Silhouette ModelMaker™

silhouette

Silhouette ModelMaker™

Section 1: Basics

Overview

Digital Cutting Machines for Schools

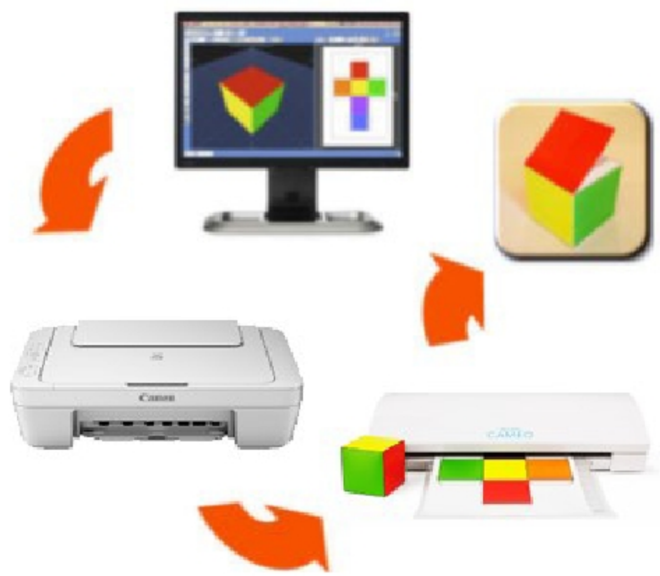
Silhouette ModelMaker™ educational software enables students to design and manufacture models from 3D shapes like cubes, cones, prisms, and pyramids to make boxes and simple models like buildings and space rockets. It gives students a hands-on design and making experience, which enriches Science, Technology, Engineering, and Math in STEM education. It can provide students a simplified taste of real world engineering and commerce scenarios.

Silhouette ModelMaker™ gives pupils the chance to be thinkers, planners, problem solvers, designers, inventors, mathematicians, and engineers!

Design it. Design a 3D shape on the computer with Silhouette ModelMaker and display its geometric net, which is an unfolded, segmented version of the 3D shape.

Print it. Print the geometric net generated by Silhouette ModelMaker on cardstock using a photo quality printer.

Make it. The printed geometric net is processed by a Silhouette cutting machine, which scores, perforates, and cuts the net to form fold and cut lines. The trimmed net is then used to build the model.

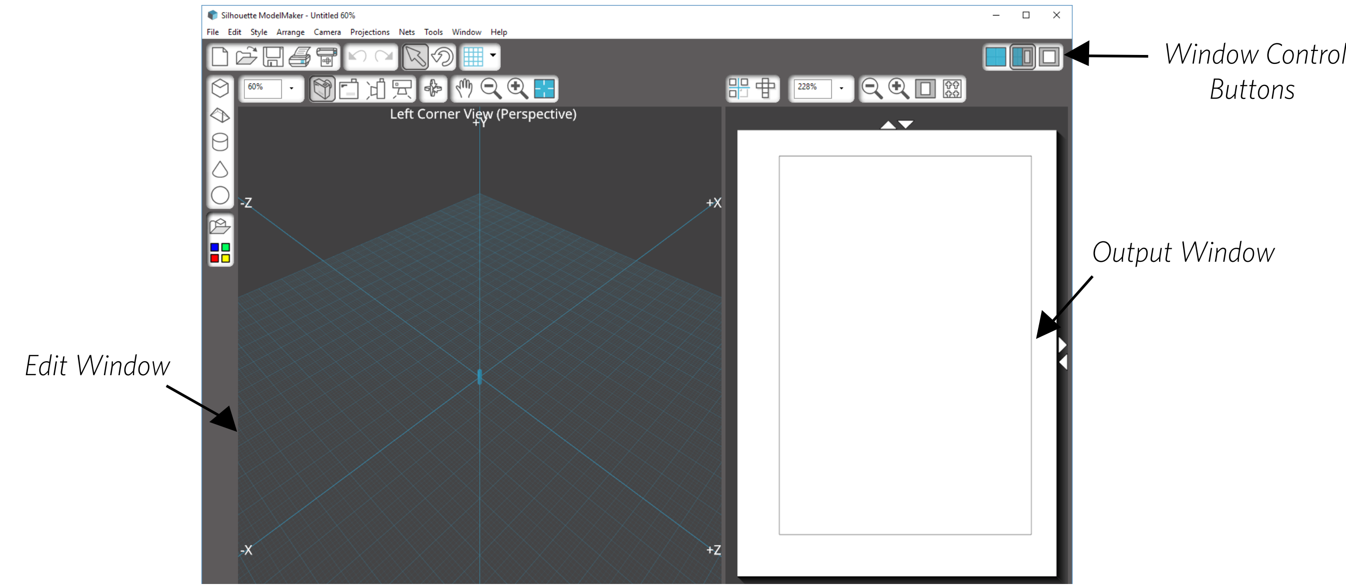


Design it, Print it, and Make it!

A Tour of Silhouette ModelMaker™

Silhouette ModelMaker™ Main Screen

The main screen of ModelMaker is divided into two parts: the Edit Window and Output Window. These are separated by a bar which can be dragged to adjust their relative sizes.



Silhouette ModelMaker main screen showing the basic tools layout

Edit Window

3D shapes are drawn and edited in the Edit Window. This works in a similar way to most standard vector packages, but in three dimensions. Shapes can be created by selecting a shape tool and then drawing the shape. They can be dragged onto the screen from a selection of shapes, or they can be defined using a wizard and typing in the dimensions.

