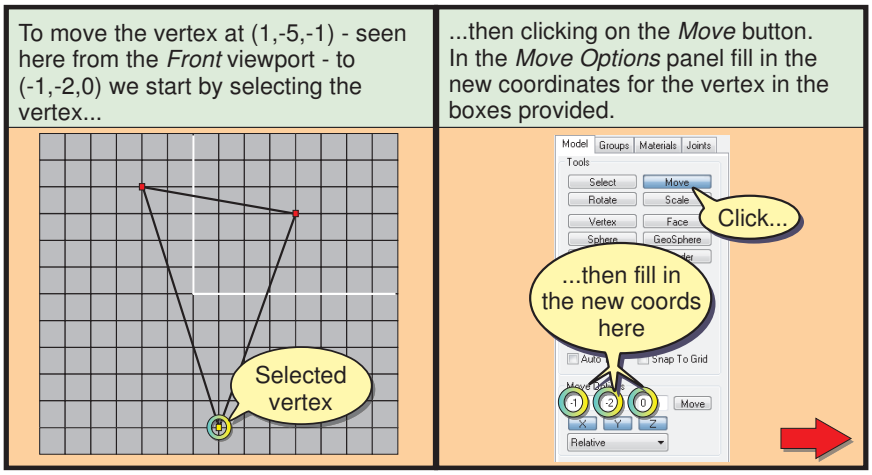
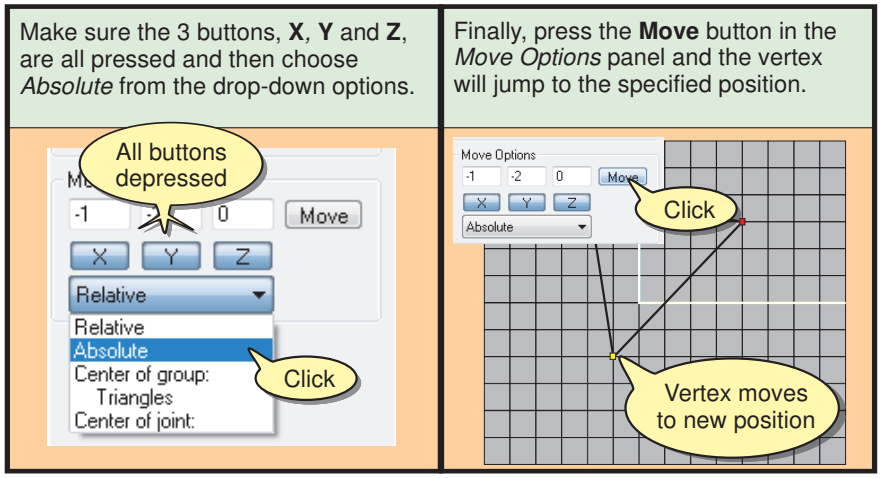


FIG-3.11
(continued)

Using Absolute Positioning



Activity 3.14

Select the vertex at (1,-5,-1) in your triangle and move it to (-1,-2,0) using absolute positioning as shown above.

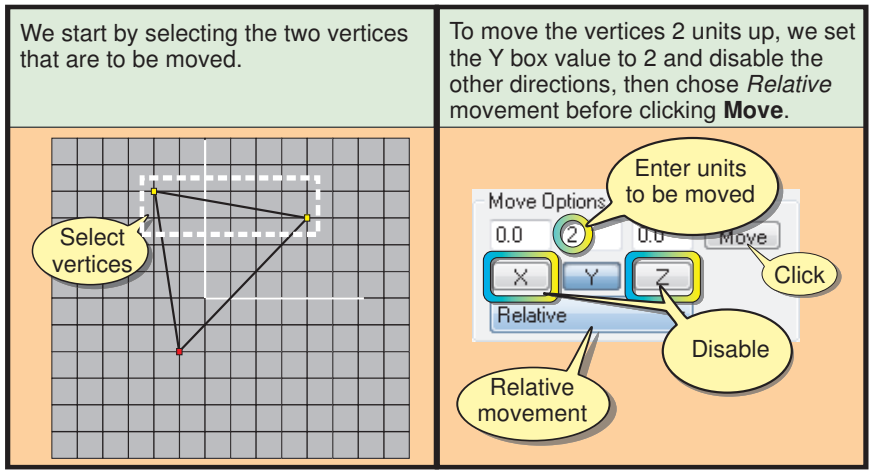
Resave the model.

Relative Positioning

We can move a vertex a given distance from its current position by using the *Relative* option in the drop-down list of the *Move Options* panel. In FIG-3.12 we see how we can use this option to move two vertices 2 units in the y direction.

FIG-3.12

Relative Movement



Activity 3.15

Move the top two vertices of your triangle (as seen from the *Front* viewport) 2 units up the y-axis, then move the lowest vertex -2 units along the x-axis.

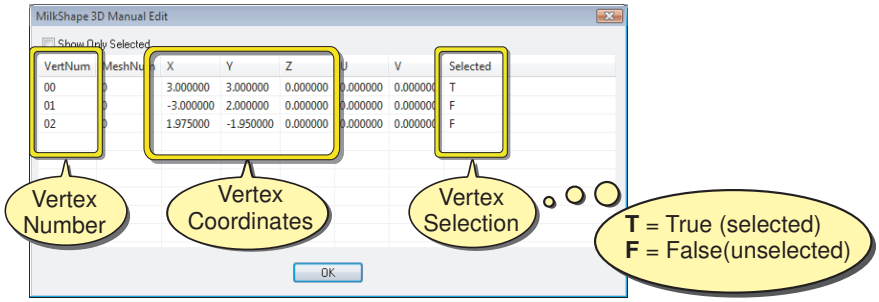
Determine the new coordinates of each vertex and resave your model.

A Final Method of Selecting and Moving Vertices

By using the **Vertex|Manual Edit** option we can obtain details of every vertex in our model. This option creates a table giving a number to each vertex (*VertNum* column), its absolute coordinates (*X*, *Y* and *Z* columns) and an indication of whether or not it is currently selected (*Selected* column) (see FIG-3.13).

FIG-3.13

The Manual Edit Vertex Table

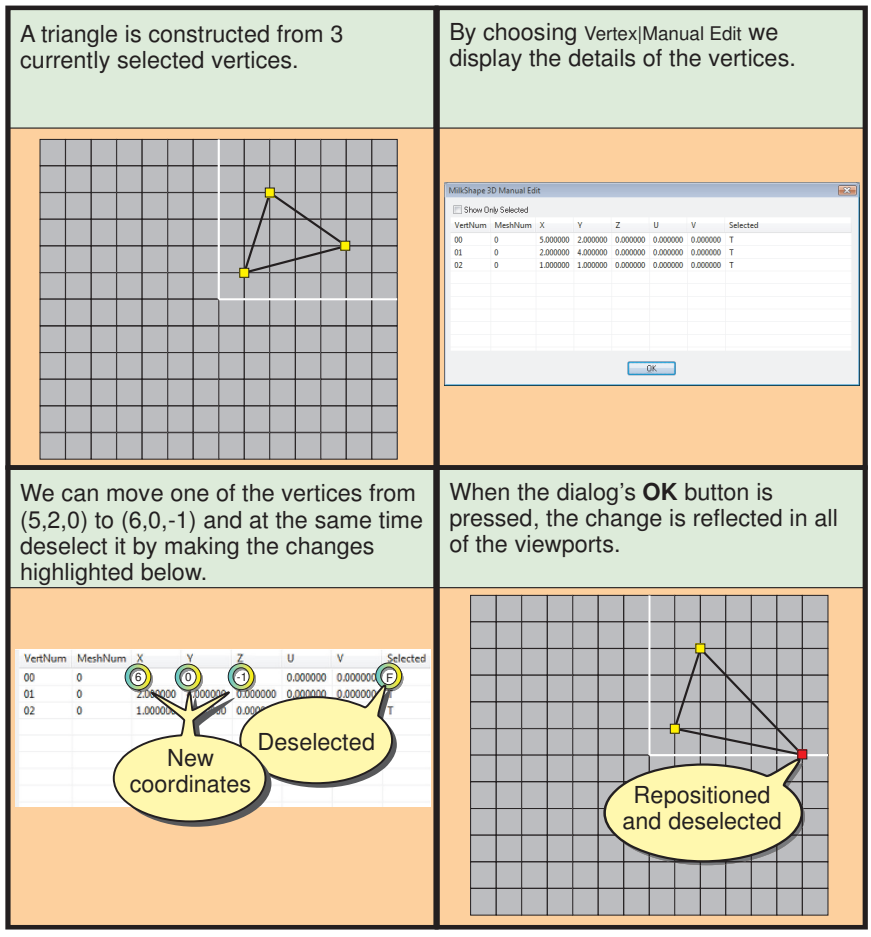


The table also gives the mesh number to which a vertex belongs - this is useful when dealing with more complex models containing several meshes - and u,v mapping details which are used in texturing.

Initially details of every vertex in the model are displayed in the table, but by checking *Show Only Selected* at the top of the dialog box, only those vertices which are currently selected will be listed. Much of the contents of the table can be edited as shown in FIG-3.14.

FIG-3.14

Modifying the Contents of the Manual Edit Table



Activity 3.16

Use the **Vertex|Manual Edit** option to place the vertices of your triangle at the following positions:

Vertex 00	(0,-3,0)
Vertex 01	(5,1,3)
Vertex 02	(-2,4,-1)

Modify the *Selected* column of the table so that only vertex 02 is selected.

Resave your model.

Moving Edges

Selecting an Edge

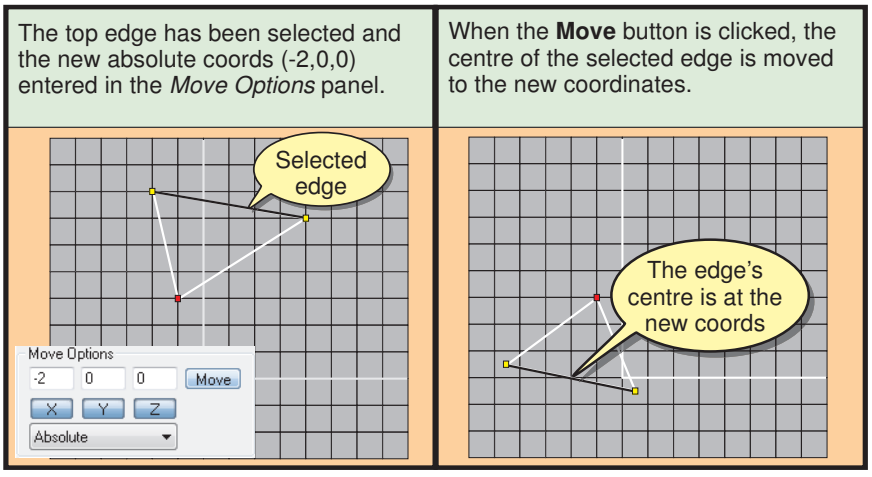
To select an edge you only need to select the two vertices at either end of the edge. There is no visual indication that the edge has been selected, only the two vertices will have changed to the *selected* colour.

Moving an Edge

Freehand and relative movement of an edge are in effect the same thing as moving the two vertices that are connected by the edge, but when you use absolute movement on an edge, it is the middle of the edge which is moved to the specified position (see FIG-3.15).

FIG-3.15

Moving an Edge



Activity 3.17

Move the centre of the top edge of your triangle (as seen from the *Front* viewport) to the position (-3,0,2).

Resave your model.

Moving Faces

Selecting a Face

Selecting a face, like any other item within our model, requires that the **Select** button on the *Model* page of the Control Panel is pressed. After that, there are two main ways to select a face.

The first of these is to click the **Face** button in the *Select Options* panel and then click (or drag a small bounding box) anywhere within the face we wish to select.

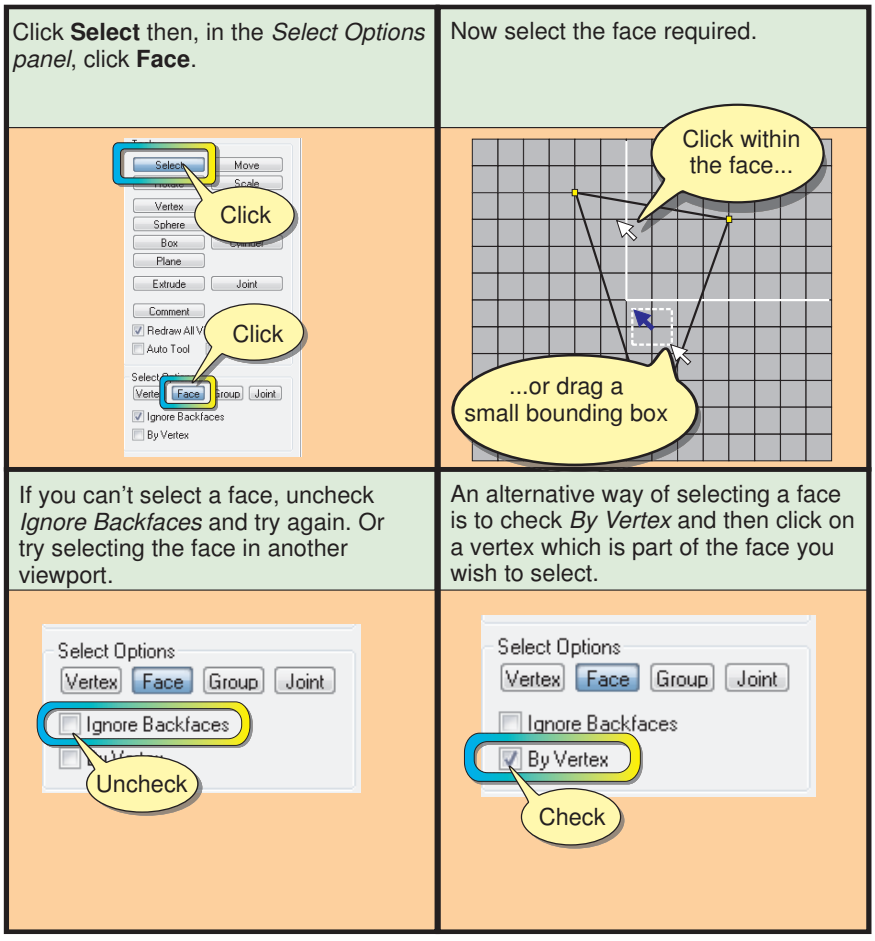
If you have problems selecting a particular triangle it may be because it is facing away from you; that is, its backface is towards you. A triangle with its backface towards you cannot be selected unless you have unchecked in *Ignore Backfaces* option in the *Select Options* panel.

An alternative way of selecting a face is to check the *By Vertex* box (again, in the *Select Options* panel) then click on a vertex (or selection of vertices). All faces that share the clicked vertex will then be selected.

All these face selection options are shown in FIG-3.16.

FIG-3.16

Selecting a Face



Sometimes Milkshape is a bit particular about just where in a face you click, so click in another location within the face if you're having problems.

Activity 3.18

Load the model *TwoTriangles.ms3d*.

Click **Select** and **Face** as explained above. Make sure *Ignore Backfaces* is checked and *By Vertex* is unchecked.

In the *Front* viewport, try to select each of the two faces in turn by clicking the mouse within the faces. Now attempt to select each face by dragging within each face. Can both faces be individually selected using these methods?

Can both faces be selected from the *Top* viewport?

Uncheck *Ignore Backfaces* and try selecting the faces from the *Top* viewport again. Does it work this time?

What happens when you drag a single bounding box through parts of both faces?

Check *By Vertex* and try selecting a face by clicking on the left-most vertex in the *Front* viewport.

What face(s) are selected when you click on the vertex at (0,-3,0)?

Uncheck *By Vertex*.

Moving a Face

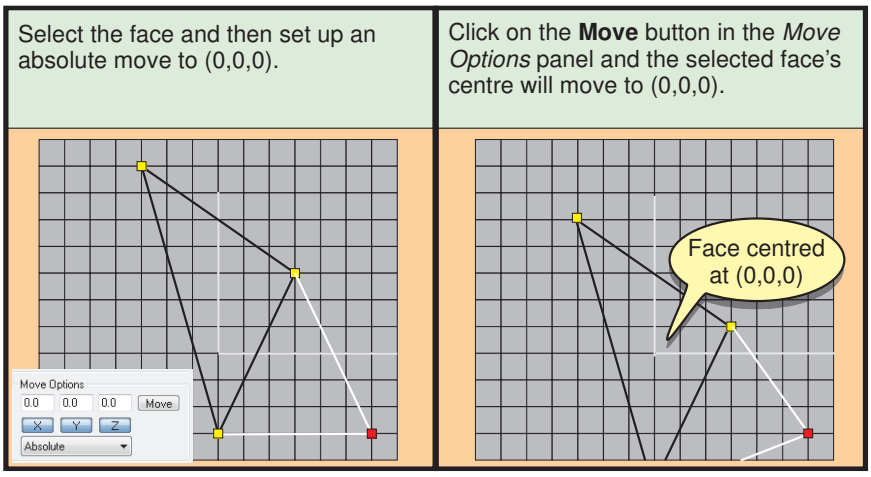
Once selected, a face can be moved using any of the methods we employed to move a vertex; we can drag freehand, or produce a relative move by entering values in the X, Y and Z boxes of the *Move Options* panel.