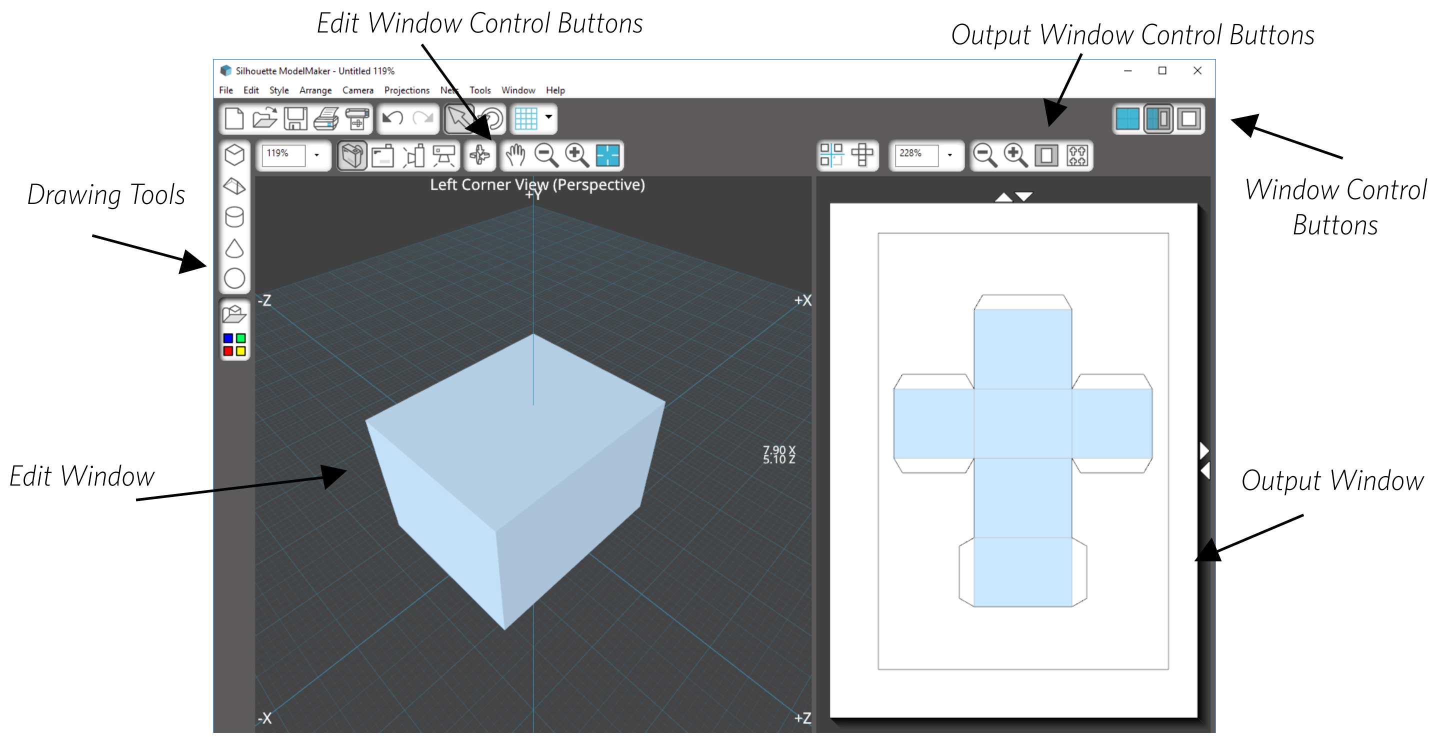
Output Window

The Output Window can display either nets of shapes created in the Edit Window, or 1st angle, 3rd angle, or single view Projections. It's called the Output Window because what you see in this window is what gets output to the printer or Silhouette machine. The Output Window acts like a print preview, allowing the user to place shapes as they will appear on the printout.

Switching between the windows

The bar separating the Edit and Output Windows can be moved to allocate more space to one and less to the other. Alternatively, three buttons are provided to switch between Edit Window only, both Edit and Output Windows, and Output Window only modes. These icons are mirrored by the options in the Window menu.

The main screen can be displayed with a basic, intermediate or advanced toolbar layout, selected using the dropdown Tools menu. An overview of the main screen with all the toolbar buttons is illustrated below.

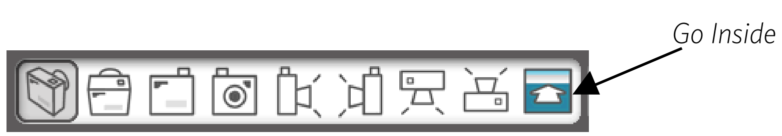


Silhouette ModelMaker main screen showing the advanced tools layout

Edit Window

All shape drawing and editing is done in the Edit Window. The window provides a 3D space to lay the shapes out, move them around, rotate, stretch and scale them. There are three visible axes and a grid to help position all the shapes in the right place. They can be grouped, cloned, colored, and rendered with pictures.

The default view for the Edit Window is the Left Corner View, and camera buttons allow the view to be changed to the top, front and right side views. Other camera views are available in the camera menu and can also be displayed permanently by setting them in preferences.

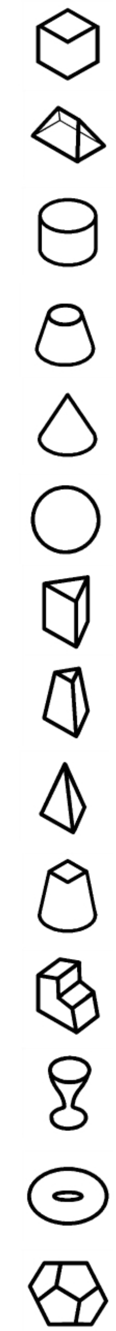


All the Edit Window camera view buttons

The green button on the right takes the user inside the 3D model, transforming it into a virtual where the user can walk around and see all the different parts of the design close-up.

Shapes in Silhouette ModelMaker™

The Shapes Toolbar to the left of the Edit Window contains a button for each type of shape.



**Use the drop-down menu to choose shape of polygon.*

Drawing Shapes

Silhouette ModelMaker™ uses 3D shapes to design models on the screen. Either a single shape can be drawn and manipulated, or lots of different shapes can be combined to make a more complex 3D model.

This model of a Saturn V rocket was drawn using mainly cylinder shapes with images placed onto them. The command module and the engines were drawn using the frustum of cone shape.

Saturn V Rocket

> **Quick Tip**
>
> Some of the shapes have a drop down menu revealing other variants of the shape that can be selected to draw.

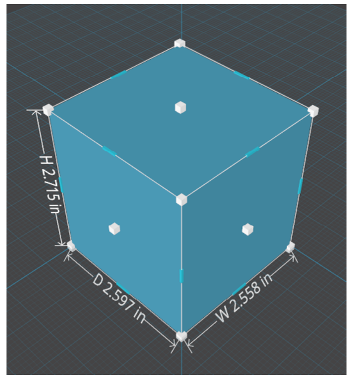
Silhouette ModelMaker™

Section 2: Drawing Shapes

Shapes can be drawn in three ways:

- Select a shape tool and draw it with the mouse.
- Drag a library shape on to the screen.
- Use the shape wizard and type in dimensions.

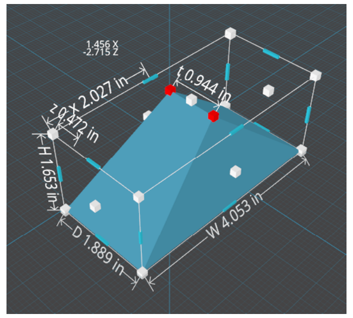
Cuboid



Drawing a cuboid shape:

Select the cuboid tool. Click on the screen to set a corner point of the base. Then drag the mouse to draw out the base, and click to set the base. Drag the mouse again, upwards or downwards, to give the cuboid height, or its third dimension. Click to finish.

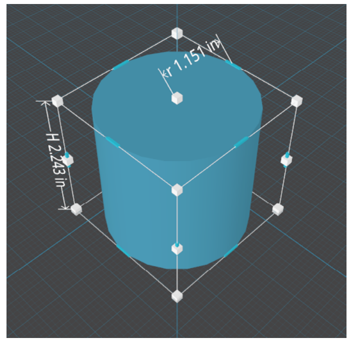
Wedge



Drawing a wedge shape:

Select the wedge tool. Click on the screen to set a corner point of its base. Then drag the mouse to draw out the base and click to set it. Drag the mouse again, upwards or downwards, to give the wedge height. Click to finish. When the wedge is selected, as shown in the illustration, two red control handles are displayed on top of the wedge. Use these handles to adjust the pitch of the sides of the shape.

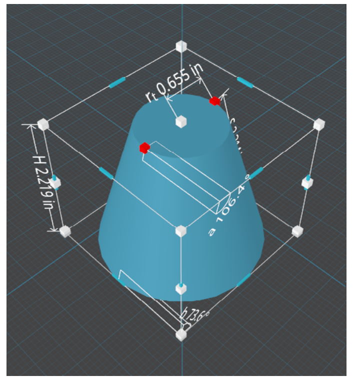
Cylinder



Drawing a cylinder shape:

Select the cylinder tool. Click on the screen to start drawing its base. Drag the mouse to draw out the base, and then click to set the base. Drag the mouse again, upwards or downwards, to give the cylinder height. Click to finish.