However, for absolute positioning, the question arises: which part of the face will move to the specified point? As we saw earlier, when an edge is selected, its centre moves to the specified position. The same is true for a face; its centre is moved to the specified position when absolute coordinates are given.

FIG-3.17 shows the result of moving one of the triangles in the *TwoTriangles* model to the origin (0,0,0).

FIG-3.17

Centring a Face on a Point



Activity 3.19

Using *TwoTriangles.ms3d*, select the left-most triangle in the *Front* viewport and drag it to a new position 1 unit to the right.
With the same triangle selected, enter 2, 1, and 3 in the edit boxes of the *Move Options* panel and, using relative positioning, click *Move* to move the triangle.
Use absolute positioning to centre the same triangle on the origin.

Another way of moving or even reshaping faces is to specify new positions for the individual vertices from which the face is constructed. This is done by selecting **Vertex|Manual Edit** to display details of the vertices and then entering the new coordinates at the appropriate positions.

Scaling Edges and Faces

Basic Principles

Scaling simply means resizing. However, there's a little more to scaling than we might think, so we'll discuss the idea in general before going on to look at how scaling is handled in Milkshape. Imagine we have a single line (something we can't have in Milkshape) and we wish to double its length (see FIG-3.17).

FIG-3.17

Scaling a Horizontal Line

As you can see, this doesn't present a great problem. The original line has been scaled by a factor of 2 (it's length has been doubled).

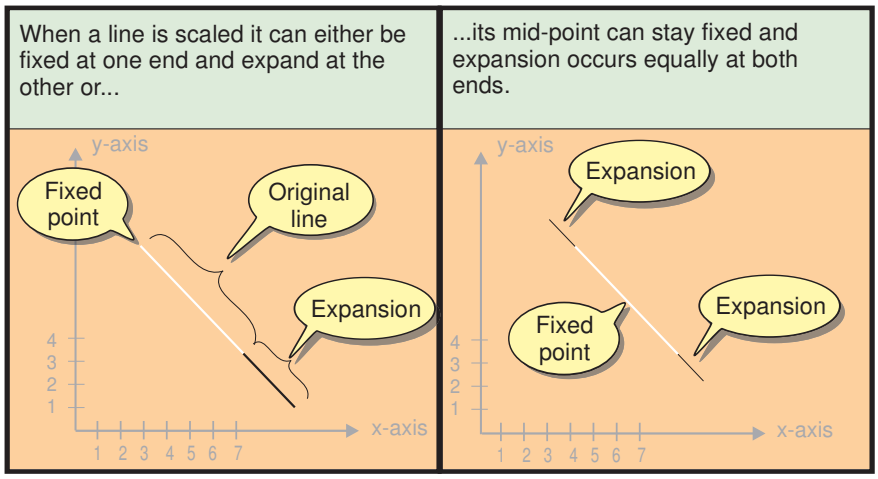
Activity 3.20

A line is initially 5 units in length. What would be the final length of the line which was resized using a scale factor of:
a) 0.5 b) 1 c) 1.5

But how does scaling affect the position of a line in 2D space? Is one end to remain in its original position while the other end "grows"? Or should the middle of the line stay fixed while both ends "grow"? FIG-3.18 shows how both options work.

FIG-3.18

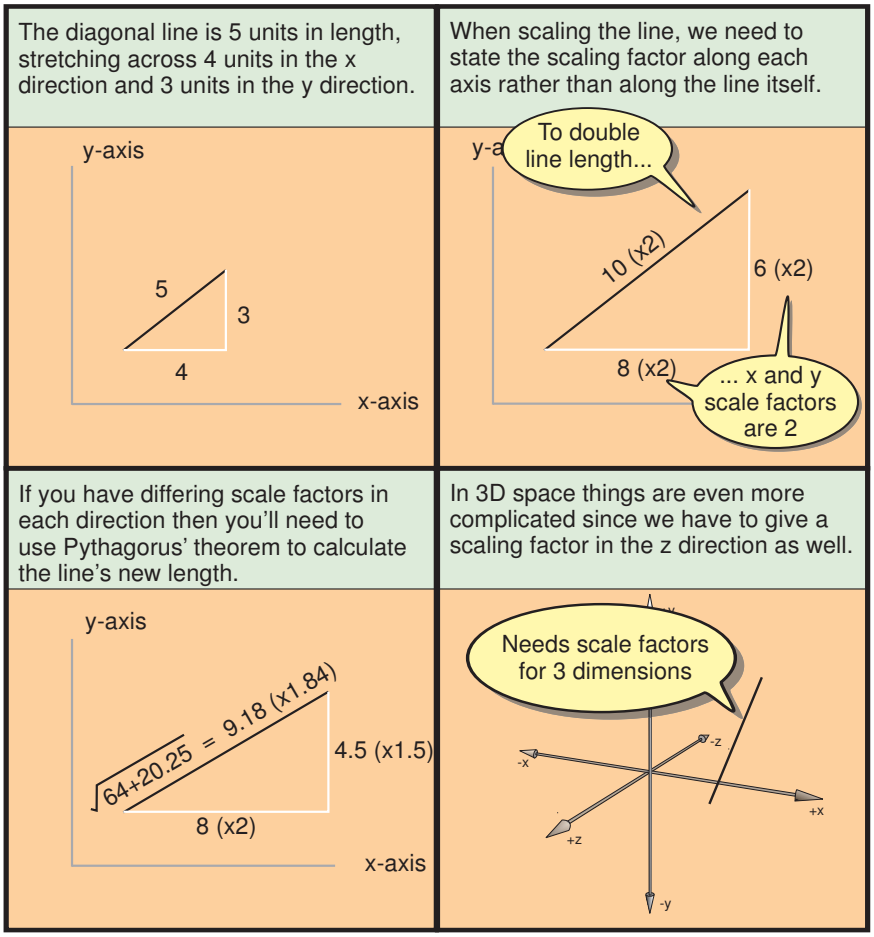
Dealing with Scaling



Another problem is the manner in which the scaling factors are specified in most modelling packages. Rather than just state the scaling factor for the line, we need to state how much the line will grow in the x and y directions. For example, if we want a diagonal line to double in length, the scaling factor must be given as 2 in both the x and y directions. FIG-3.19 shows the steps involved.

FIG-3.19

Scaling Using x and y Scaling Factors

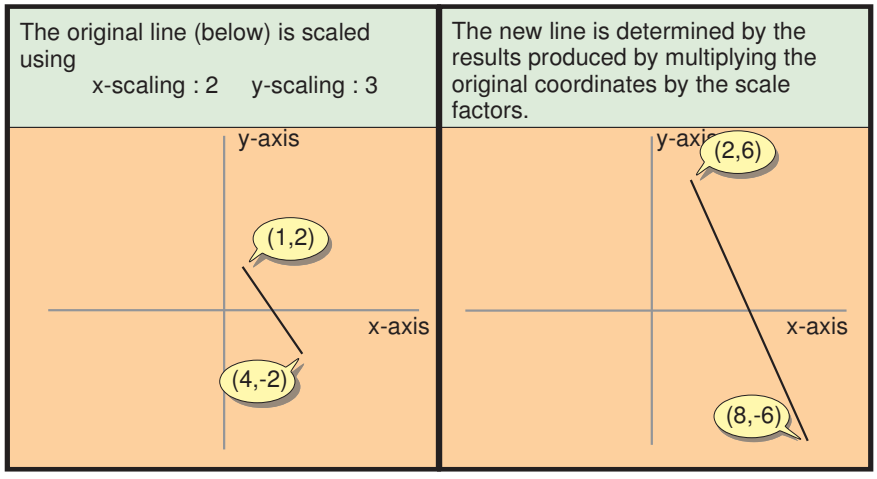


Having differing scale factors will change the angle at which the line lies.

Another method of handling scaling is to scale the coordinate values of the ends of the line. For example if a 2D line starts at (1,2) and ends at (5,-3) and it is scaled in the x direction by 2 and the y direction by 3, then the scaled line would start at (2,6) and end at (10,-9) (see FIG-3.20).

FIG-3.20

Scaling End Coordinates



Scaling Controls in Milkshape

In Milkshape we can't create or scale lines but we can scale both edges and faces.

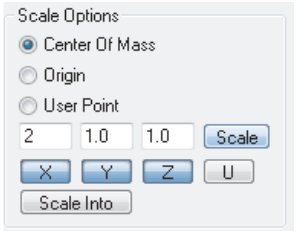
Scaling an edge is a little different from scaling a line; edges form part of a face and scaling one edge will affect one or both of the other edges in that face as well as the face itself.

When a face is scaled, the scaling factors given affect the length of the three edges. The fixed point on the face can be the mid-point of the face or a specified point (such as one of the vertices).

In Milkshape we start by selecting the edge or face to be scaled and then pressing the **Scale** button. Scaling details are then entered in the *Scale Options* panel (see FIG-3.21).

FIG-3.21

Scale Options



The options in this panel allow us to choose the point that remains fixed before and after scaling. These options are:

- ***Center of mass*** - the centre of the edge or face. This will be the option selected most of the time.
- ***Origin*** - by choosing this option, coordinates scaling is used to calculate the new vertex positions.
- ***User Point*** - a point defined by the user. The user must click on the point to be fixed just before completing the scaling operation.

Unless freehand scaling is being performed, scale factors for the x, y and z directions should be given. A value of 1.0 means no change for that direction.

Scaling in any direction can be disabled by unpressing the appropriate **X**, **Y** or **Z** button.

The **U** button allows uniform scaling in all three dimensions when in freehand mode.

The **Scale Into** button is used to squeeze or expand the selected faces into a specific volume.

Freehand Scaling

Freehand scaling is a simple operation but does not give us accurate control over the scaling factors.

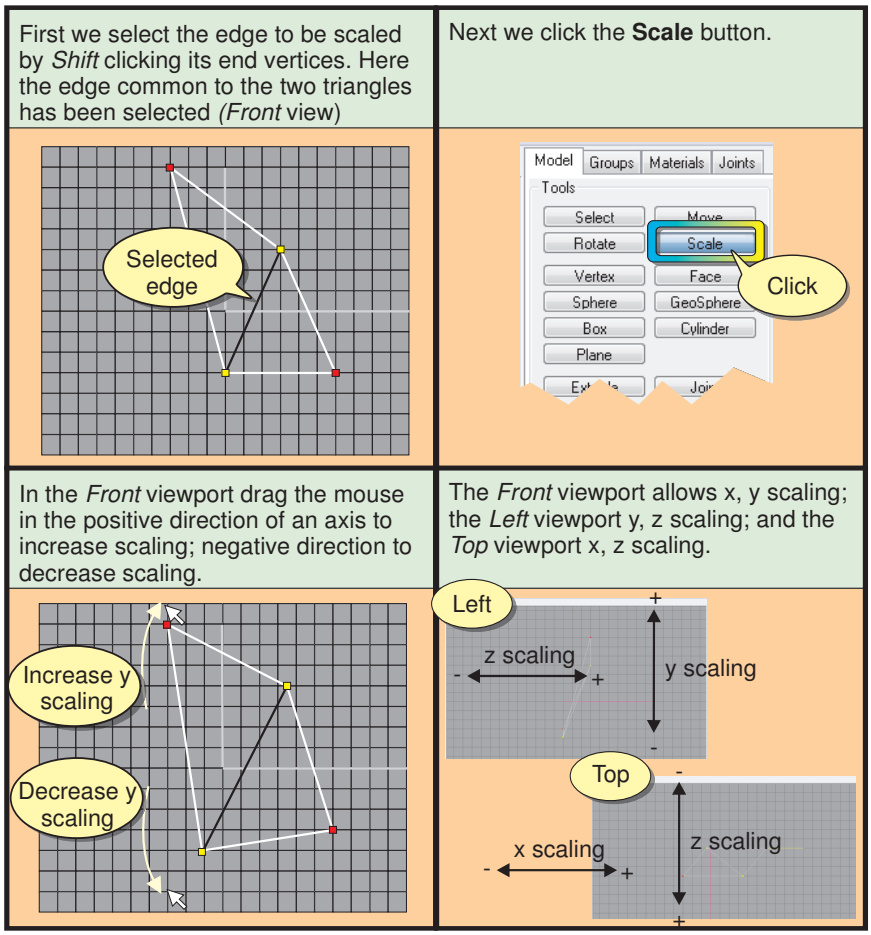
Selecting and dragging an edge or a face in the *Front* viewport allows us to scale in the x and y directions while the *Left* viewport allows us to scale in the y and z directions and the *Top* viewport offers x and z scaling.

FIG-3.22 shows the effects of scaling an edge using freehand scaling.

FIG-3.22

Freehand Scaling of an Edge

Unlike this diagram, Milkshape does not highlight the selected edge.



Activity 3.21

Load *TwoTriangles.ms3d* and select the common edge between the two triangles.

Click the **Scale** button and choose the *Center of Mass* option. Drag the mouse within each viewport, observing the effect of the freehand scaling.

Use **Edit|Undo** to return the edge to its original size.

Click on the *Origin* option and see how this changes the scaling (it's quite subtle - so look carefully).

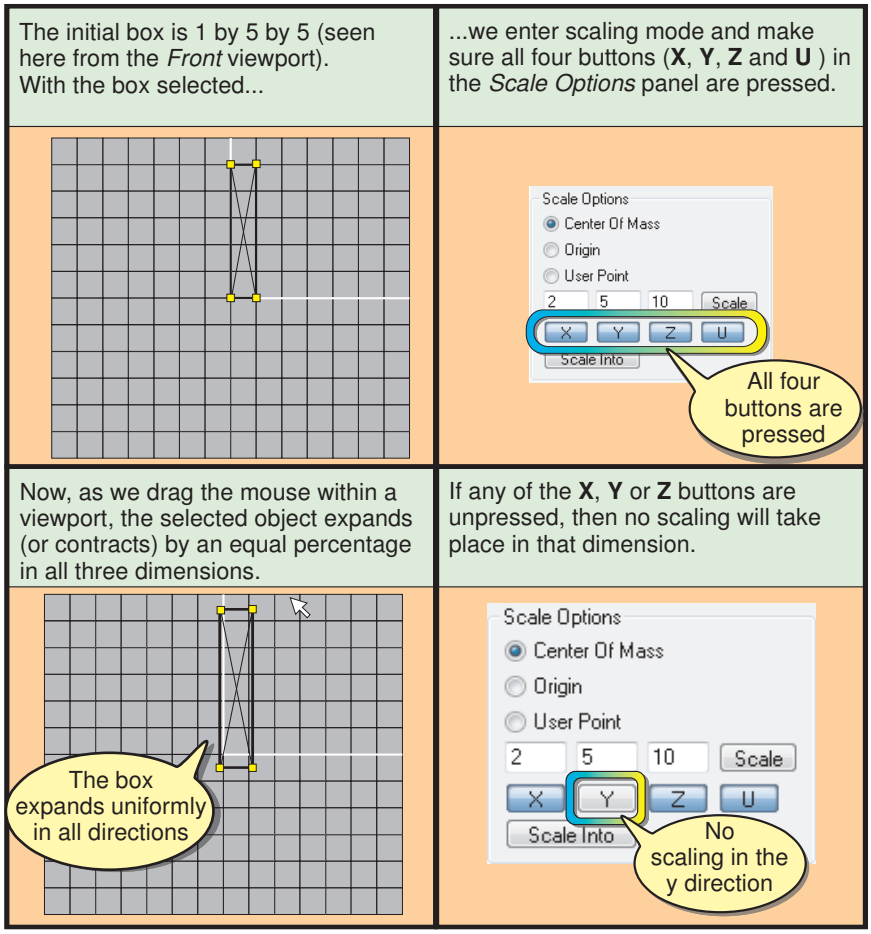
Finally, select the *User Point* option. Now move the mouse pointer over a part of the edge being scaled (one end will show the most obvious results) and click the left mouse button before dragging to scale the edge. How has this last option affected the scaling?

Do not save the changes you have made to the model.

If we need our selected object to scale equally in different dimensions, then we can use the **U** button which creates uniform expansion in the dimensions currently enabled by the **X**, **Y** and **Z** buttons. FIG-3.23 shows an example of how the **U** button can be used when scaling a box.

FIG-3.23

Uniform Freehand Scaling



Activity 3.22

Load the model *Cylinder.ms3d* and select all the model's faces.

Choose the **Scale** option with scaling about the centre of mass. Make sure all four buttons, **X**, **Y**, **Z** and **U,** in the *Scale Options* panel are pressed.

Drag within the *Front* viewport to scale the cylinder. (Notice that it expands by an equal percentage in all three dimensions.)

How does scaling differ if the mouse is dragged within another orthogonal viewport?

Unpress the **Y** button in the *Scale Options* panel.

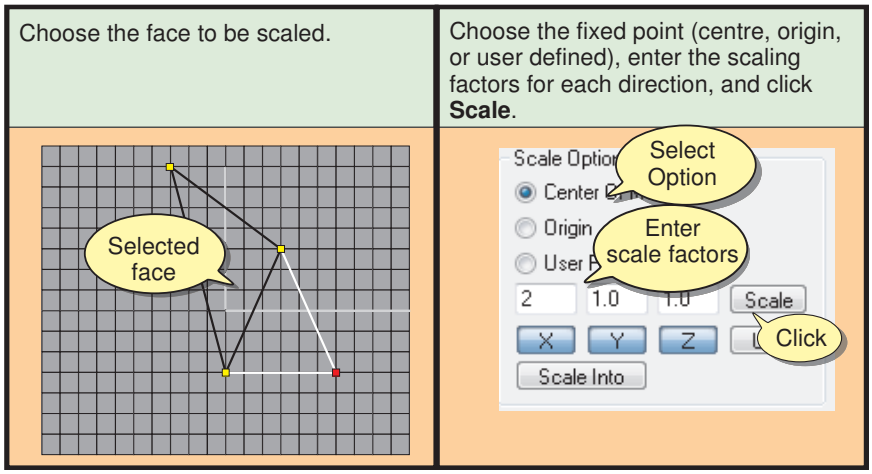
Drag the mouse in the *Front* viewport. How is scaling in the y direction affected?

Fixed Scaling

For more exact scaling, we need to enter scaling factors for each direction and allow the software to do the scaling for us. FIG-3.24 shows the steps in scaling the top triangle in *TwoTriangles.ms3d*.

FIG-3.24

Specifying Scaling Factors



Activity 3.23

Reload the *TwoTriangles.ms3d* model.

Scale the same triangle as shown in FIG-3.24 using *Center of Mass* as the fixed point and the following scaling factors x:1.5; y:1.2; z:0.5.

Undo the scaling then choose *User Point* for the fixed point.

Click on the top vertex of the selected face before clicking on the **Scale** button again.

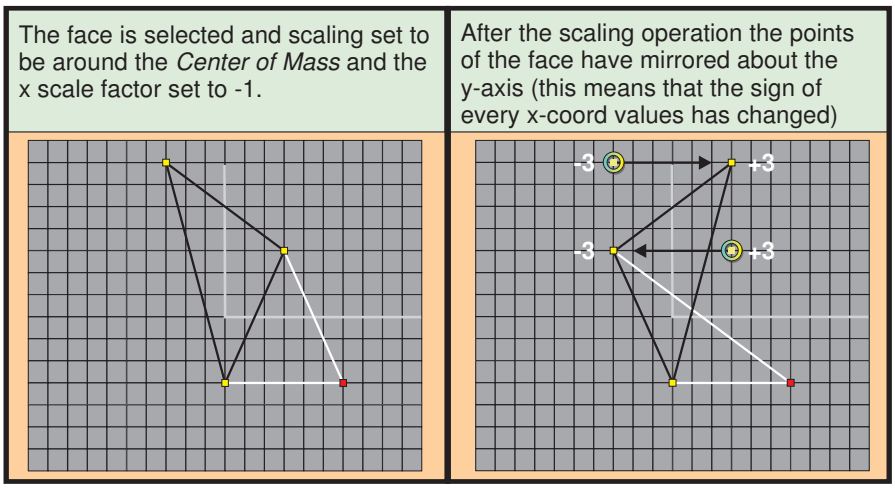
How do the two scalings you have performed differ?

Undo the final scaling.

If you use a scale factor of -1 in a particular direction, then you'll create a mirror image of the selected face about one of the axial planes. For example, in FIG-3.25 the top triangle is shown before and after a scaling of -1 in the *x* direction which creates a reflection of the triangle about the YZ plane.

FIG-3.25

Mirroring a Face



Activity 3.24

Choose the top-left triangle from *TwoTriangles.ms3d* and scale it, in the x direction only, using a value of -1 with scaling about the origin.

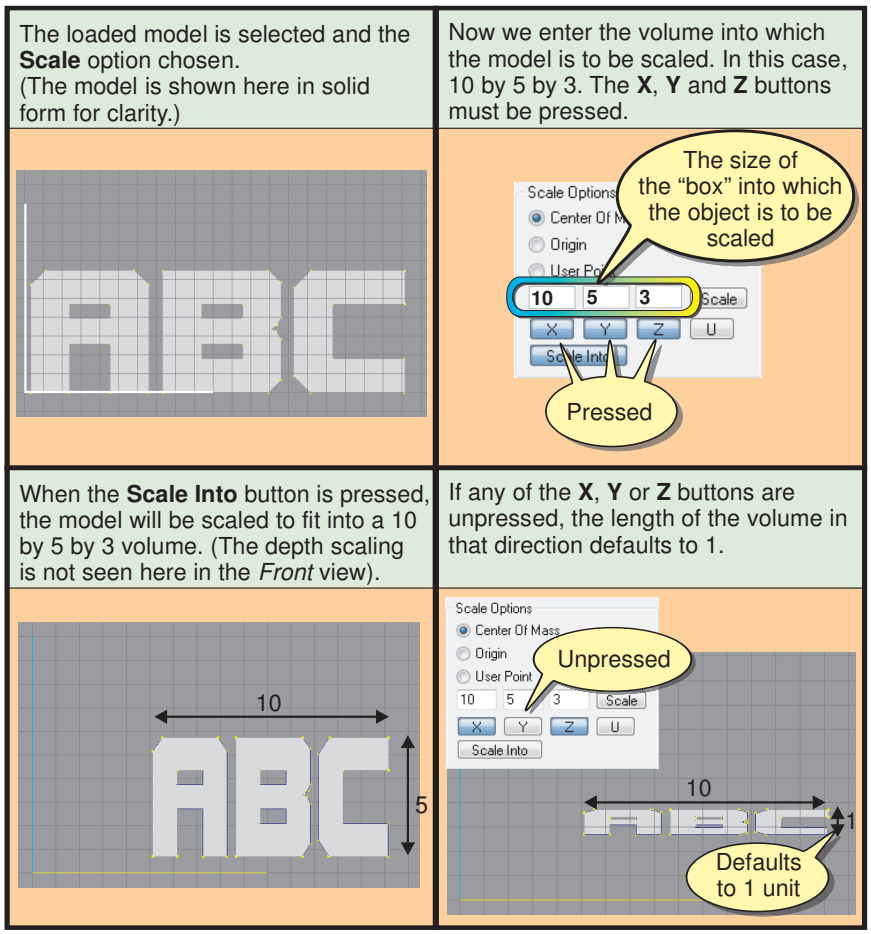
Volume Scaling

Milkshape offers one last form of scaling in which the selected object can be scaled to fit a specified volume. That is to say, it automatically expands or shrinks the object to fit into a volume whose width, height and depth have been defined.

To use this option we first select the object (anything from a single face to the complete model) and then specify the dimensions into which that object is to fit by entering these in the X, Y and Z boxes in the *Scale Options* panel, before finally pressing the **Scale Into** button. FIG-3.26 takes us through the steps required to scale the model *ABC.ms3d*.

FIG-3.26

Using the **Scale Into** Option



Activity 3.25

Start a new Milkshape project and load the *ABC.ms3d* model.

Scale the model into an 8 x 6 x 2 volume. Unpress the **Y** button in the *Scale Options* panel and click the **Scale Into** button again.

Rotating Edges and Faces

The last of the three basic mesh editing operations is rotation.

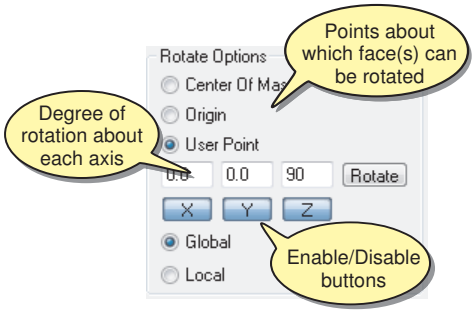
Rotation Controls in Milkshape

In Milkshape it is possible to rotate edges and faces about a point using the **Rotate** button in the *Model* page of the Control Panel. Freehand and measured rotation options are available.

The *Rotate Options* panel offers very similar controls to those for scaling (see FIG-3.27) with choices for the point about which rotation is to occur and the degree of rotation required about each axis.

FIG-3.27

Rotation Options



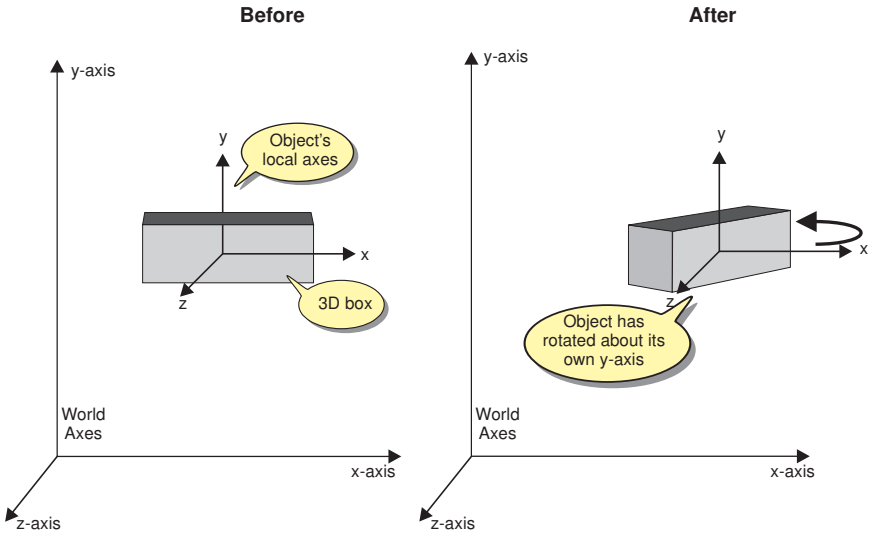
The **Local** and **Global** options are used when performing joint rotation in an animation.

The *Local* and *Global* radio buttons at the bottom of the panel do not affect the result of a rotation and can be ignored.

Rotation about the *Center of Mass* is, in effect, rotation about a set of axes whose origin is at the centre of the object being rotated. This local set of axes is always parallel to the world axes. In FIG-3.28 we see the result of rotating a box 45° about its local y-axis.

FIG-3.28

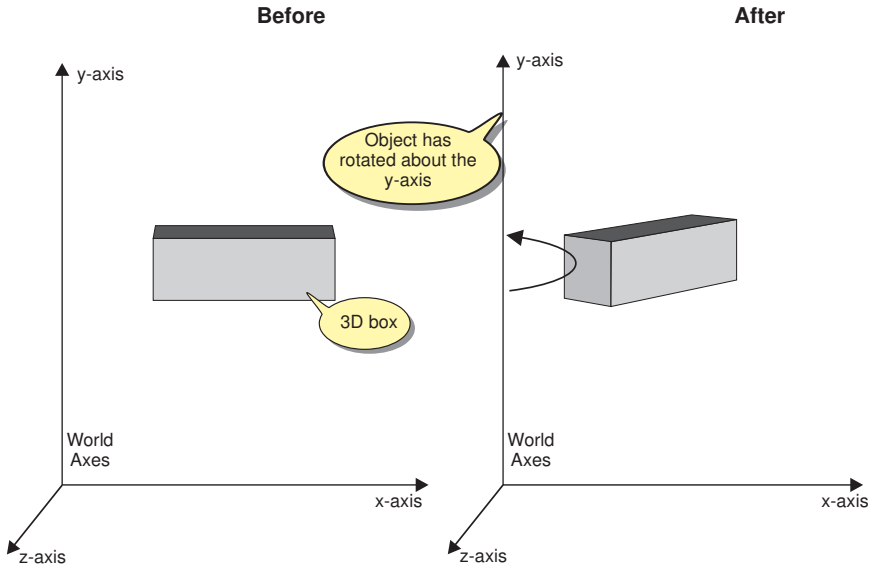
Rotation About Centre of Mass



Using the *Origin* option, on the other hand, produces a rotation about the world axes (see FIG-3.29).

FIG-3.29

Rotation About the Origin



Activity 3.26

Load the model *Box.ms3d*.

Make sure all its faces are selected.

Press **Rotate** in the *Tools* panel.

In the *Rotate Options* panel, select *Center of Mass* and enter 45 in the Y box. Ensure only the **Y** button is pressed. Press the **Rotate** button.

Press the **Rotate** button a further two times and observe how the box rotates about its own local axis.

Undo all three rotations and change the rotate option from *Center of Mass* to *Origin*.

Perform the same three 45^{o} rotations and see how this result differs from the first.

Try rotating the box about the x and then z-axis using both *Center of Mass* and *Origin* options.

From Activity 3.26 we can see that rotations are cumulative, with the object being rotated by the specified angle from its current position. In effect, this means Milkshape offers relative rotation rather than absolute rotation.

Rotations can also be performed in freehand mode. When using freehand rotation, the axis of rotation depends on the viewport in which the mouse is positioned; *Front* allows rotation about the z-axis; *Left* allows rotation about the x-axis; and *Top* allows rotation about the y-axis. Drag the mouse within the appropriate viewport to perform the freehand rotation. Also, rotation direction can be restrained by unpressing the **X**, **Y** and **Z** buttons but this is not really necessary when using freehand mode since only one direction is available in each viewport.

Activity 3.27

Reload *Box.ms3d*.

Select the object's faces and press **Rotate** in the *Tools* panel.

Make sure all three buttons (**X**, **Y** and **Z**) in the *Rotate Options* panel are pressed. Select the *Center of Mass* option.

Drag the mouse in each of the three orthogonal viewports observing how this affects the rotation of the box.

Change from *Center of Mass* to *Origin* and again drag the mouse in all three orthogonal viewports.

Rotation about a *User Point* is allowed in freehand rotation only and causes rotation to be about the point determined by left-clicking the mouse within an orthogonal viewport.

Activity 3.28

Reload *Box.ms3d*.

Select the object's faces and press **Rotate** in the *Tools* panel.

Make sure all three buttons (**X**, **Y** and **Z**) in the *Rotate Options* panel are pressed. Select the *User Point* option.

In the *Front* viewport click on the top-left corner of the box then drag the mouse.
(Notice how rotation is centred on the position clicked.)

Rotating Edges and Faces

Individual faces and edges can also be rotated.

To rotate an edge, we start by selecting the two vertices at either end of the edge using the **Select** and **Vertex** buttons in the *Tools* panel; to rotate a face, select that face using the **Select** and **Face** buttons.

The rotation itself is performed just as we did with the box, with both freehand and fixed rotation available about the centre of mass, origin or a user-defined point.

Of course, if we rotate only some of the edges or faces within a mesh, this will have a distorting effect on some of the remaining elements of that mesh.

Activity 3.29

Load *TwoTriangles.ms3d*.

Select the "top" triangle (as seen from the *Front* viewport).

Rotate it 60^{o} about the y-axis using the *Center of Mass* as the fixed point.

Summary

➺ To select an existing vertex:

Click the **Select** button in the *Tools* panel.
Click the **Vertex** button in the *Select Options* panel.
Click on the vertex to be selected ***OR*** drag the mouse to create a bounding box enclosing the vertex.

➺ To select multiple vertices, drag an enclosing rectangle over the required vertices **OR** hold down the *Shift* key while clicking on the required vertices.

➺ When *Ignore Backfaces* is checked, certain vertices may not be selectable from some viewports.

➺ To move a vertex freehand:

Select the vertex.
Click **Move** in the *Tools* panel.
Drag the vertex in the *Front* viewport to move in the x or y directions.
Drag the vertex in the *Left* viewport to move in the y or z directions.
Drag the vertex in the *Top* viewport to move in the x or z directions.

➺ To move a vertex a specific distance:

Select the vertex.
Click **Move** in the *Tools* panel.
In the *Move Options* panel:
Ensure the drop-down list setting is *Relative.*
Enter the movement distance in the x, y and z directions.
If required, raise **X**, **Y** or **Z** buttons to disable movement in a particular direction(s).
Click **Move**.

➺ To move a vertex to a specific position:

Select the vertex.
Click **Move** in the *Tools* panel.
In the *Move Options* panel:
Ensure the drop-down list setting is *Absolute.*
Enter the coordinates in the x, y and z boxes.
If required, raise **X**, **Y** or **Z** buttons to disable movement in a particular direction(s).
Click **Move**.

➺ To select a face:

In the *Tools* panel, click **Select**.
In the *Select Options* panel, click **Face**.
In a viewport, click anywhere within the required face.

➽ To move a face freehand:

Select the face.
In the *Tools* panel, click **Move**.
Drag the face in the *Front* viewport to move in the x or y directions.
Drag the face in the *Left* viewport to move in the y or z directions.
Drag the face in the *Top* viewport to move in the x or z directions.

➽ To move a face by a specific distance:

Select the face.
In the *Tools* panel, click **Move**.
In the *Move Options* panel:
Ensure the drop-down list setting is *Relative.*
Enter the movement distance in the x, y and z directions.
If required, raise **X**, **Y** or **Z** buttons to disable movement in a particular direction(s).
Click **Move**.