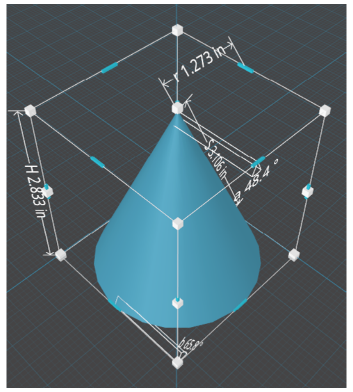
Frustum of a Cone



Drawing a frustum of a cone shape:

Select the frustum of a cone tool. Click on the screen to start drawing its base. Drag the mouse to draw the base, and click to set the base. Drag the mouse upwards to give the shape height, and click to set the height. Then drag the mouse again to set the diameter of the top face. Click to finish.

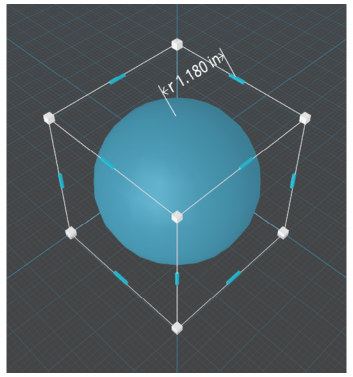
Cone



Drawing a cone shape:

Select the cone tool. Click on the screen to start drawing its base. Drag the mouse to draw out the base diameter, and click to set the base. Then drag the mouse upwards to give the cone height, which is its third dimension. Click to finish.

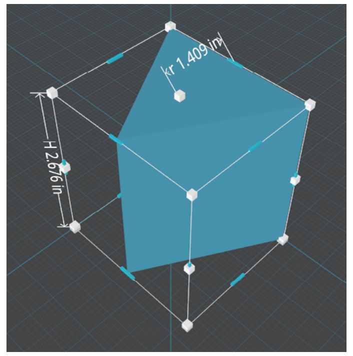
Sphere



Drawing a sphere shape:

Select the sphere tool and click on the screen to start drawing. Drag the mouse to draw out its diameter. Click to finish.

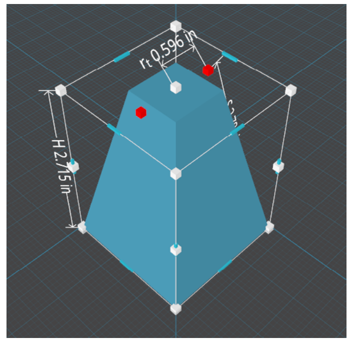
Regular



Drawing a regular prism shape:

Select the regular prism tool. Click on the screen to start drawing its base. Drag the mouse to draw out the base, and click to set it. Then drag the mouse upwards to give the prism height. Click to finish. Use the dropdown menu on the prism tool to choose the number of sides to the end faces.

Frustum of a Pyramid



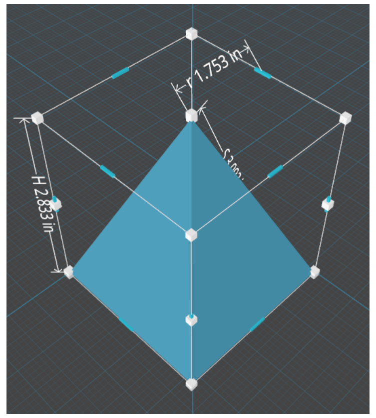
Drawing a frustum of a pyramid shape:

Select the frustum of a pyramid tool. Click on the screen to start drawing the base. Drag the mouse to draw out the base, and click to set it. Then drag the mouse upwards to give the pyramid height. Click to finish.

When the frustum of a pyramid is selected, as shown in the illustration, two red control handles are displayed on top of the wedge. Use these handles to adjust the pitch of the sides of the shape. Use the dropdown menu on the pyramid tool to choose the number of sides to the top and base.

Drawing a pyramid shape:

Select the pyramid tool. Click on the screen to start drawing its base. Drag the mouse to draw out the base, and click to set it. Then drag the mouse upwards to give the pyramid height. Click to finish. Use the dropdown menu on the pyramid tool to choose the number of sides to the top and base.

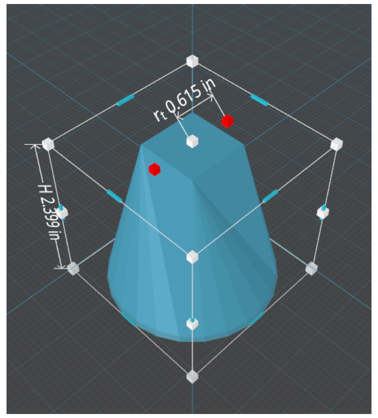


Pyramid

Drawing a transition shape:

Select the transition tool. Click on the screen to start drawing its base. Drag the mouse to draw out the base, and click to set it. Drag the mouse upwards to give the transition piece height. Click to finish.

A drop down menu for the transition tool provides options to create a transition shape with different end faces. For example, choose to draw a shape with a square face at one end and a pentagonal base at the other end.

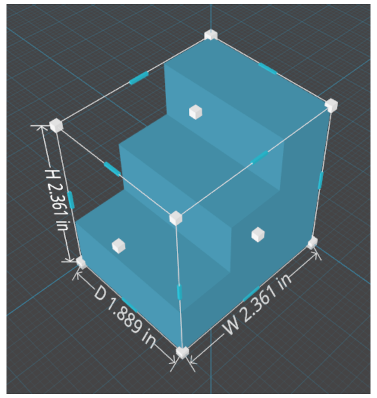


Transition

Drawing an irregular prism shape:

Select the irregular prism tool. Click on the screen to set a corner point of the base. Drag the mouse to draw out the base, and click to set it. Then drag the mouse upwards to give the cuboid height. At this point, the prism looks like a cuboid shape.

ModelMaker then animates the shape to position its end face square on to the viewer, ready for editing. Use the mouse to add points to the shape by clicking on the white perimeter line. Move points with the mouse to create the desired shape, like a staircase. Click the FINISH button in the pop-up toolbar.

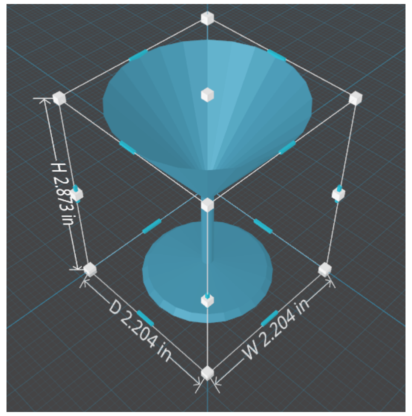


Irregular Prism

Drawing a rotational shape:

Select the rotational tool. Click on the screen to start drawing its base. Drag the mouse to draw out the diameter and click to set it. Drag the mouse upwards to give the shape height. Click to finish.

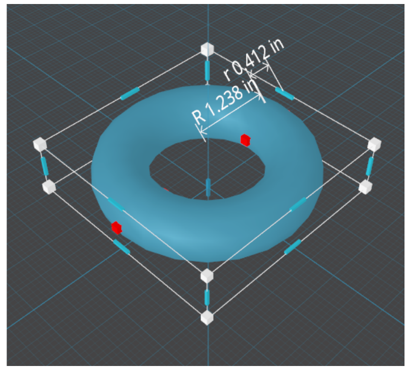
At this point, the shape looks like a cylinder. ModelMaker then animates the shape to position its side view square on to the viewer, ready for editing. Use the mouse to add points to the shape by clicking on the white perimeter line. Move points with the mouse to create the desired shape, like a wine glass. Click the FINISH button in the pop-up toolbar.



Rotational Shape

Drawing a torus shape:

Select the torus tool. Click on the screen to start drawing. Drag the mouse to draw out the diameter. Click to finish. When the torus is selected, as shown in the illustration, two red control handles are displayed on inner radius of the shape. Use these handles to adjust the diameter of the cross section of the torus.

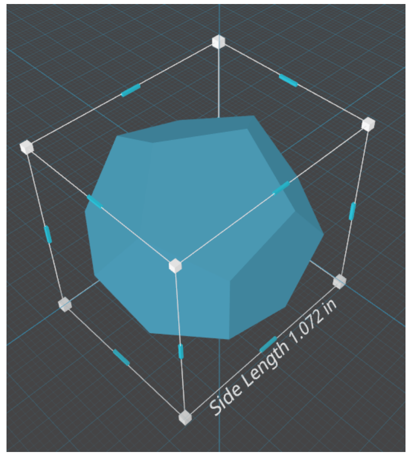


Torus

Drawing a platonic solid shape:

Select the platonic shape tool. Click on the screen to start drawing the default shape, a dodecahedron. Drag the mouse to draw out its diameter. Click to finish.

Use the dropdown menu on the platonic shape tool to choose the number from any of the five platonic solids to draw: dodecahedron, tetrahedron, hexahedron, octahedron, or icosahedron.



Dodecahedron

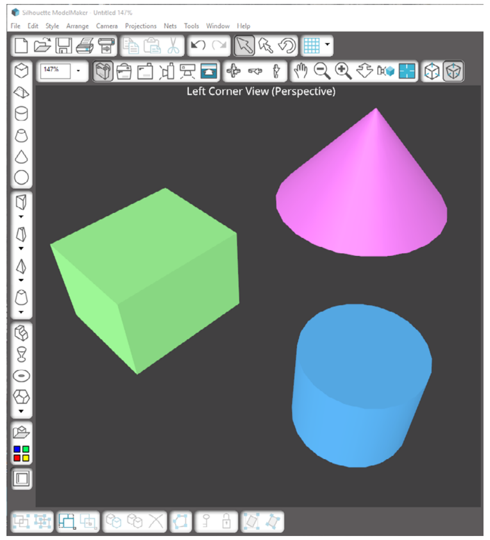
Quick Tip

Keep the shapes small. When learning ModelMaker it is best to keep the shapes quite small, around two inches wide. It is much easier to see what is happening and the shape NET will fit on a single page.

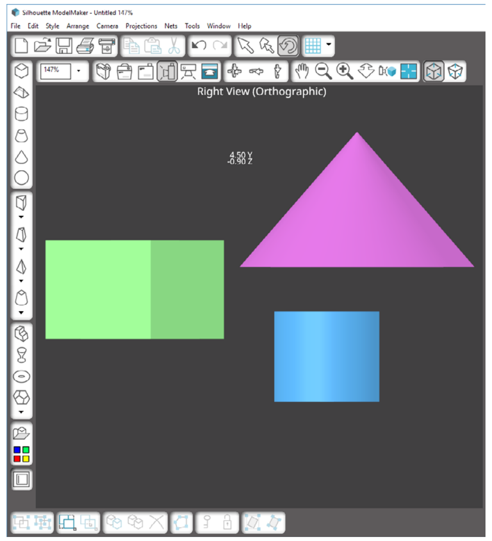
Section 3: Drawing in 3D

We live in a 3D world with width, height, and depth dimensions. Drawings created in Modelmaker are also in 3D. It can be inconvenient the that the computer screen only has two dimensions. It has a width dimension and a height dimension, but it doesn't have a depth dimension. The fact that the screen is 2D presents a hurdle in our efforts to draw a 3D model. ModelMaker helps to overcome the lack of real depth on the screen by drawing in a world with virtual depth. In this world, models are drawn with their dimensions adjusted to show perspective, so the dimensions at the rear of the model are smaller than those at the front. Also, models that are drawn towards the rear of the screen are smaller.

This method of drawing combines to give the appearance of a 3D dimensional space to work within. Think of the railway track effect in the real world. Imagine standing on a railway track and looking along the track into the distance. The part of the track closest is wide, but the track in the distance is narrow. Yet we all know that the real dimensions of the track are the same, whether close or far away. ModelMaker mimics this effect to give the illusion of a 3D world.



A drawing with three shapes on a flat plane?



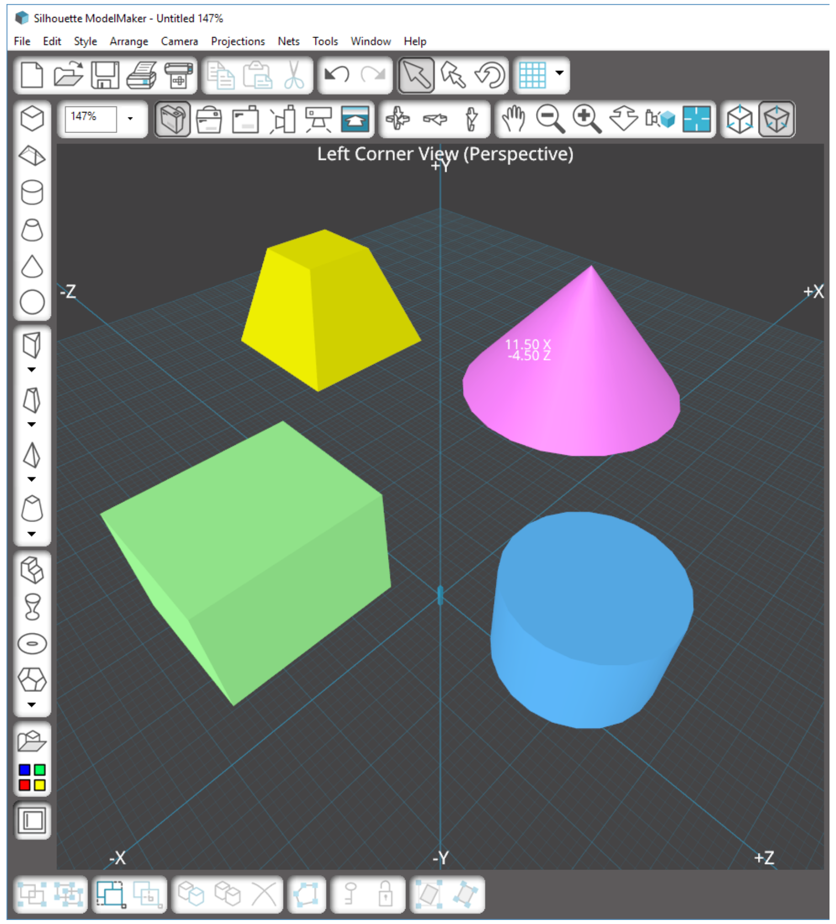
The same drawing looking from the side

Creating this illusion of a 3D space is just a part of the story. When placing 3D shapes on to the 2D screen, it is impossible to accurately gage exactly where to put the shape. Look at the illustrations above. In the left-hand drawing, the user has intended to draw three shapes on a flat and level plane. The right-hand drawing shows the same model from the side view. See how all the shapes are at different heights?