➽ To move a face to a specific position:

Select the face.
In the *Tools* panel, click **Move**.
In the *Move Options* panel:
Ensure the drop-down list setting is *Absolute.*
Enter the movement distance in the x, y and z directions.
If required, raise **X**, **Y** or **Z** buttons to disable movement in a particular direction(s).
Click **Move**.

➽ To scale a face freehand:

Select the face.
In the *Tools* panel, click **Scale**.
Choose the fixed point (*Center of Mass*, *Origin*, or *User Point*).
In the *Front* viewport:
Drag the mouse up to increase height of the face.
Drag the mouse down to decrease height of the face.
Drag the mouse right to increase the width of the face.
Drag the mouse left to decrease the width of the face.
In the *Left* viewport:
Drag the mouse up to increase height of the face.
Drag the mouse down to decrease height of the face.
Drag the mouse right to increase the depth of the face.
Drag the mouse left to decrease the depth of the face.
In the *Top* viewport:
Drag the mouse up to increase depth of the face.
Drag the mouse down to decrease depth of the face.
Drag the mouse right to increase the width of the face.
Drag the mouse left to decrease the width of the face.

➽ To ensure uniform scaling in all three dimensions when using freehand scaling, press the **U** button on the *Scale Options* panel.

- To disable freehand scaling in one or more dimensions, unpress the appropriate button (**X**, **Y** or **Z**) in the *Scale Options* panel.

- To scale a face by a specific factor:

    Select the face.
    In the *Tools* panel, click **Scale**.
    In the *Scale Options* panel:
        Choose the fixed point (*Center of Mass*, or *Origin*).
        Enter the scale factors in the x, y and z boxes.
        If required, unpress **X**, **Y** or **Z** buttons to disable scaling in a particular direction(s).
        Click **Scale**.

- To scale selected faces into a specific volume, specify the dimensions of that volume in the x, y and z boxes then press the **Scale Into** button in the *Scale Options* panel.

- If any of the **X**,**Y** or **Z** buttons are unpressed when the **Scale Into** button is pressed, the volume's size in that particular dimension will default to 1.

- To rotate a face freehand:

    Select the face.
    In the *Tools* panel, click **Rotate**.
    Choose the fixed point (*Center of Mass*, *Origin*, or *User Point*).
    In the *Front* viewport:
        Drag the mouse to rotate about the z-axis.
    In the *Left* viewport:
        Drag the mouse to rotate about the x-axis.
    In the *Top* viewport:
        Drag the mouse to rotate about the y-axis.

- To rotate a face by a specific angle:

    Select the face.
    In the *Tools* panel, click **Rotate**.
    In the *Rotate Options* panel:
        Choose the fixed point (*Center of Mass*, *Origin*).
        Enter the angles of rotation about the x, y and z axes.
        If required, raise **X**, **Y** or **Z** buttons to disable rotation in a particular direction(s).
        Click **Rotate**.

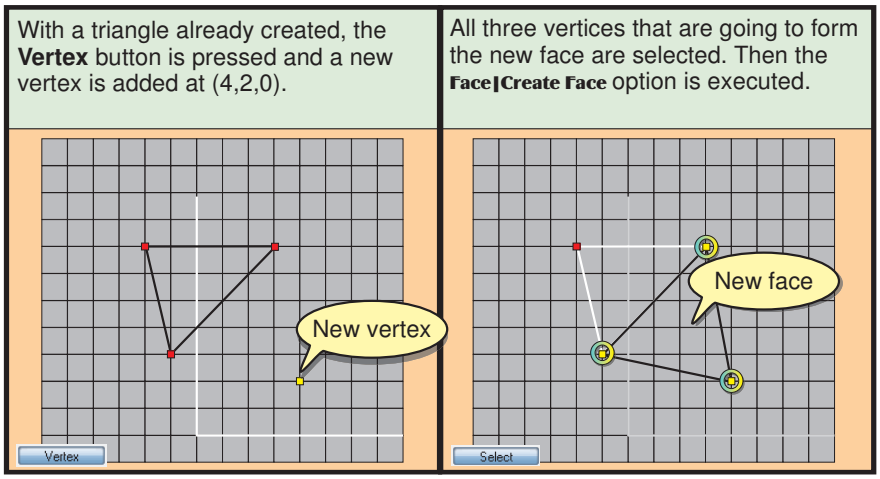
A Multi-Facetted Model

Adding a Second Triangle

So far we have only created a model with a single face (*Triangle.ms3d*). In this section we'll discover how to add more triangles (see FIG-3.30) and finally create a solid 3D shape.

FIG-3.30

Adding a Second Face to our Model



Activity 3.30

Start a new Milkshape project.

Create a triangle with vertices at points (3,7,3), (-2,7,-2) and (-1,3,0).

Add a new vertex at (4,2,0). Using this vertex and two existing vertices (as shown above), add a second face to your model using the **Face|Create Face** option and save the model as *Shape.ms3d.*

The two faces are more distinct using Flat Shading.

In the 3D viewport, select the **Flat Shading** and **Draw Backfaces** options from the pop-up menu. Rotate your viewpoint to examine your new shape from various perspectives.

Groups

One or more faces constitute a **group**. As a general rule, if one face shares a common edge with another face, then those faces form a group. This effect is chained, so, for example, if face A shares a common edge with face B and face B shares a common edge with face C, then faces A, B and C are a group. Our own model now forms a group consisting of two faces. We'll have more to say about groups in a later chapter.

Creating an Enclosed Shape

With four vertices in our model, it is possible to add new faces without adding any more vertices. For example, we could create a face using the existing vertices at (3,7,3), (-2,7,-2) and (4,2,0).

Activity 3.31

If it is not already loaded, open the model *Shape.ms3d*.

Make sure you have enabled **Draw Backfaces** and **Flat Shading** from the 3D viewport's pop-up menu.

Create a new face on your model by selecting the **Face** button and clicking on the vertices in the following order:

(4,2,0), (-2,7,-2) then (3,7,3).

Create a final face by linking the vertices (-2,7,-2), (-1,3,0) then (4,2,0).

Examine your model in the 3D viewport.

Are there any problems with any of the faces?

The Backface Problem

Despite the fact that we've clicked the vertices in counterclockwise order, the final face appears black in the 3D viewport. This must mean that we are seeing the back of the face rather than the front. Unfortunately, it turns out that clicking in counterclockwise order is no guarantee that a face will be pointing in the direction that we want. Of course we could just use **Edit|Undo** to get rid of the face and then click the vertices in the reverse order. This would certainly solve our problem, but Milkshape offers us another option; the main menu's **Face|Reverse Vertex Order** will do the job of reversing the order in which the vertices are linked automatically, turning the problem face in the correct direction.

Activity 3.32

Select the triangle whose backface is showing.

Use **Face|Reverse Vertex Order** to correct the orientation of the face in your model.

Spin the final shape in the 3D viewport and ensure no backfaces are visible.

Save the new model as *Pyramid.ms3d*.

Another command that ensures the vertices of a face are connected in a counterclockwise direction - rather than just reversing the connection order - is **Face|Face to Front**. Using this option should ensure that all the faces of a model face outwards.

A Few More Editing Options

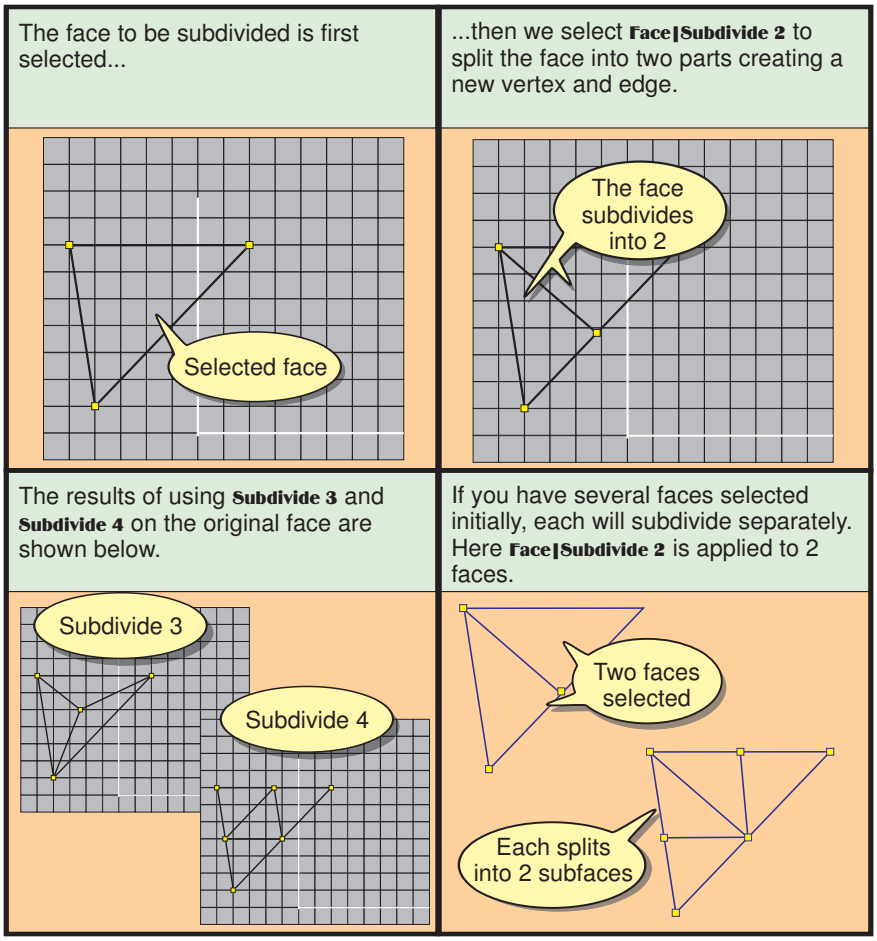
Milkshape offers a few more options to help with mesh editing. These are given here with a brief explanation of each. We'll make further use of these later.

Subdividing a Face

Subdividing means splitting a single face into two (or more) faces. This can be useful when we want to work at a finer detail level than is possible with the current number of faces. Milkshape offers options to subdivide a face into 2, 3 or 4 subfaces from the **Face** option in the main menu bar. FIG-3.31 shows the results of each operation on a single face.

FIG-3.31

Face Subdivision



Activity 3.33

Start a new model.

Create a single triangular face.

Select the face and select **Face|Subdivide 2**.

Undo the last operation and try **Face|Subdivide 3**.

With all the faces selected try **Face|Subdivide 4**.

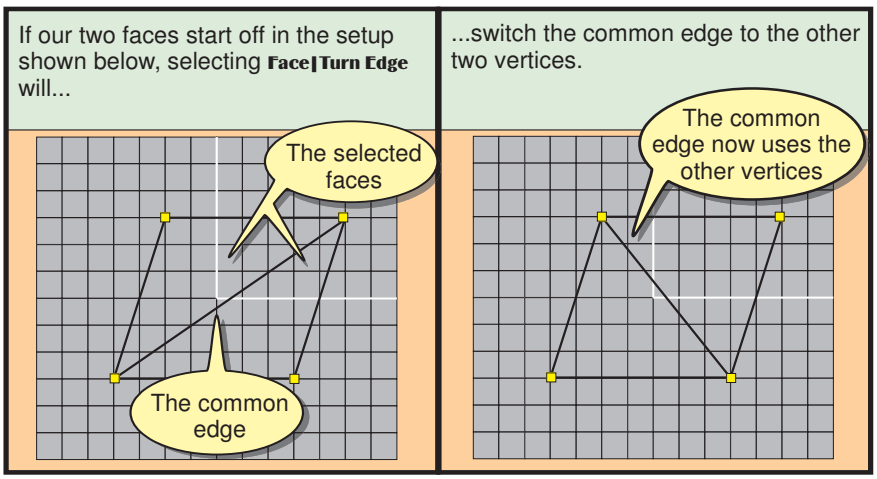
How many vertices and faces exist after this last operation has been performed?

Turning an Edge

Two connecting faces will be constructed from a total of four vertices with a common edge between two of these vertices. It is possible to switch that edge so that it connects between the two other vertices that make up the two faces. This can be achieved by selecting two adjoining faces and choosing **Face|Turn Edge**. The effect is shown in FIG-3.32.

FIG-3.32

Turning an Edge



Activity 3.34

Load the *TwoTriangles.ms3d* model, select its two faces, and execute **Face|Turn Edge**, observing the effect of the command on the faces.

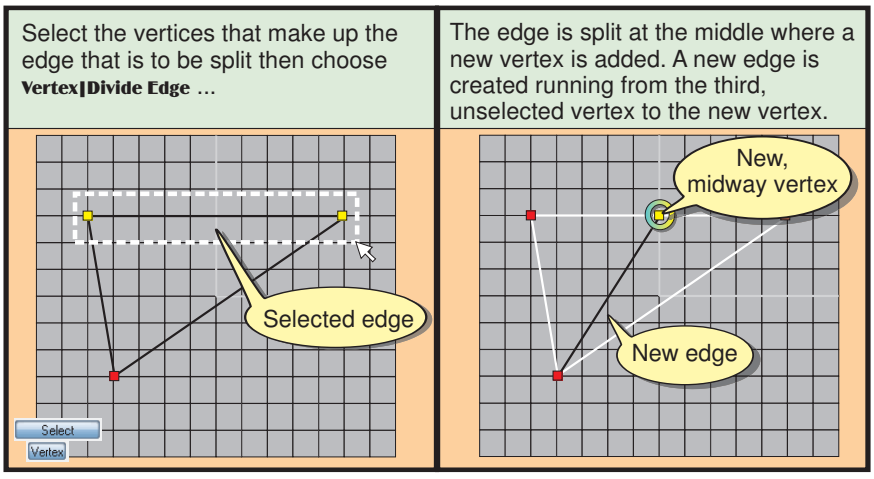
Do not save the model.

Dividing an Edge

We can divide an edge into two equal parts - and thereby subdivide an existing face into two - using the main menu's **Vertex|Divide Edge** option. The operation creates a new vertex half-way along the selected edge and splits the face into two parts by adding a new edge from the third vertex of the face. FIG-3.33 shows the effect of this operation.

FIG-3.33

Dividing an Edge



Activity 3.35

Reload *TwoTriangle.ms3d.*

Select the two top vertices in the *Front* viewport and select **Vertex|Divide Edge**.

What are the coordinates of the new vertex?

What are the coordinates of the second vertex connected to the new edge?

Other mesh editing options which are more usefully employed on complex models will be covered in a later chapter.

Summary

- A new face can be created by selecting its three vertices and choosing **Face|Create Face**.
- A group is a set of linked faces.
- **Face|Reverse Vertex Order** will reverse the order in which vertices of a selected face are linked. This has the effect of turning a polygon to face in the opposite direction.
- **Face|Face to Front** ensures that selected polygons face towards the *Front* view.
- **Face|Subdivide** divides a face into 2, 3 or 4 sub-faces.
- **Face|Turn Edge** changes the common edge between two faces by changing which vertices are used to make the shared edge.
- **Vertex|Divide Edge** splits an edge into two equal parts. A new vertex is created and an additional edge joins the new vertex to the unselected vertex of the face. In effect this splits the face into two sub-faces.

Solutions

Activity 3.1

If necessary, set the viewport magnification to an appropriate figure (about 25) so that grid lines are drawn 1 unit apart.

In the *Model* page of the Control Panel, click the **Vertex** button.
In the *Front* viewport click at the points (3,3,0), (-3,2,0) and (0,-3,0). (Remember the coordinates of the mouse are shown in the bottom left of the screen.)

Activity 3.2

In the *Model* page of the *Control Panel*, click the **Face** button.
Click on each of the existing vertices moving in a counterclockwise direction.

When you rotate the face in the 3D viewport the back of the triangle is black (or it may be totally invisible).

If your mouse has a wheel use this to zoom in on the triangle or hold down the *Shift* key and left mouse button, dragging the mouse away from you to zoom in or towards you to zoom out.

Hold down *Ctrl*+left mouse button and drag to move your viewpoint.

Right click in the 3D viewport and choose **Reset View** from the pop-up menu to return the viewpoint to its original position.

Activity 3.3

Select **Edit|Undo** - this will return you to the point where only the three vertices exist.

Select all three vertices (drag a bounding box over all 3 or *Shift*+click each in turn).
Select **Face|Create Face** - this will create a face between the 3 vertices.

Activity 3.4

With **Draw Backfaces** checked, the backface of the triangle is black. With **Draw Backfaces** unchecked, the backface of the triangle is invisible.

Activity 3.5

Select **File|Save As**.
Move to the *Hands On Milkshape* folder.
In the dialog box:
- Click **New Folder**
- Name the folder *MyMilkModels.*
- Enter the filename *Triangle* (the *.ms3d* extension is added automatically).
- Click **Save**.

Activity 3.6

Choose **File|Preferences...** to display the *Preferences* dialog box.
On the *Misc* page of the dialog box enter 5 in the *Auto Save* box and click **Ok**.

Check **Window|Show Message Window**.
Click at 20 random points in any of the orthogonal viewports.

Activity 3.7

The folder should contain auto-saved files named *triangle_autosave001.ms3d, triangle_autosave002.ms3d*, etc.

Activity 3.8

Use **File|Open** and select *triangle_autosave001.ms3d* from your folder.