To help overcome this problem and to make 3D drawing easy and more intuitive, ModelMaker uses techniques to seamlessly guide the user when drawing 3D models. The first of these aids is the solid grid in the default drawing window. The grid acts as a floor for 3D shapes.

Silhouette ModelMaker™

The default Edit Window shows a view of the drawing area looking down from the left corner. In this view, the grid provides a solid floor and all the shapes drawn in this view are automatically drawn on the floor. They can be moved afterwards, but they are initially drawn on the floor.



When the grid is displayed in the default drawing view, it acts as a solid floor for newly drawn shapes.

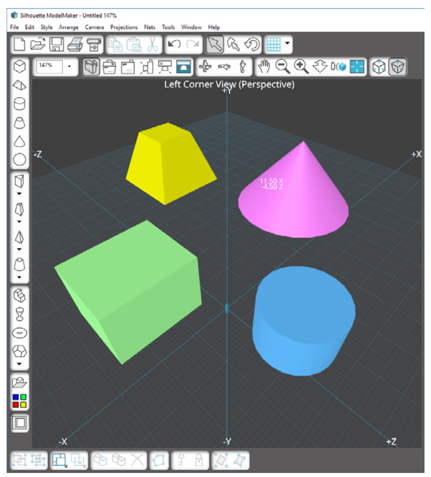
Once a shape has been drawn on the floor, it will remain on the floor even when moving it around the screen. This makes it really easy to build models when combining lots of shapes.

To help further, the grid can be locked so that shapes snap to the squares. The dimensions and number of grid squares can be adjusted to suit different preferences. For example, the default grid might comprise of 1 inch squares divided up into sixty-four (8 x 8) smaller squares. But if all the shapes get drawn on the solid grid floor, what happens if one wants to place shapes on top of others? In this case, if ModelMaker detects that a shape is being drawn on top of another shape, it will cause the existing shape to become the "floor".

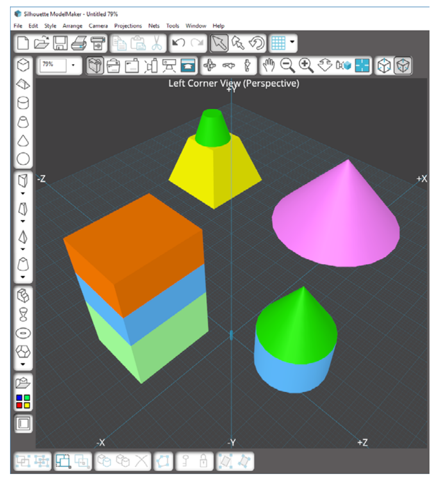
Silhouette ModelMaker™

The illustration on the left shows 3D shapes sitting on the floor. These shapes can be moved around, but they will stay on the floor. They can, of course, be moved in the Y axis by using special grab handles to move the shape directly up or down.

The illustration on the right shows shapes drawn on top of each other. In this case, ModelMaker detects when a shape is going to be drawn on top of another and causes the existing shape to become the floor for the new shape. Once the top shape is drawn, the height at which it sits acts as the floor for that particular shape throughout the whole 3D space. The height of the shape is easily changed using grab handles.

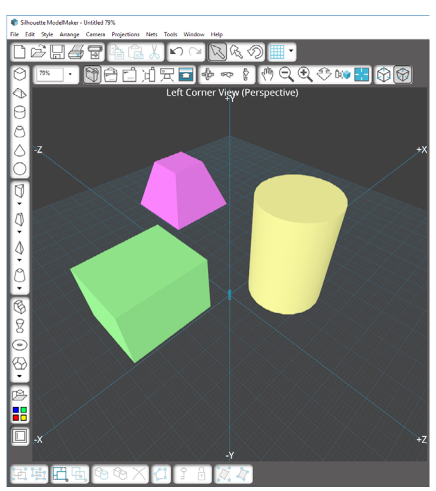


3D shapes on the grid floor

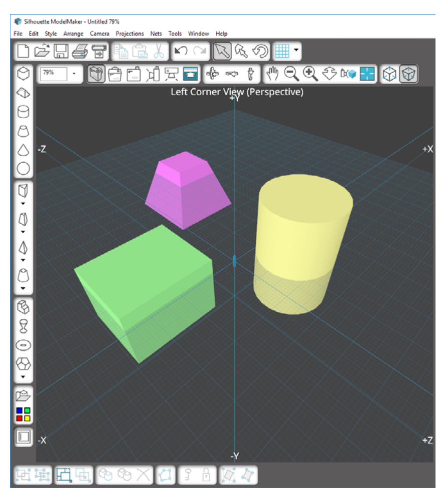


3D shapes on top of each other

The grid presents itself as a solid floor, but that doesn't mean that the floor is always in the same place. In the illustration above, the top of an existing shape became the floor. In the illustrations below, a blue grab handle at the center of the grid is being used to change its height and thus the height of the floor for the next shape being drawn.



3D shapes on the grid floor

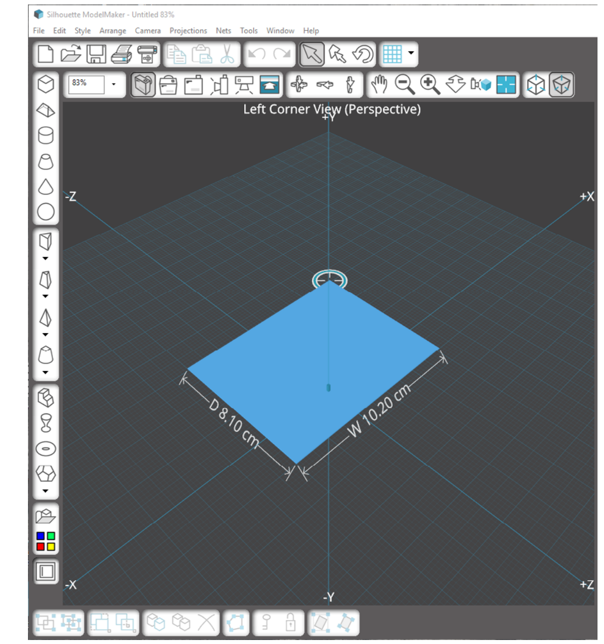


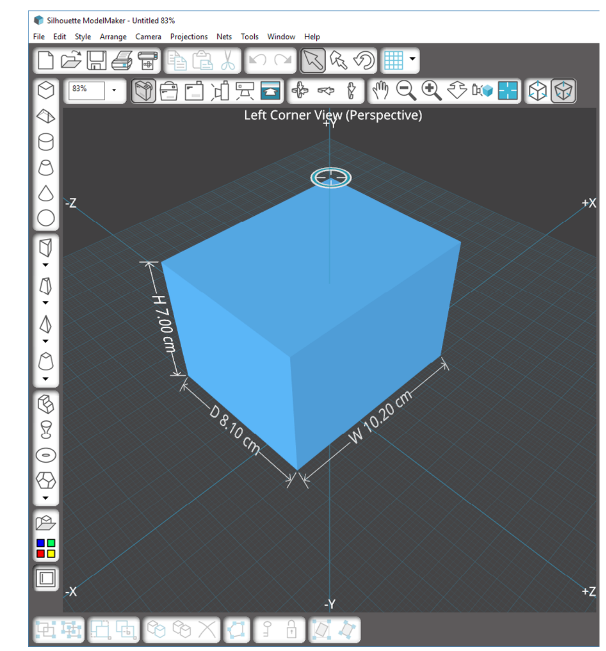
The grid floor adjusted to a new height, becoming the floor for the next shape to be drawn

Quick Tip

How-to draw a cuboid shape.