Use **File|Recent Files** to load *Triangle.ms3d*

To change auto-save to a 50 operation gap:
- Choose **File|Preferences** to display the *Preferences* dialog box.
- On the *Misc* page of the dialog box enter 50 in the *Auto Save* box.
- Click **Ok**.

Activity 3.9

With the two models merged, a cuboid shape should appear beneath the 3D text.

Activity 3.10

Choose **File|Export** and **DirectX8.0 File**. In the dialog box make sure all options are checked and then choose the folder and enter the filename *UnderlinedText.X*.

Activity 3.11

No solution required.

Activity 3.12

Set the zoom factor in the *Front*, *Left* and *Top* viewports to 30.

Select each vertex in turn pressing **Ctrl+G** after each selection. If the vertex is close enough to the required point, it will jump automatically to that point.

Activity 3.13

Working in the *Model* page of the Control Panel:
- For each vertex:
  - Select it (Click **Select** in the *Tools* panel and **Vertex** in the *Select Options* panel).
  - Click **Move** in the *Tools* panel and drag the vertex

in the *Front* viewport to its new x,y position.
In the *Top* (or *Left*) viewport drag the vertex to its new z position.

Activity 3.14

Select the vertex at (1,-5,1).
Click the **Move** button in the *Tools* panel.
In the *Move Options* panel:
- Enter the new coordinates (-1,-2,0) for the vertex in the X, Y and Z boxes.
- Make sure all three buttons below (**X**, **Y** and **Z**) are pressed.
- Choose *Absolute* from the dropdown list.
- Click the **Move** button.

Activity 3.15

Select the "top" two vertices at (4,3,3) and (-2,4,-2) .
Click the **Move** button in the *Tools* panel.
In the *Move Options* panel:
- Enter the value 2 in the Y box.
- Ensure only the **Y** button is pressed.
- Choose *Relative* from the drop-down list.
- Click the **Move** button.

Select the "lowest" vertex at (-1,-2,0).
Click **Move** button in the *Tools* panel.
In the *Move Options* panel:
- Enter -2 in the X box.
- Ensure only the **X** button is pressed.
- Choose *Relative* from the drop-down list.
- Click the **Move** button.

The new coordinates of the vertices are: (4,5,3) (-2,6,-2) (-3,-2,0).

Activity 3.16

Load *Triangle.ms3d.*
Choose **Vertex|Manual Edit** to display the vertex details.
For each of the vertices:
- Enter the new coordinates in the *X, Y* and *Z* columns of the table.
- Set the *Selected* value to F (except for vertex 02 which should be set to T).

Resave the model.

Activity 3.17

Select the two vertices which the edge joins (-2,4,-1) and (5,1,3).
Click the **Move** button in the *Tools* panel.
In the *Move Options* panel:
- Enter -3, 0, 2 in the X,Y and Z boxes.
- Make sure all 3 buttons (**X**, **Y** and **Z**) are pressed.
- Choose *Absolute* from the dropdown list.
- Click the **Move** button.

The centre of the edge is at (-3,0,2) but its end vertices. are now at (0.5,-1.5,4) and (-6.5,1.5,0).

Resave the model.

Activity 3.18

Both faces can be selected in the *Front* viewport using either the click or drag methods.

Neither face can be selected in the *Top* viewport.

When *Ignore Backfaces* is unchecked, the faces can be selected in the *Top* viewport.

The two faces are selected when you drag a single bounding box over both.

Clicking on the left-most vertex selects the upper-left face.

Clicking on the bottom-left vertex at (0,-3,0) results in the two faces being selected since that vertex is common to both.

Activity 3.19

Select the top-left face.
Click the **Move** button in the *Tools* panel.
Unpress the **Y** and **Z** buttons in the *Move Options* panel. (This will restrict movement to the x direction only.)
Drag the triangle one unit to the right in the *Front* viewport.

In the *Move Options* panel:
- Enter 2, 1 and 3 in the X, Y and Z boxes respectively.
- Make sure the **X**, **Y** and **Z** buttons are all pressed.
- Choose *Relative* from the dropdown list.
- Click **Move**.

In the *Move Options* panel:
- Enter 0, 0 and 0 in the X, Y and Z boxes respectively.
- Make sure the **X**, **Y** and **Z** buttons are all pressed.
- Choose *Absolute* from the dropdown list.
- Click **Move**.

Activity 3.20

a) 2.5
b) 5
c) 7.5

Activity 3.21

To select the common edge, select the vertices at positions (3,3,3) and (0,-3,0).
Click the **Scale** button.
Make sure the **X**, **Y** and **Z** buttons in the *Scale Options* panel are all pressed.

Within the *Front* viewport dragging to the left reduces the size in the x direction; dragging to the right increases size in the x direction. Dragging up increases the size in the y direction; down decreases the size.
In the *Left* viewport: drag left to decrease size in z direction; right to increase. Drag up to increase size in y direction; down to decrease.
In the *Top* viewport: drag left to decrease size in x direction; right to increase. Drag down to increase size in z direction; up to decrease.

When the *Center of Mass* option is used, the vertices on

both sides move equally. When *Origin* is used the vertex on the origin does not move when scaled in the x direction.

When using *User Point*, the point selected using the mouse remains fixed.

Activity 3.22

Since uniform scaling has been selected, the end result is the same irrespective of which viewport is used during the scaling operation.

With the **Y** button unpressed, uniform scaling takes place in the x and z directions only. No scaling occurs in the y direction.

Activity 3.23

Select the face.
Click **Scale** in the *Tools* panel.
In the *Scale Options* panel:
Click *Center of Mass.*
Enter 1.5, 1.2 and 0.5 in the X, Y and Z boxes.
Make sure the **X**, **Y** and **Z** buttons are all pressed.
Click **Scale**.

Select **Edit|Undo** to undo the scaling.
In the *Scale Options* panel:
Click *User Point.*
Enter 1.5, 1.2 and 0.5 in the X, Y and Z boxes.
Make sure the **X**, **Y** and **Z** buttons are all pressed.
Click on the top vertex of the selected face.
Click **Scale**.

The vertices in the face will move to different positions for each of the two settings (*Center of Mass* and *User Point*) but the area of the triangle will be the same in both cases.

Undo the scaling.

Activity 3.24

Select the upper-left face in the *Front* viewport.
Click **Scale** in the *Tools* panel.
In the *Scale Options* panel:
Click *Origin.*
Enter -1 in the X box.
Press the **X** button.
Unpress the **Y** and **Z** buttons.
Click **Scale**.

Activity 3.25

Load the *ABC.ms3d* model.
Select all the faces of the model (make sure the *Ignore Backfaces* option is unchecked).
Press the **Scale** button.
Enter 8, 6 and 2 into the X, Y and Z boxes.
Make sure the **X**, **Y** and **Z** buttons are pressed.
Press the **Scale Into** button.
The letters are forced into a volume which is 8 x 6 x 2.

Select **Edit|Undo**.
Unpress the **Y** button in the *Scale Options* panel.

Rescale the model by pressing the **Scale Into** button.
With the **Y** button unpressed, the volume's height defaults to 1, so the model is scaled into a space which is 8 x 1 x 2.

Activity 3.26

No solution required.

Activity 3.27

No solution required.

Activity 3.28

No solution required.

Activity 3.29

Load *TwoTriangles.ms3d.*
Select the "top" face.
Click the **Rotate** button in the *Tools* panel.
In the *Rotate Options* panel:
Select *Center of Mass* as the point of rotation.
Enter 60 in the Y box.
Ensure only the **Y** button is pressed.
Click **Rotate**.

Activity 3.30

Start a new Milkshape project.
Click **Vertex** in the *Tools* panel.
Create vertices at the points (3,7,3), (-2,7,-2) and (-1,3,0).
Click **Face**.
Click each of the vertices in a counterclockwise direction.
Click **Vertex**.
Click at the positions (4,2,0), (3,7,3) and (-1,3,0).
Select the three vertices that are to make up the face.
Select **Face|Create Face**.
Select **Flat Shading** from the 3D viewport's pop-up menu.
Select **File|Save As** and save the model as *Shape.ms3d*.

Activity 3.31

In the 3D viewport, select **Flat Shading** and **Draw Backfaces** from the pop-up menu.

Add the face linking points (4,2,0), (-2,7,-2) and (3,7,3).

Add the face linking the points (-2,7,-2), (-1,3,0) and (4,2,0)

The final face has its backface on the "outside" of the shape.

Activity 3.32

To reverse any triangle which has its backface on the outside, first select the face (**Select** and **Face** buttons) then use the **Face|Reverse Vertex Order** option in the main menu.
If you have trouble picking out the correct face to reverse, showing the wireframe overlay in the 3D viewport may help (select **Wireframe Overlay** from the viewport's pop-up menu).

Activity 3.33

There are 10 vertices and 12 faces.

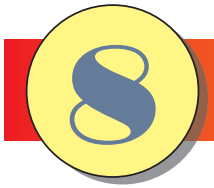
Activity 3.34

Load *TwoTriangles.ms3d.*
Press **Select** in the *Tools* panel.
In the *Select Options* panel, press **Face**.
Drag over the two faces of the model in the *Front* viewport.
Select **Face|Turn Edge**.

The common edge will move to use the alternative vertices.

Activity 3.35

The first operation creates a new vertex at (0,5,3) exactly half way along the selected edge. This new vertex is joined to (0,-3,0) by a new edge.



Groups

In this Chapter

- How Groups are Created
- Modifying Smoothing Groups
- Regrouping Faces
- Renaming Groups
- The Effect of Smoothing Groups
- Using Groups to Select and Hide Faces

Groups

Introduction

A group is an identity given to a set of faces. There are two main types of groups within Milkshape: **mesh groups** and **smoothing groups**.

Mesh groups (called simply *groups* in Milkshape) are important because they make selecting multiple faces within a complex model simpler and they also play an essential part when texturing a model. Normally, every primitive object we create in our model constitutes a separate group. Each group is automatically assigned a name when it is created and these names are listed in the Control Panel's *Groups* page.

The effects created by smoothing groups are only visible when the 3D viewport is set to **Smooth Shaded** or **Textured** mode.

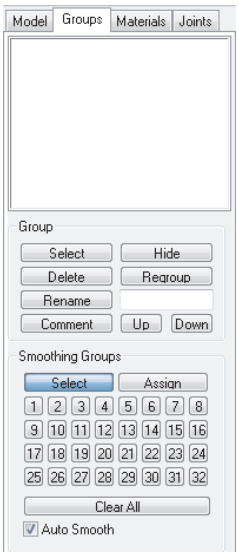
Smoothing groups are used to determine how a set of faces should be shaded. Faces belonging to the same smoothing group will have only slight differences in shading from one face to the next. For example, all the faces in a sphere will belong to the same smoothing group since the surface of a sphere should be smooth with individual faces not easily seen. On the other hand, faces on adjacent sides of a box will belong to different smoothing groups because there is a sharp edge between one side and the next. In general, then, faces belong to the same smoothing group if they meet each other at a slight angle and the finished result should be a smooth transition from one face to the next; faces belong to different smoothing groups if there is to be a sharp distinction in the shading between each set of faces - generally when there is a large angular difference between the sets of faces. Smoothing groups are assigned numbers rather than names.

A face will belong to exactly one mesh group and one smoothing group, but a group can contain many faces.

Milkshape's Control Panel contains a tagged page specifically for handling groups (the *Groups* page) which is shown in FIG-8.1.

FIG-8.1

The Control Panel's Groups Page



The white box at the top of the page is used to list the names of every mesh group in the currently loaded model.

The *Group* panel contains mostly buttons for manipulating the mesh groups.

The *Smoothing Groups* panel contains controls for manipulating smoothing groups.

An important characteristic to bear in mind is that as we move from the *Model* page of the Control Panel to the *Groups* page, the current selection in the *Model* page remains active. For example, if we had clicked on the **Move** button in the *Model* page immediately before changing to the *Groups* page, should we then drag the mouse within one of the orthogonal viewports, any currently selected vertices or faces will be moved.

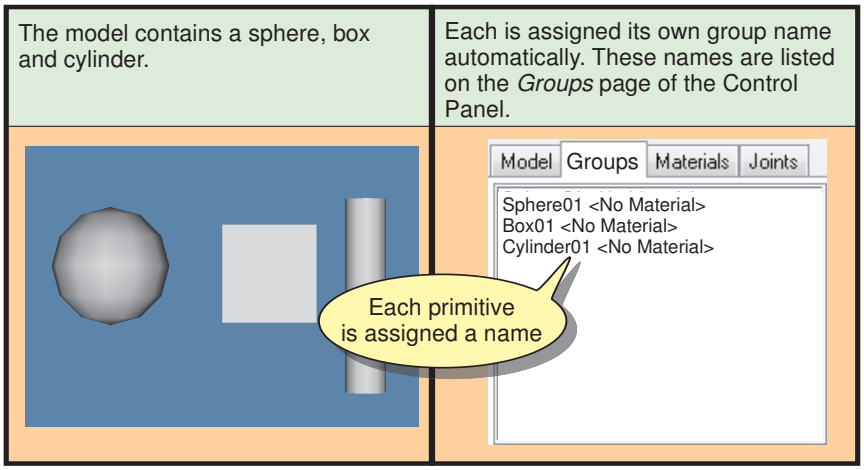
Mesh groups

Renaming Groups

The model in FIG-8.2 contains 3 primitives and each is automatically assigned a group name which is listed on the *Groups* page of the Control Panel.

FIG-8.2

Each Primitive Shape is a Named Group

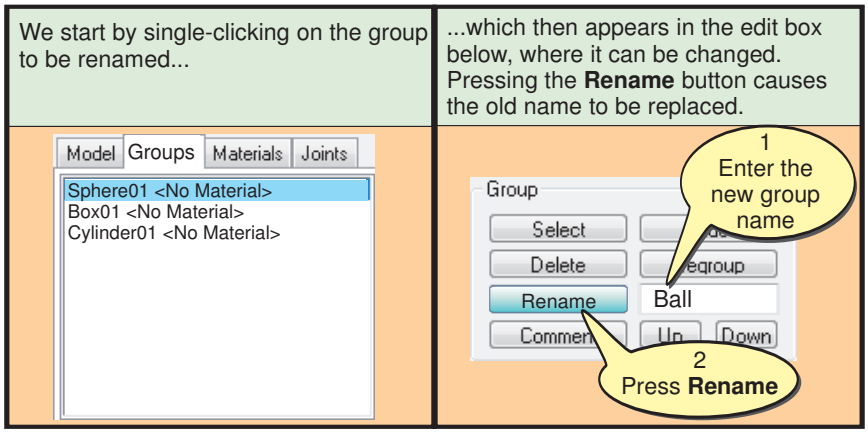


The term <*No Material*> shown beside each group refers to the fact that no texturing material has yet been assigned to the group.

Since the names assigned to the groups have little meaning in the context of the model we are creating, it will be helpful to assign a more relevant name to each group (see FIG-8.3).

FIG-8.3

Renaming Groups



Activity 8.1

Create a new Milkshape project containing a sphere, box and cylinder. Rename the three groups as *Ball, Gift and Pipe.*

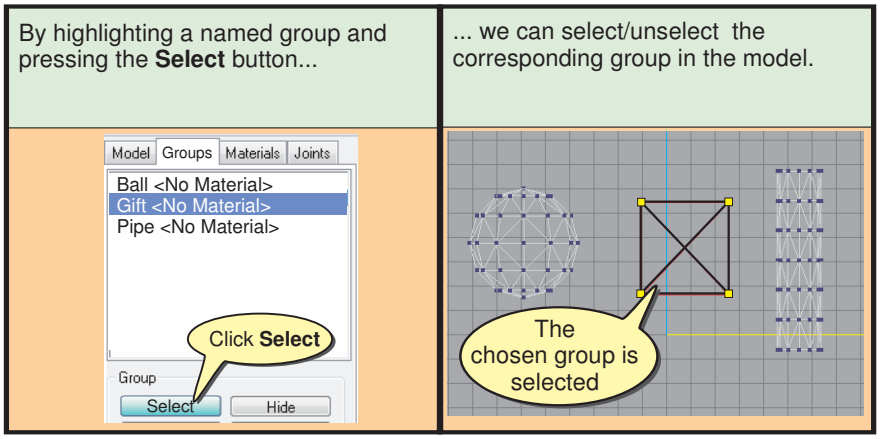
This model is used in the next three Activities.

Selecting Groups

The vertices and faces that make up a group can be selected using the **Select** button (see FIG-8.4).

FIG-8.4

Selecting Groups



You can also select a group's faces by just double-clicking the appropriate entry in the *Groups* list.

Pressing the **Select** button again or a second double-click of the appropriate list entry will deselect the group.

Activity 8.2

Using the model created in Activity 8.1, make use of both selection methods described above to select the *Ball* and *Gift* groups. Deselect both groups.

All the faces within a group can also be selected from the *Model* page of the Control Panel. To do this, first click on the **Select** button in the *Tools* panel and then the **Group** button in the *Select Options* panel. Now click on a face within one of the orthogonal viewports and all of the vertices and faces belonging to the same group as that face will be selected. To select more than one group, hold down the *Shift* key while clicking within each group.

Activity 8.3

Using the same model as before, select both the *Ball* and *Gift* groups using the **Select** and **Group** buttons on the *Model* page.

Save the model as *Groups01.ms3d*.

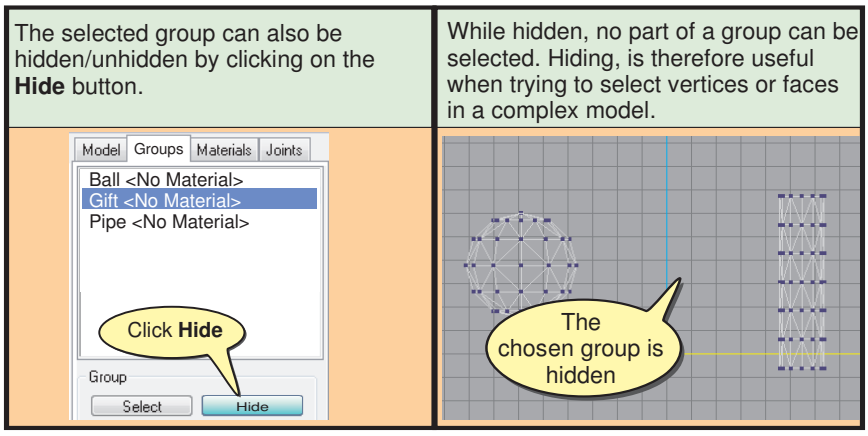
Hiding Groups

We've seen in previous chapters that it can, on occasion, be useful to hide sections of a model. To hide all the faces of a group, highlight the group in the list and press the **Hide** button (see FIG-8.5).

Pressing the **Hide** button a second time will unhide the faces of the group.

FIG-8.5

Hiding the Faces of a Group



Activity 8.4

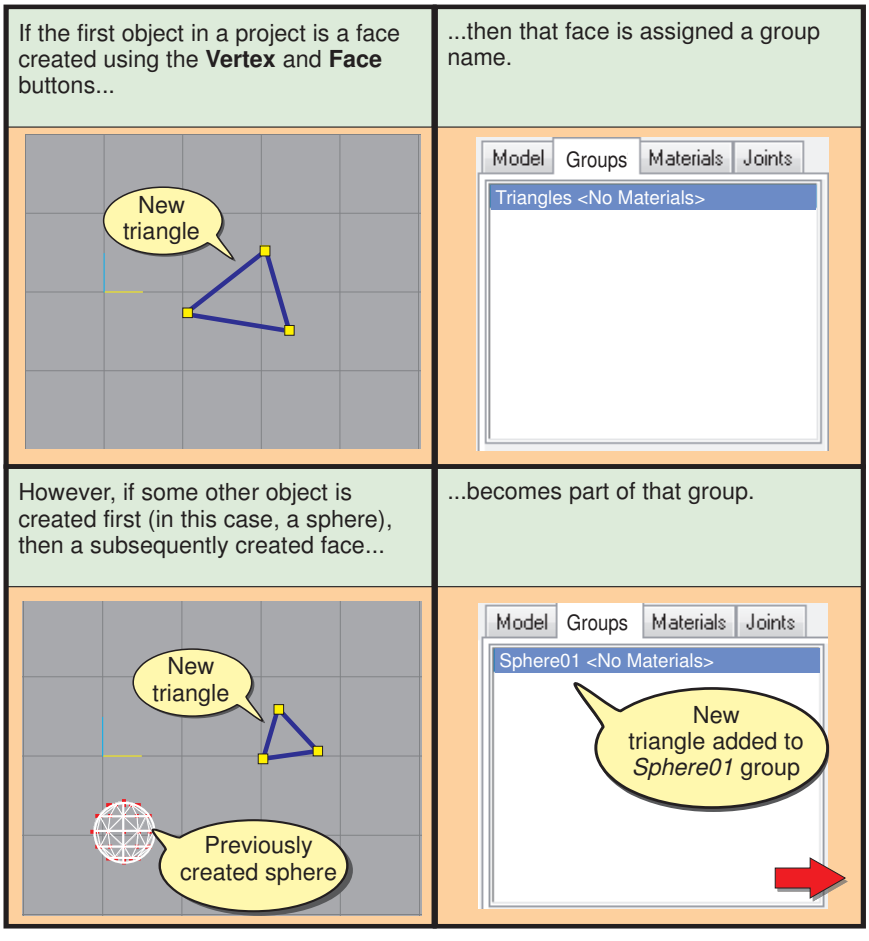
Reload *Groups01.ms3d* and use the method shown in FIG-8.5 to hide the *Gift* group of faces. Click the **Hide** button a second time to unhide the faces.

Group Creation

Although each primitive we add to a model is usually given its own group identity, this is not always true when creating a new face as demonstrated in FIG-8.6.

FIG-8.6

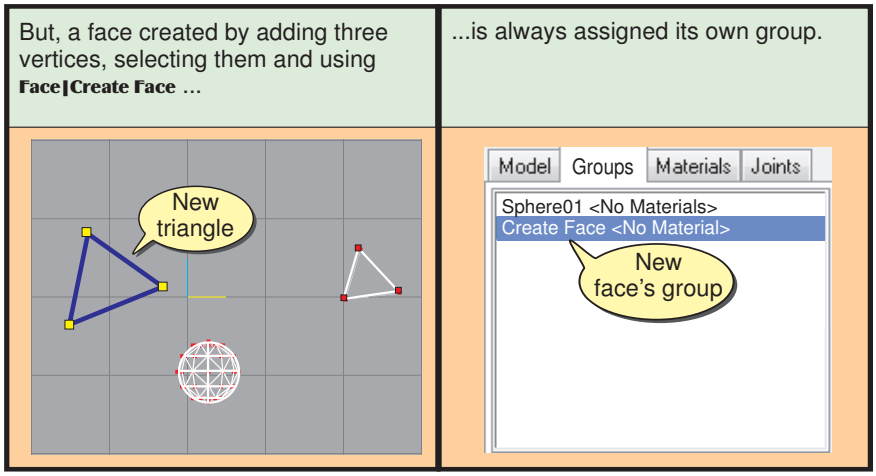
How New Faces are Grouped



Where several groups already exist, the new face is always added to the top group in the list.

FIG-8.6
(continued)

How New Faces are Grouped



Activity 8.5

Start a new Milkshape project.

Create a single triangle using the **Vertex** and **Face** buttons on the *Model* page.

What is the name of the group created by this operation?

Add a sphere to the model.

Add a second triangle to the model, again using the **Vertex** and **Face** buttons.

What group has the second triangle been added to?

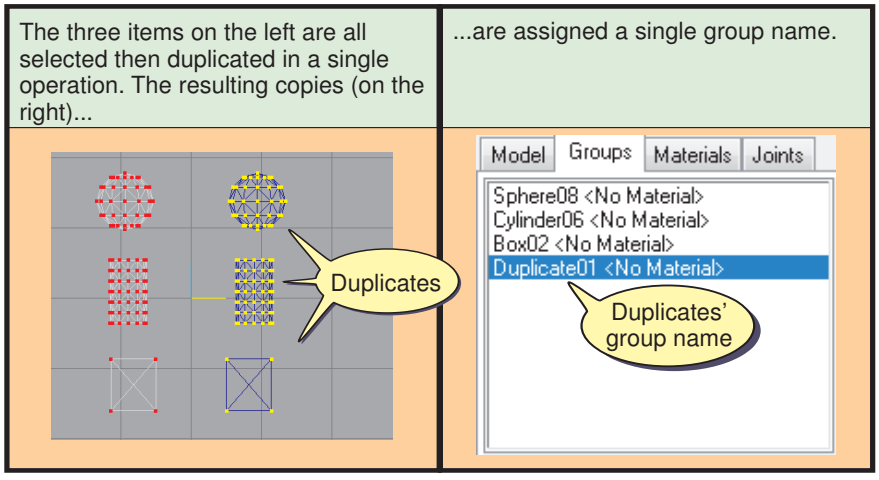
Add a third triangle using the **Vertex** button and **Face|Create Face**.

How is the groups list affected by the third triangle?

Another situation that is handled in an unexpected manner is duplication of groups. For example, if we have an existing sphere, cylinder and box, which are subsequently all selected and duplicated in a single operation, then the three duplicated items are assigned a single group name (see FIG-8.7).

FIG-8.7

Duplicating Multiple Groups



In order to assign a separate name to each duplicated group, it is necessary to copy the originals one at a time.

Activity 8.6

Reload your model *Groups01.ms3d*.

Create a duplicate of the three existing objects so that three new groups are created.

Name the three new groups *Ball2, Gift2* and *Pipe2* - assigning the names appropriately.

Resave your model.

Other Minor Operations

Other buttons within the *Groups* panel are:

Deletes the selected group from the model.

Allows a comment to be associated with the group. Useful for reminding you of the purpose of a group.

Moves the highlighted group up the listings order. This has no effect on the actual group of vertices.

Moves the highlighted group down the listings order.

Activity 8.7

Reload your model *Groups01.ms3d*.

Rearrange the order of the groups as shown in the groups list, placing them in the order, *Pipe, Pipe2, Gift, Gift2, Ball, Ball2.*

Resave your model.

Regrouping

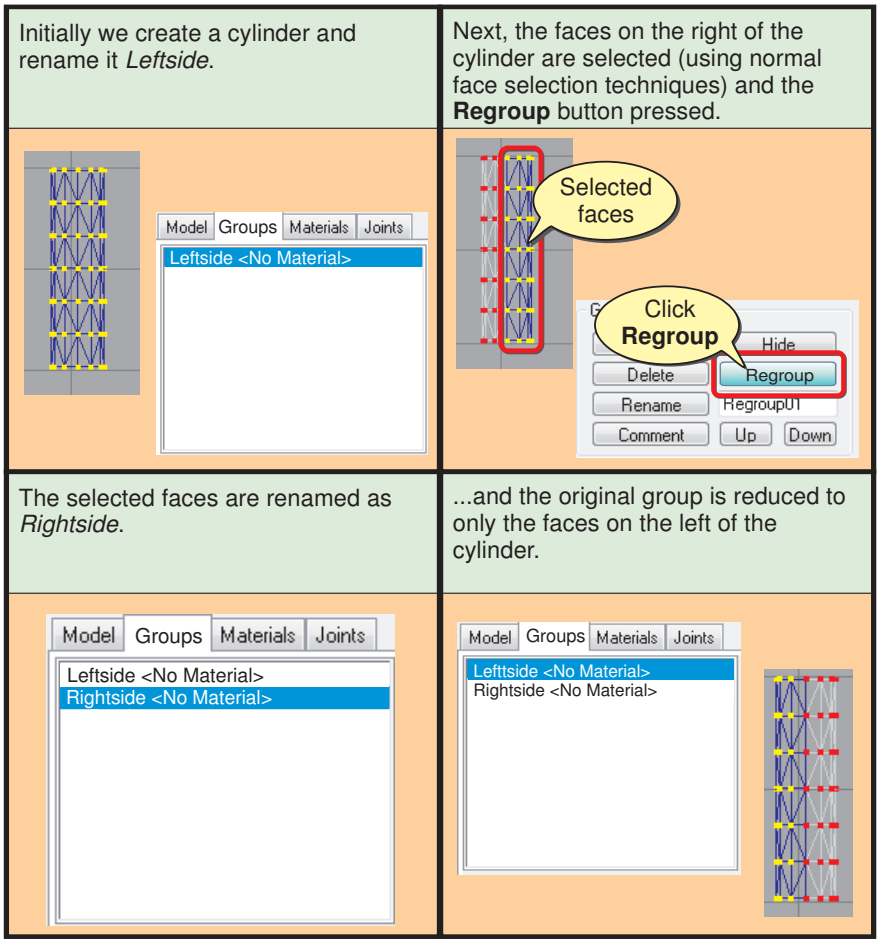
The faces in a single group can be split into two or more separate groups. Again, this can be useful when it comes to hiding sections of a model, allowing easier access to individual vertices and faces, but a more important reason for splitting groups involves texturing (which is covered in the next chapter).

Conversely, two or more groups can be merged into a single group.

For the moment we'll content ourselves with learning how to split a primitive shape into several groups. FIG-8.8 shows the steps required to split a cylinder into two groups.

FIG-8.8

Regrouping Faces



A face cannot belong to more than one group.

The faces to be assigned to a new group are selected in the normal way using the **Select** button in the *Model* page of the Control Panel. Remember to click **Faces** in the the *Select Options* panel and check or uncheck *Ignore Backfaces* as appropriate.

Activity 8.8

Start a new Milkshape project.

Create a 6 x 12 cylinder about 4 units high and 2 units in diameter.

Divide the cylinder into four groups: *Topcap, Bottomcap, Leftside,* and *Rightside.*

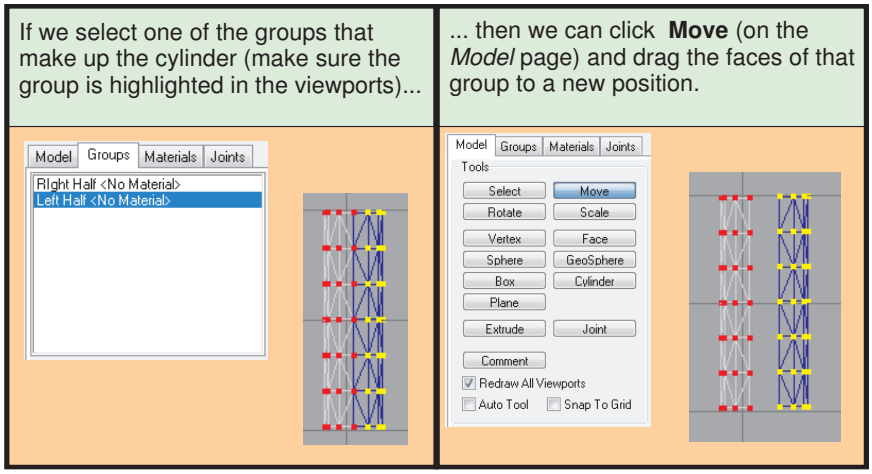
Save the model as *Groups02.ms3d.*

Once a group has been created in this way, the faces it contains have effectively been unwelded from the original mesh meaning that the group can be moved, scaled or rotated independently from the remainder of the original primitive.

In FIG-8.9 we see how the newly formed group *Regroup01* (as shown in FIG-8.8), is moved away from the remainder of the original cylinder mesh.

FIG-8.9

Each Group can be Transformed Independently



Activity 8.9

Reload *Groups02.ms3d*.

Move the four groups slightly apart.

Scale the *Leftside* group so that it is half its original dimensions in the x and y directions.

Resave the model.

Activity 8.10

Start a new Milkshape project.

Create a perfect cube measuring 4 units in each dimension.

Make each side of the cube a group and name these *One*, *Two*, *Three*, etc. Name opposing sides so that the numeric equivalent always add up to 7 (e.g. group *One* should be opposite group *Six*).

Save the model as *Dice.ms3d*.

Just as we can split a group into several new groups, so we can merge multiple groups into a single group (this does not affect the actual positions of the faces within those groups being merged) . This can be useful if we want to treat what were separate groups as a single entity which can be moved, scaled, or rotated.

To merge groups, just select the faces of those groups involved and press the **Regroup** button. The original group names will disappear from the groups list.

Activity 8.11

Reload your model, *Groups02.ms3d*.

Merge its components into a single group called *Splitcylinder* and rotate the object by 90^{o} about the z-axis on its centre of mass.

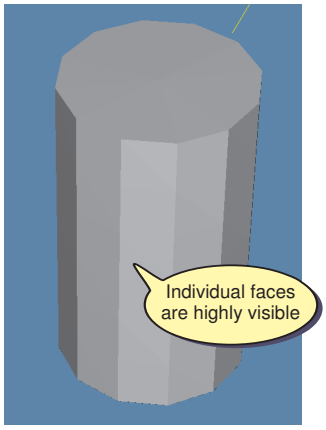
Smoothing Groups

The Effect of Smoothing Groups

When a model is viewed in 3D mode using the flat shading view, the individual faces that make up the model can be quite obvious (see FIG-8.10).

FIG-8.10

Flat Shading

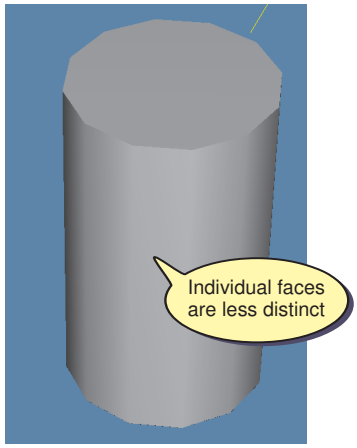


Notice that some of the faces (those in the cylinder cap) appear to merge into a single smooth surface, while other faces that are at a slight angle to each other (as in the side of the cylinder), stand out, thereby destroying the illusion of a curved surface.

But if we change to the smooth shading view, the edges between each of the side faces become less distinct giving the surface a rounder, smoother appearance (see FIG-8.11).