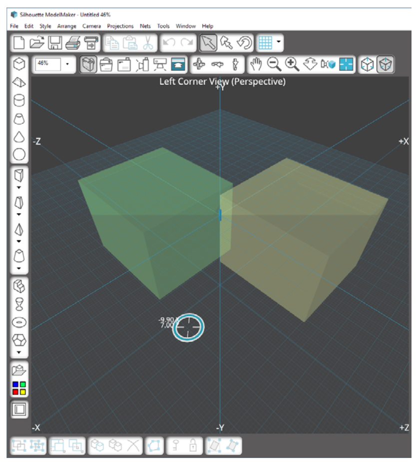
1. Select the cuboid shape tool.
2. Click to set the corner of the cuboid.
3. Drag the mouse to draw the base of the cuboid.
4. Click to finish drawing the base.
5. Drag the mouse up to draw the height.
6. Click to finish.



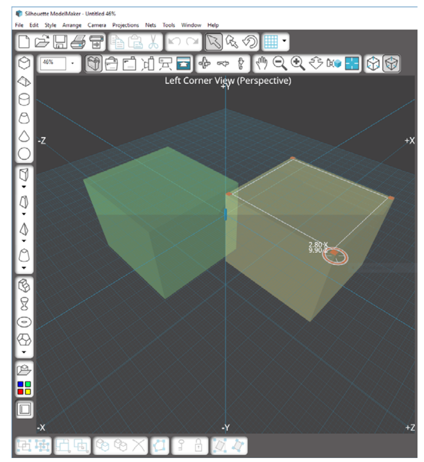


The illustrations below show what the mouse cursor looks like when drawing a shape. In the left-hand illustration, the mouse cursor is blue and a shape is about to be drawn on the floor. In the right-hand illustration, the mouse cursor has been moved so that it hovers over a shape. In this case, a set of guides has appeared on top of the shape.

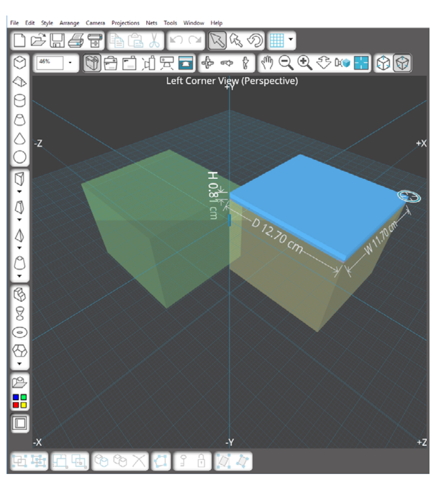
When the mouse cursor turns orange, it indicates that any point drawn with a click of the mouse will snap to a logical point on the shape below. A logical point might be the corner, middle, or the center of a side. When the cursor is blue, one can choose a position to click and draw. When a new shape is being drawn, all the existing shapes become transparent, which helps to see what is happening during construction of the new shape.



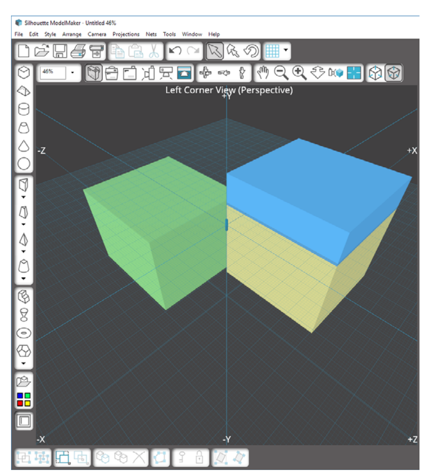
A new shape is about to be drawn on the grid floor



A new shape is about to be drawn on top of an existing shape



The base of the new shape is being drawn (click to drag)



Drag the mouse up and click to complete the shape on top of an existing one

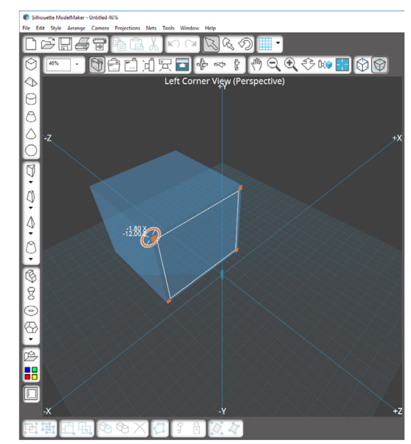
In the same way that ModelMaker will detect when the mouse is on top of an existing shape and will display drawing guides to help draw the new shape on top of it, similar guides are displayed when the mouse is hovering by the side of an existing shape.

These illustrations show the sequence of events when the mouse hovers close to the side of an existing shape. In this case, guides are displayed and the cursor has turned orange, which means that the first click will snap the corner of the new shape to the corner of the existing one.

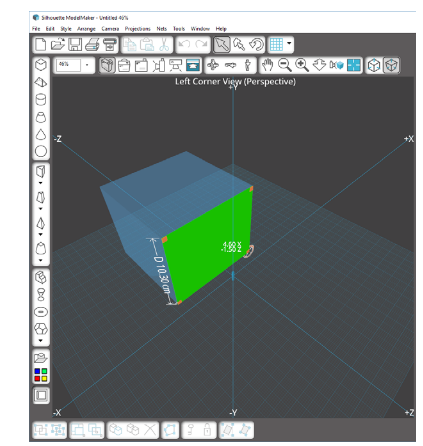
__Quick Tip__

Draw a shape adjoined to another in the front view.

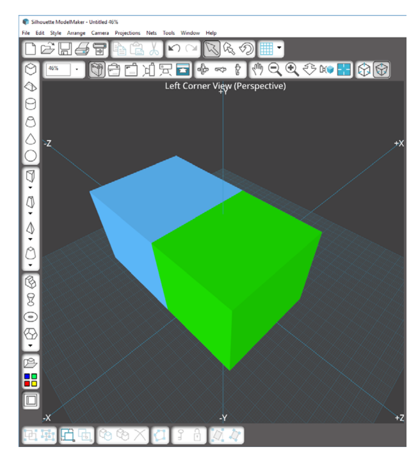
1. Select the Edit Window front view camera.
2. Click to set the corner of the shape.
3. Drag mouse to draw the front face.
4. Click to finish front face.
5. Edit Window rotates to show side view.
6. Drag mouse to draw side face.
7. Click to finish drawing side face.
8. Edit Window reverts back to the front view.