FIG-8.11

Smooth Shading



However, if we examine FIG-8.11 more closely, we'll see that the shading between the top cap of the cylinder and the side are still as distinct as in the previous image.

Automatic Smoothing Group Creation

When a primitive is first created it is assigned one or more smoothing groups.

Any faces that belong to the same smoothing group are blended together to give the appearance of a smooth surface when the model is displayed in the 3D viewport using **Smooth Shaded** mode.

As a general rule, faces at an angle of less than 90^{o} to each other belong to the same smoothing group.

The faces on the side of the cylinder all belong to the same smoothing group and hence we see a smooth, curving effect when viewing the side in smooth shaded mode. However, since the top cap of the cylinder (which is at 90^{o} to the side) belongs to another group, there is an obvious difference in shading between the side and cap surfaces.

To minimise the number of shading groups allocated to a primitive, Milkshape will often place disconnected faces in the same smoothing group. Because these faces are not touching, there is no attempt by the program to create a smoothing effect between them. For example, the faces in the two caps of a cylinder all belong to the same smoothing group, but since they are separated from each other by the curved side of the cylinder, this has no effect on how the shading appears in the 3D viewport.

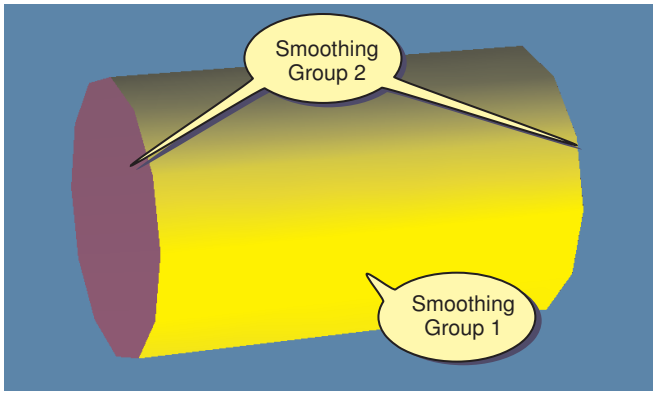
Unlike mesh groups, smoothing groups are not assigned names. Instead they are assigned numbers. For example, while a cylinder will by default, be assigned to a single mesh group with a name such as *Cylinder01*, the two smoothing groups within that cylinder will be assigned the values 1 and 2.

While mesh group names appear in the *Group* page's main list, there is no obvious way of discovering how many smoothing groups have been assigned to an object.

One way of identifying the smoothing groups within a single object is to select the **Colored Smoothing Groups** option from the 3D viewport's pop-up menu. This assigns artificial colours to the model, with faces belonging to the same smoothing group being displayed in the same colour. FIG-8.12 shows colour-coded smoothing groups of a cylinder.

FIG-8.12

Coloured Smoothing Groups



Activity 8.12

Start a new Milkshape project then create a closed 6 x 12 cylinder about 4 units high and 2 units in diameter.

In the 3D viewport, select **Colored Smoothing Groups** and identify which faces belong to which smoothing group.

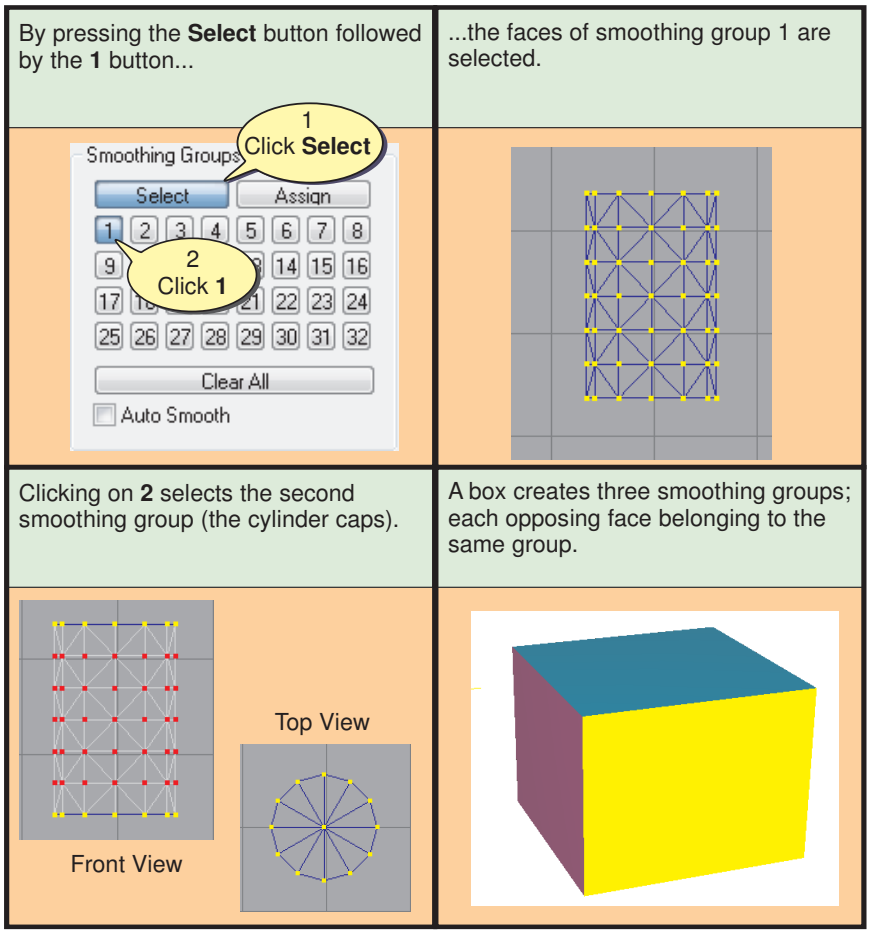
This model will be used in the next Activity.

Make sure **Colored Smoothing Groups** is deselected in the 3D viewport before completing the Activity.

Also, by using options in the *Smoothing Groups* panel we can select the faces that make up any of the existing smoothing groups (see FIG-8.13).

FIG-8.13

Automatic Smoothing Groups



Activity 8.13

Using the cylinder you created in the last Activity, select the faces belonging to smoothing group 1.

What faces are selected when you click on smoothing group 2? What faces are selected when you click on smoothing group 3?

Remove the cylinder from your model.

Create a cube about 4 units in each dimension.

Select the faces in each smoothing group of the model.

How many smoothing groups are assigned to a sphere?

Surprisingly, when new primitives are placed within a model their faces are added to existing smoothing groups where possible.

For example, if we start with a cylinder (which forms smoothing groups 1 and 2) and then add a box, two sides of the box will be added to group 1 and another two to group 2; the final two sides of the box form a new smoothing group 3. This is easily seen by selecting the **Colored Smoothing Groups** option from the 3D viewport's pop-up menu before adding the cylinder and box to a new model.

Activity 8.14

Start a new Milkshape project.

Select the **Colored Smoothing Groups** option from the 3D viewport's pop-up menu.

Add a cylinder to the project (size is irrelevant).

Add a box to the model.

Add a sphere to the model.

How many smoothing groups are formed by the model?

Deselect the **Colored Smoothing Groups** option.

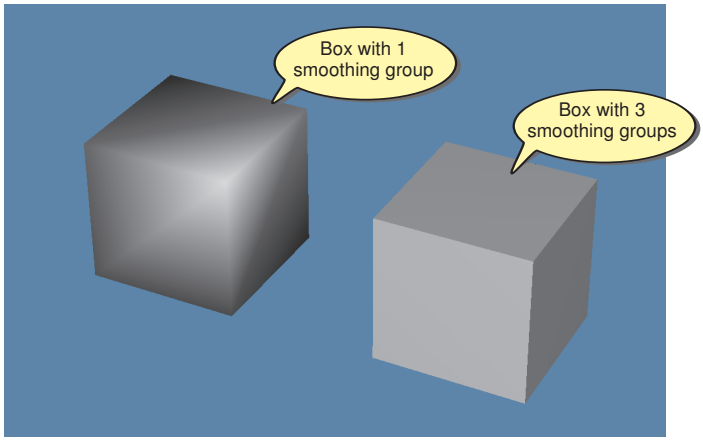
Manually Assigning Smoothing Groups

Although faces are automatically assigned to specific smoothing groups, we can destroy those groupings, reassign faces to other groups, or even create new groups.

The **Clear All** button in the *Smoothing Groups* panel destroys the existing smoothing groups' allocation by placing every face within a model into smoothing group 1. Without distinct smoothing groups, the shading process within the 3D viewport attempts to create a smoothing effect between every face - even those at 90^{o} to each other - this creates an unrealistic shading on the surface of the model (see FIG-8.14).

FIG-8.14

Clearing Smoothing Groups Destroys Realistic Shading



When faces are reassigned to new smoothing groups, the necessary calculations required to show the effects of this change are only performed automatically if the *Auto Smooth* check box at the bottom of the *Smoothing Groups* panel is checked. Should this option be unchecked when the faces are reallocated, there will be no visible difference to the model (although the reassignment will still take place). As a general rule, the *Auto Smooth* option should remain checked at all times.

Should you create new smoothing groups while the *Auto Smooth* option is unchecked, all is not lost; you can still force the necessary recalculations by selecting **Face|Smooth All** from the main menu.

Activity 8.15

Start a new Milkshape project.

Create a cube about 6 units in each dimension.

In the *Smoothing Groups* panel of the *Groups* page, make sure *Auto Smooth* is checked, then reduce the number of smoothing groups in the model to 1.

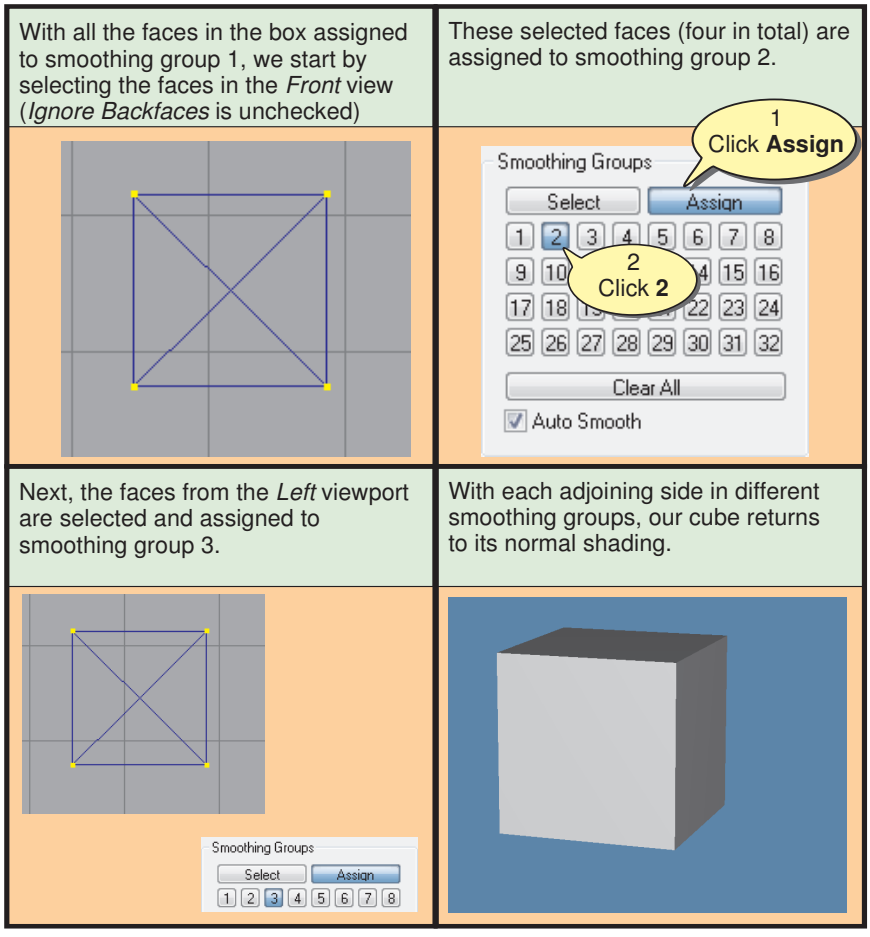
Observe the effects of this on the model's shading when in **Smooth Shaded** mode in the 3D viewport.

This model is used in the next Activity.

By using the **Assign** button in the *Smoothing Groups* panel, we can assign selected faces to a new smoothing group. In FIG-8.15 we start with a cube which has had its faces assigned to a single smoothing group and reassign its faces to smoothing groups 1, 2 and 3 as appropriate.

FIG-8.15

Reassigning Faces to Other Smoothing Groups



Activity 8.16

Using the model you created in the previous Activity, reassign three smoothing groups to your cube as shown in FIG-8.15.

Shading Problems with the Fin Model

At the end of Chapter 7 we created a "fin" shape by modifying a sphere and adding new faces. However, there was a problem with the shading of the final model which we could see when viewing it in the 3D viewport. This was caused by faces being automatically assigned to inappropriate smoothing groups.

Activity 8.17

Load *Fin.ms3d*.

Examine the shading of the model in the 3D viewport (make sure the **Smooth Shading** option is selected).

Switch on the **Colored Smoothing Groups** option.

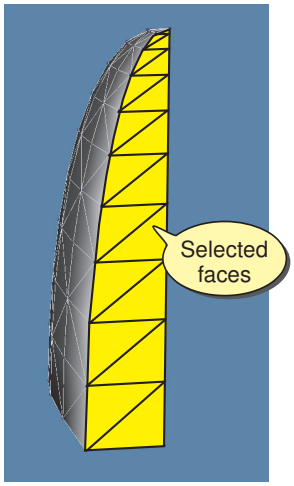
How many smoothing groups are in the model?

So now we see what is causing the shading problem in the model - all faces belong to a single shading group. To achieve a more realistic model we need to create new smoothing groups for the new faces we added to the model, since these are at a 90^{o} angle to the faces that were on the original sphere.

Activity 8.18

With the *Fin.ms3d* model loaded, select **Tools|Selection Editor**.

Use the editor to select the new faces we added along the long vertical side of the model (see diagram).



Assign the selected faces to smoothing group 2.

Select the other faces that were added to the model (on the short horizontal side) and assign these to smoothing group 3.

How is the shading of the model affected by these changes?

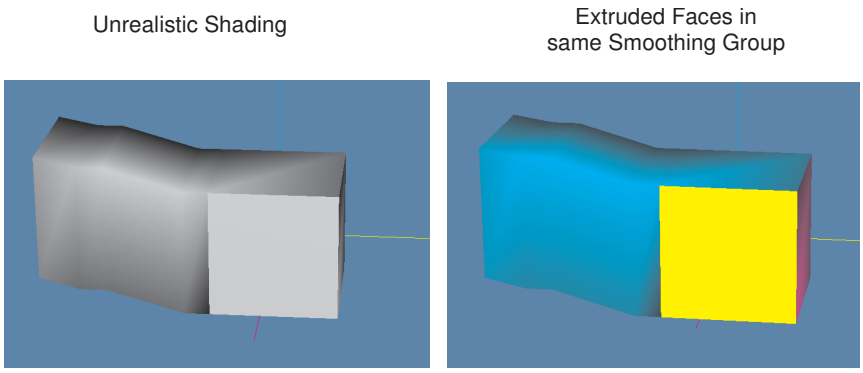
Resave the model.

Smoothing Groups and Extrusions

It's this same problem of faces being assigned to inappropriate smoothing groups that causes problems with extrusions. We can see in FIG-8.14 that the unrealistic shading on the extruded surfaces of the model *Extrude01.ms3d* is caused by the new faces being assigned to the same smoothing group.

FIG-8.14

Extruded Faces are Assigned to the Same Smoothing Group



Activity 8.19

Reload your model *Extrude01.ms3d* and reallocate the extruded faces to appropriate smoothing groups.

Resave your model.

If, despite faces being correctly allocated to appropriate smoothing groups, the shading of the model still looks wrong, this is probably caused by the vertices in any new faces not being correctly welded to those in existing faces. Try selecting the vertices of the faces involved and then use **Vertex|Weld Together** - this should solve the shading problems.

Shading Groups and Modified Cylinders and Spheres

Back in Chapter 4 we saw how to create new shapes by specifying low values for the stacks and slices parameters of cylinders and spheres. However, these shapes can suffer from shading problems when viewed in the 3D viewport. This is caused by the faces which are at acute angles to each other being assigned to the same smoothing group (after all, when using standard stacks and slices values, these faces would belong to the same gently curving surface). Just assign each of the faces to different smoothing groups to achieve correct shading.

Activity 8.20

Start a new Milkshape project.

Create a 1 stack, 4 slice, closed cylinder about 6 units high and 1 unit in diameter. This will produce a long, box-shaped object.

In the 3D viewport, observe how the object you have created is shaded (make sure you are in **Smooth Shaded** mode).

continued on next page

Activity 8.20 (continued)

Again in the 3D viewport, select **Colored Smoothing Groups** from the pop-up menu.

How many smoothing groups are used in the object? How many smoothing groups are used by the long sides of the object?

Select two opposing long sides of the object and assign them to smoothing group 3.

How many smoothing groups are in the object now?

Switch off the **Colored Smoothing Groups** option and observe the difference in the object's shading.