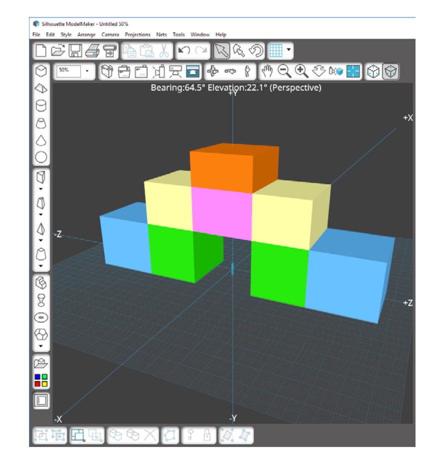
When the mouse is close to the side of a shape, guides are displayed to help draw the new shape attached to the side of the existing one.



The side of the new shape is drawn (click drag click).



The new shape is complete (drag click) and the two shapes are joined exactly together.



It's easy to draw shapes joined together in this virtual 3D world.

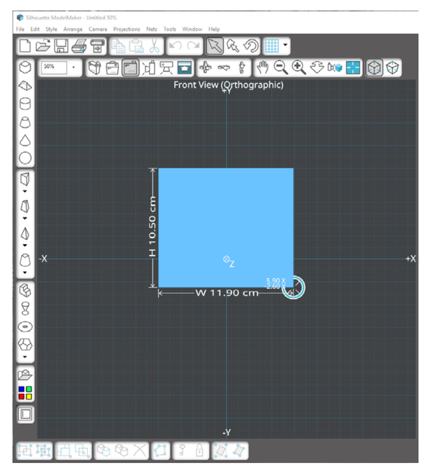
Section 4: Drawing in Different Views

Drawing in Front, Side, Top, or Bottom Views

When ModelMaker displays the default view, looking down at the model from the left corner, the grid will act as a floor making it easy to draw shapes in 3D and combine them to make models. But when the Edit Window is in the front, side, top, or bottom views, it is impossible to visualize where the grid is in terms of how far or close it is to the viewer. In a corner view where one can see shapes sitting on the grid, it is easy to move them around and to draw new shapes. But, in the front view, while it is easy to draw a shape with width and height (a 2D shape), is not possible, by eye, to draw and accurate depth dimension.

Drawing 3D shapes in the front view

When drawing in the front view, ModelMaker switches automatically to a different method of drawing shapes, allowing the user to draw a 3D shape and place it exactly in the desired place. This requires more skill than drawing shapes on the grid floor, but it does provide an accurate method to draw and place shapes at exact coordinates in 3D space and to draw shapes next to existing ones.

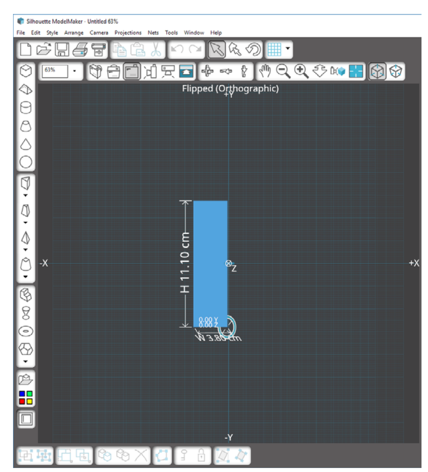


Click and drag the mouse to draw the front face of the shape, then click to finish the face.

The process to draw shapes when the Edit Window shows the front view is a two stage process:

1. Draw the front face of the shape. When drawing a cuboid, click to set the first point, then drag the mouse and click to complete the front face. At this point, the entire Edit Window rotates to show the side view of the model. The "side view" of the front face just drawn is on the mouse cursor.

2. Draw the side of the shape. Without touching any of the mouse buttons, move the mouse to position the "side view" of the front face in the desired place and click to set its position. Dragging the mouse will then draw the side view of the shape, giving it depth. Click to finish. The Edit Window reverts back to the front view. The shape just drawn still looks like a flat 2D shape when looking at it from the front view, but one can select another view by clicking different camera buttons to see the 3D shape that's been drawn.

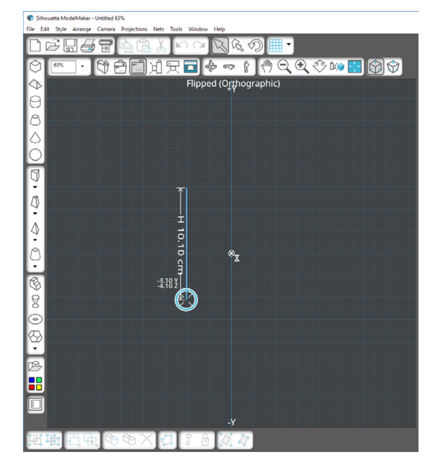


Edit Window rotating from the front view to the side view.

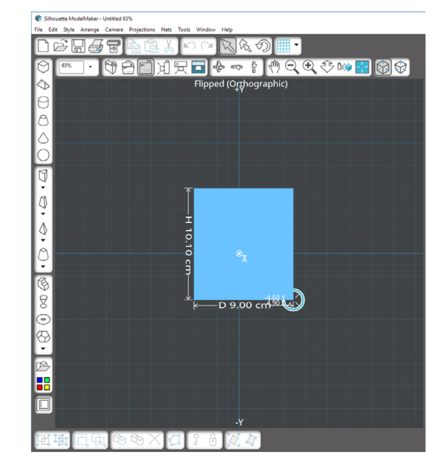
Once the front face of the shape has been drawn, (by clicking to set the first corner, dragging the mouse to form the size of the front face, and then clicking to finish) the entire Edit Window will automatically rotate to display the side view of the model. It rotates quite slowly to make it easy to see what is happening.

If there are any other shapes in the model when the new shape is being drawn, these shapes will become transparent making it easier to see the shape that is in the process of being drawn. Once the front face has been drawn and the Edit Window has rotated to display the side view, the "side view" of the front face will remain on the mouse cursor. The "side view" of the front face can then be moved back and forth by moving the mouse, and it can be placed in the desired position by clicking.

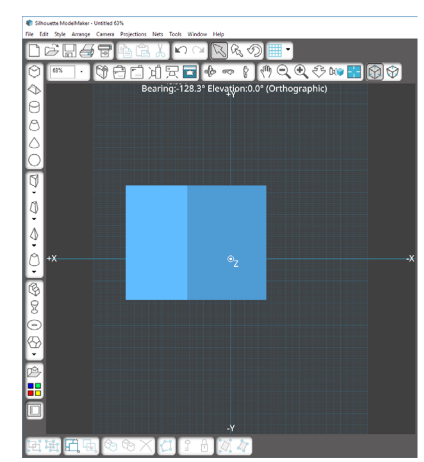
Having set the "side view" of the front face in position, dragging the mouse will draw the side view of the shape, giving it depth. Click to finish. The Edit Window rotates from the side view back to the front view, and the shape is complete.



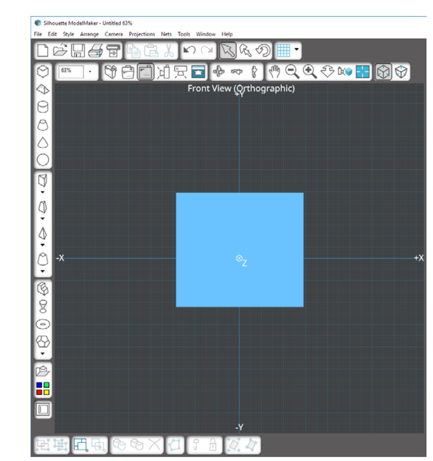
Edit Window showing the "side view" of the front face, looking like a vertical line.



The "side view" of the front face is set in place by clicking, then the face dragged out to complete the shape.