Summary

- A group is a collection of faces.
- Milkshape makes use of two types of groups: mesh groups and smoothing groups.
- Mesh groups are a convenient way of grouping sets of faces so they can be more easily selected.
- Mesh groups are also used when a model is being textured.
- Smoothing groups are used to determine the shading of a model's surface.
- Each new primitive within a model is automatically assigned its own mesh group.
- Mesh group names are generated automatically.
- Mesh groups can be renamed.
- By selecting a group name, the faces in that group can be selected, hidden or deleted.
- The order in which the group names appear within the names list can be reorganised.
- When faces are duplicated in a single operation, all the duplicated faces belong to the same mesh group.
- Faces can be assigned to new mesh groups.
- Smoothing groups are assigned numeric values, not names.
- Adjoining faces within the same smoothing group create a smooth shading effect within the 3D viewport when the **Smooth Shaded** option is selected.
- Smoothing groups are allocated automatically every time a primitive is created.
- Disjointed faces may share the same smoothing group, since this will have no effect on the shading produced.

- The shading of new smoothing groups is calculated automatically only when the *Auto Smooth* check box is selected.

- Recalculation of the shading of all smoothing groups can be achieved by selecting **Face|Smooth All**.

- When adjoining faces that are at 90^{o} or more to each other are included in the same smoothing group, unrealistic shading is produced.

- Extruded faces belong to the same smoothing group and will often have to be reallocated to achieve realistic shading.

- Unrealistic shading can also be caused by unwelded vertices.

- All the faces in a model can be allocated to a single smoothing group by clicking on the **Clear All** button in the *Smoothing Groups* panel of the *Groups* page of the Control Panel.

- The smoothing groups used within a model can be seen in a colour-coded form by selecting the **Colored Smoothing Groups** option from the 3D viewport's pop-up menu.

Solutions

Activity 8.1

Start a new Milkshape project.
Create a sphere, box and cylinder (sizes are not relevant).
Click the *Groups* tag in the Control Panel.
Click on the first group name in the groups list (this should be *sphere01* - the number may be different).
In the *Group* panel:
  Enter *Ball* in the edit box beside the **Rename** button.
  Press the **Rename** button.
Click on the box name in the main list.
In the *Group* panel:
  Enter *Gift* in the edit box beside the **Rename** button.
  Press the **Rename** button.
Click on the cylinder name in the main list.
In the *Group* panel:
  Enter *Pipe* in the edit box.
  Press the **Rename** button.

Activity 8.2

Using the model created in Activity 8.1, make sure no part of the model is currently selected.
Click the *Groups* tag in the Control Panel.
Click on the *Ball* group name in the group list.
In the *Group* panel, click **Select.**
Double click on the *Gift* group name in the group list to select it.

Deselect the *Ball* group by double-clicking its entry in the groups list.
Deselect the *Gift* group by double-clicking its entry in the groups list.

Activity 8.3

Using the model created in Activity 8.1, make sure no part of the model is currently selected.
Click the *Model* tag in the Control Panel.
Click the Select button.
In the *Select Options* panel:
  Click on the **Group** button.
In one of the orthogonal viewports, click anywhere within the sphere (this will select the *Ball* group).
Shift + click anywhere within the box (this will select the *Gift* group).

Save the model as *Groups01.ms3d*.

Activity 8.4

Reload *Groups01.ms3d*.
Make sure no part of the model is currently selected.
Click on the *Groups* tag of the Control Panel.
Click on the *Gift* entry in the groups list.
Click the **Hide** button (this hides the faces of the box).
Click the **Hide** button (this will unhide the faces).

Activity 8.5

Start a new Milkshape project.
Press the *Model* tag in the Control Panel.
Press the **Vertex** button.
Create three vertices by clicking in an orthogonal viewport.
Press the **Face** button.
Click the vertices in counterclockwise order to create a face.
Press the *Groups* tag in the Control Panel.
The face is listed as *Triangles* in the group list.

Press the *Model* tag in the Control Panel.
Click **Sphere**.
Drag within an orthogonal viewport to create a sphere (this will create a new group called *Sphere02*).
Press the **Vertex** button.
Create three vertices by clicking in an orthogonal viewport.
Press the **Face** button.
Click the vertices in counterclockwise order to create a face.
Press the *Groups* tag in the Control Panel.
The groups list now contains two entries: *Triangles* and *Sphere02*.
Make sure no part of the model is currently selected.
Double click the *Triangles* entry.
Both triangles will be highlighted. The second triangle has been added to the first entry (*Triangles*) in the groups list.

Press the *Model* tag in the Control Panel.
Press the **Vertex** button.
Create three vertices by clicking in an orthogonal viewport.
Select all three vertices.
Select **Face|Create Face**.
Press the *Groups* tag in the Control Panel.
The groups list now contains three entries: *Triangles*, *Sphere02*, and *Create Face*.

Activity 8.6

Reload *Groups01.ms3d*.
Make sure no part of the model is selected.
Click the *Model* tag in the Control Panel.
Click the **Move** button.
In the *Move Options* panel, make sure the **X**, **Y** and **Z** buttons are pressed.
Click the *Groups* tag in the Control Panel.
Double click the *Ball* entry in the groups list.
Press **Ctrl+D** to duplicate the selected group.
Move the mouse to an orthogonal viewport and drag the duplicated sphere away from the original.
Double click the duplicate's entry in the groups list (probably called *Duplicate01*) to deselect it.
In the *Group* panel:
  Enter the name *Ball2* in the edit box.
  Press **Rename**.
Double click the *Gift* entry in the groups list.
Press **Ctrl+D** to duplicate the selected group.
Move the mouse to an orthogonal viewport and drag the duplicated box away from the original.
Double click the duplicate's entry in the groups list (probably called *Duplicate02*) to deselect it.
In the *Group* panel:
  Enter the name *Gift2* in the edit box.
  Press **Rename**.
Double click the *Pipe* entry in the groups list.
Press **Ctrl+D** to duplicate the selected group.
Move the mouse to an orthogonal viewport and drag the duplicated cylinder away from the original.

Double click the duplicate's entry in the groups list (probably called *Duplicate03)* to deselect it.
In the *Group* panel:
Enter the name *Pipe2* in the edit box.
Press **Rename**.

Resave your model.

Activity 8.7

Reload *Groups01.ms3d*.

The current order of the groups list entries should be:
Ball, Gift, Pipe, Ball2, Gift2, Pipe2

Click the *Groups* tag in the Control Panel.
Click the *Pipe* entry in the groups list.
Press the **Up** button twice to bring *Pipe* to the top of the list.
Click the *Pipe2* entry in the groups list.
Press the **Up** button four times to bring *Pipe2* to position 2 in the list.
Click the *Gift* entry in the groups list.
Press the **Up** button once to bring *Gift* to position 3 in the list.
Click the *Gift*2 entry in the groups list.
Press the **Up** button twice to bring *Gift2* to position 4 in the list.

Resave the model.

Activity 8.8

Start a new Milkshape project.
Create a 6x12 cylinder 4 units high and 2 units in diameter.
Click the *Groups* tab in the Control Panel.
Click on the group name in the group list.
In the *Group* panel:
Enter *Leftside* in the edit box beside the **Rename** button.
Press the **Rename** button.
Press the **Select** button in the *Tools* panel of the model page.
Press **Faces** in the *Select Options* panel.
Uncheck *Ignore Backfaces.*
In the *Front* viewport:
Select the faces on the right-hand side of the cylinder (as seen from your perspective).
Select the *Groups* tag in the Control Panel.
Click the **Regroup** button (this creates a new group for the selected faces).
Enter *Rightside* in the edit box.
Press the **Rename** button.
Select the *Model* tag in the Control Panel.
Check *Ignore Backfaces.*
In the *Top* viewport, select the faces in the top cap of the cylinder.
Select the *Groups* tag in the Control Panel.
Click the **Regroup** button.
Enter *Topcap* in the edit box.
Press the **Rename** button.
Change the viewpoint in the bottom-left viewport from *Top* to *Bottom.*
In the *Bottom* viewport, select the faces in the bottom cap of the cylinder.
Click the **Regroup** button.
Enter *Bottomcap* in the edit box beside the **Rename** button.
Press the **Rename** button.
Return the viewpoint in the bottom-left viewport to *Top.*

Save the model as *Groups02.ms3d*.

Activity 8.9

If necessary, reload the model *Groups02.ms3d.*
Ensure no elements of the model are currently selected.
Click the *Model* tab in the Control Panel.
Press the **Move** button.
Ensure the the **X**,**Y** and **Z** buttons in the *Move Options* panel are all pressed.
Click the *Groups* tab in the Control Panel.
Double click the *Rightside* name in the groups list (this selects the associated faces in the model).
In the *Front* viewport, drag the faces away to the right.
Double click the group name again to deselect the faces.
Double click the *Leftside* name in the groups list.
In the *Front* viewport, drag the faces away to the left.
Double click the group name again to deselect the faces.
Double click the *Topcap* name in the groups list.
In the *Front* viewport, drag the faces away upwards.
Double click the group name again to deselect the faces.
Double click the *Bottomcap* name in the groups list.
In the *Front* viewport, drag the faces away downwards.
Double click the group name again to deselect the faces.

Double click the *Leftside* name in the group list.
Click the *Model* tab in the Control Panel.
Press the **Scale** button.
In the *Scale Options* panel:
Select *Center of Mass.*
Enter 0.5 in the X and Y boxes.
Make sure only the **X** and **Y** buttons are pressed.
Press the **Scale** button.

Resave the model.

Activity 8.10

Start a new Milkshape project.
Create a cube 4 units in each direction.
Press the **Select** button in the *Tools* panel.
Press **Face** in the *Select Options* panel.
Check *Ignore Backfaces.*
In the *Front* viewport:
Select the two faces on the front of the cube.
Click the *Groups* tab in the Control Panel.
Click the **Regroup** button.
Enter *One* in the edit box beside the **Rename** button.
Press the **Rename** button.
Change the top-left's viewport from *Front* to *Back*
In the *Back* viewport, select the two faces showing.
Click the **Regroup** button.
Enter *Six* in the edit box.
Press the **Rename** button.
Reset the top-left viewport to *Front* view.
In the *Left* viewport, select the two faces showing.
Click the **Regroup** button.
Enter *Two* in the edit box.
Press the **Rename** button.
Change the top-right's viewport from *Left* to *Right.*
In the *Right* viewport, select the two faces showing.
Click the **Regroup** button.
Enter *Five* in the edit box.
Press the **Rename** button.

Reset the top-right viewport to *Left* view.
In the *Top* viewport, select the two faces showing.
Click the **Regroup** button.
Enter *Three* in the edit box.
Press the **Rename** button.
Change the bottom-left's viewport from *Top* to *Bottom.*
In the *Bottom* viewport, select the two faces showing.
Click the **Regroup** button.
Enter *Four* in the edit box.
Press the **Rename** button.
Reset the bottom-left viewport to *Bottom* view.

Save the model as *Dice.ms3d*

Activity 8.11

Reload the model *Groups02.ms3d*.
Select all the faces within the model.
On the *Groups* page of the Control Panel:
    Press the **Regroup** button.
    Enter *Splitcylinder* as the group name.
    Press **Rename.**
Make sure the complete model is still selected.
On the *Model* page of the Control Panel:
    Press **Rotate.**
    In the *Rotate Options* panel:
        Select *Center of Mass.*
        Enter 90 in the Z box.
        Make sure only the **Z** button is pressed.
        Press **Rotate.**

Activity 8.12

Start a new Milkshape project.
Create 6x12 closed cylinder 4 units high and 2 units in diameter.
In the 3D viewport, select **Colored Smoothing Groups** from the pop-up menu.
From the colours displayed, we can see that there are two smoothing groups. The side of the cylinder forms one group; the two caps form the other.

Uncheck **Colored Smoothing Groups** from the 3D viewport's pop-up menu.

Activity 8.13

Make sure no part of the cylinder is selected.
In the 3D viewport, select **Colored Smoothing Groups** from the pop-up menu.
In the *Groups* page of the Control Panel:
    In the *Smoothing Groups* panel:
        Press **Select.**
        Press **1.**
The faces and vertices within the side of the cylinder are selected.
    In the *Smoothing Groups* panel:
        Press **2.**
The elements in the two caps are selected (and the faces in the side of the cylinder are deselected).
When button **3** is pressed, no elements in the cylinder are selected since the cylinder contains only two smoothing groups.

Delete the cylinder.

Create a cube 4 units in each direction.

The cube contains 3 smoothing groups (this can be seen from the colour coding in the 3D viewport).

Select each group by pressing **Select** then the **1**, **2** and **3** buttons in the *Smoothing Groups* panel.

Delete the cube from the model.

Create a sphere.

A sphere contains only a single smoothing group (it appears as a single colour).

Uncheck **Colored Smoothing Groups** from the 3D viewport's pop-up menu.

Activity 8.14

Start a new Milkshape project.
In the 3D viewport, select **Colored Smoothing Groups** from the pop-up menu.
Add a cylinder.
Add a box.
Add a sphere.

There are three different smoothing groups (we can see the three different colours in the 3D viewport).

The sphere's surface shows a single colour so it has only one smoothing group.

Activity 8.15

Start a new Milkshape project.
Create a cube 6 units in each direction.
In the *Groups* page of the Control Panel:
    In the *Smoothing Groups* panel:
        Ensure *Auto Smooth* is checked.
        Press **Clear All**.
In the 3D viewport:
    Ensure the **Smooth Shading** option is selected and that
        Colored Smoothing Groups is deselected.
    The cube shows unrealistic shading particularly
        on the corners of the cube.

Activity 8.16

Using the previous model...
In the *Tools* panel of the *Model* page, press the **Select** button and make sure *Ignore Backfaces* is unchecked.
In the *Front* viewport select the visible faces (front and back).
In the *Groups* page of the Control Panel:
    Press **Assign** in the *Smoothing Groups* panel.
    Press **2**.
In the *Left* viewport select the visible faces (front and back).
In the *Groups* page of the Control Panel:
    Press **Assign** in the *Smoothing Groups*

panel.
Press **3**.
There are now three smoothing groups in the cube. We can check this using the **Colored Smoothing Groups** from the 3D viewport's pop-up menu.

Activity 8.17

Load *Fin.ms3d.*

Shading on the fin looks unrealistic where the curved surface meets the flat side of the new faces we added.

There is only one smoothing group in the model.

Activity 8.18

Load *Fin.ms3d.*
Select **Tools|Selection Editor**.
In the dialog box:
Ensure the *Shaded* and *Model Outline* icons are pressed.
Press the *Rotate* icon and move the faces of the longest flat surface into view.
Click on the *Select* icon and the *Face Selector Mode* icon.
Click on the first face on the flat surface.
Hold down the *Shift* key and click on the remaining faces of the flat surface.
Press the **Save** button.
In the *Groups* page of the Control Panel:
In the *Smoothing Groups* panel:
Ensure *Auto Smooth* is selected.
Press **Assign.**
Press **2.**
Select **Tools|Selection Editor**.
In the dialog box:
Press the *Rotate* icon and move the faces of the shortest flat surface into view.
Click on the *Select* icon and the *Face Selector Mode* icon.
Click on the first face on the flat surface.
Hold down the *Shift* key and click on the remaining faces of the flat surface.
Press the **Save** button.
In the *Groups* page of the Control Panel:
In the *Smoothing Groups* panel:
Ensure *Auto Smooth* is selected.
Press **Assign.**
Press **3.**

With the two flat surfaces being allocated their own smoothing groups, the model now displays realistic shading on its surface.

Resave the model.

Activity 8.19

Load *Extrude01.ms3d.*
In the 3D viewport, select **Colored Smoothing Groups** from the pop-up menu.
In the *Model* page, click **Select**.
In the *Select Options* panel:
Click **Face**.
Ensure *Ignore Backfaces* is unchecked.
From the *Front* viewport, select all the polygons facing outward (the corresponding polygons at the back of the model will also be selected).
Select the *Groups* page in the Control Panel.
Assign the selected faces to smoothing group 1.
Have a look at the model in the 3D viewport. The front and back surfaces should be yellow, the top and bottom should be cyan, and the two end faces should be magenta.
If this is not yet the case, then perform the following additional instructions:

Select the forward facing polygons from the *Top* viewport.
Assign these faces to smoothing group 2.
Select the front and back ends of the model from the *Left* viewport.
Assign these faces to smoothing group 3.

Switch off **Colored Smoothing Groups** in the 3D viewport and check the updated shading effects shown on your model.

Save the model.

Activity 8.20

Start a new Milkshape project.
Create a 1x4 closed cylinder 6 units high and 1 unit in diameter.
The shading on the side corners of the object does not look realistic.
Select **Colored Smoothing Groups** from the 3D view's pop-up menu.
The object uses 2 smoothing groups: one for all four long sides, another for the smaller ends.
In the *Front* viewport, select the polygons of the forward-facing side and the opposite back-facing side.
In the *Groups* page of the Control Panel, assign these to smoothing group 3.
The object now uses 3 smoothing groups.
Switch off **Colored Smoothing Groups**.
The object now has the correct shading.