Edit Window rotating between the side



Back in the front view showing the completed 3D shape from the front

When the Edit Window is showing the front view, one can draw shapes by drawing the front face and then drawing the side face after the window has rotated to show the side view.

When there are already shapes in the scene, new shapes drawn will attach to existing ones. The process is similar to that used when drawing on top of shapes that are sitting on the grid floor. When ModelMaker detects the mouse hovering in front of an existing shape, a set of drawing guides will be displayed on the front of the existing shape. Any shape drawn while these guides are visible will be drawn joined onto that shape. Hot spots on the guides are identified by the mouse cursor changing color to orange.

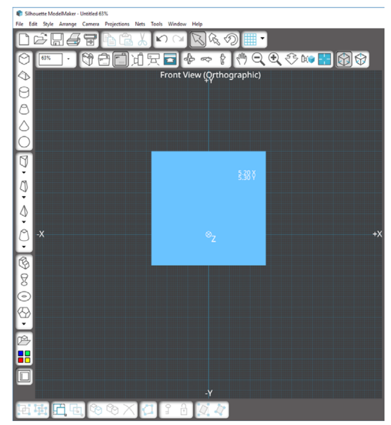
Clicking the mouse when the cursor is orange will set the corner of the new shape and snap it to the corresponding place on the existing shape. Using the hot spots makes it easy to draw shapes while accurately butting them against existing ones.

Quick Tip

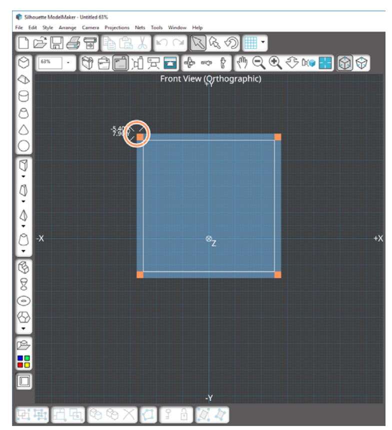
Draw a shape adjoined to another in the front view.

Assumes that a shape, a cuboid for example, already exists in the Edit Window.

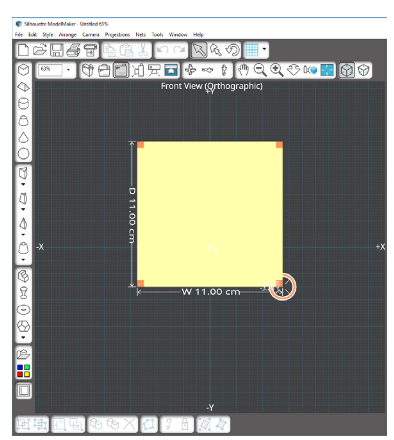
1. Select the Edit Window front view camera.
2. Hover the mouse over the shape to reveal guides.
3. Click on one of the hot spots (cursor is orange).
4. Drag mouse to draw the front face.
5. Click to finish front face.
6. Edit Window rotates to show side view.
7. Drag mouse to draw side face.
8. Click to finish drawing side face.
9. Edit Window reverts back to the front view.



Front view of an existing 3D shape in the Edit Window



When the mouse hovers in front of the shape a new set of guides is displayed.



Click drag and click again to draw the front face of the new shape.

Summary of the two drawing methods

The process for drawing shapes when the Edit Window is displaying the front view is a two stage process, described in the previous few pages. First one draws the front face. Then the window is automatically rotated to show the "side view" of the front face. Then, the side of the shape is drawn using mouse to complete the shape.

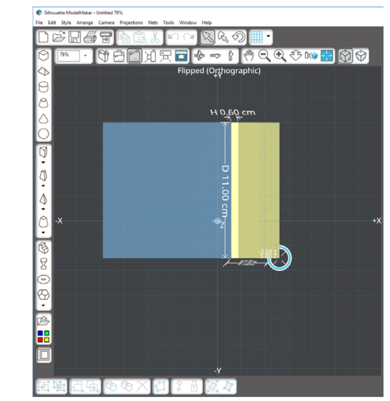
This method for drawing 3D shapes is also used when the Edit Window is set to display the side view, top view, or the bottom view of the model.

When the Edit Window is displaying a corner view, where one is looking down at the 3D model, ModelMaker uses a simple process to draw 3D shapes by using the grid as a floor.

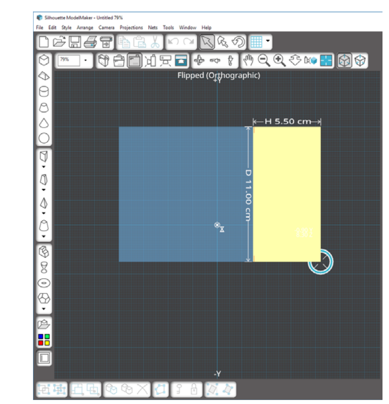
Quick Tip

When drawing a shape on top of or next to another shape, ModelMaker displays drawing guides.

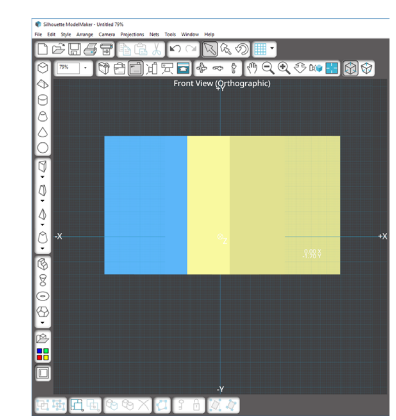
Hot Spots are revealed when the cursor turns orange. Clicking this hot spot will snap that part of the new shape to the existing one. This makes it easy to join shapes together accurately.



Edit Window rotating from the front view to the side view.



The "side view" of the front face of the shape being drawn.



Edit Window rotating from the side view back to the front view.

Silhouette ModelMaker™

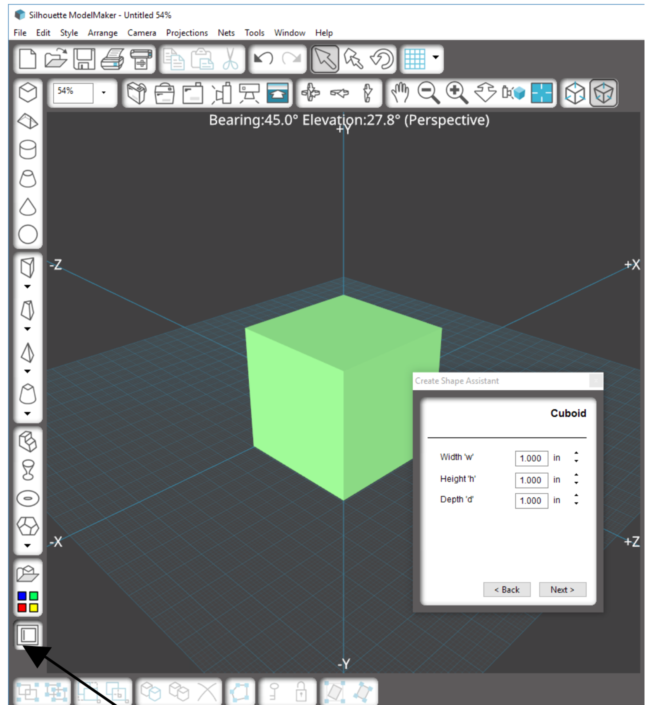
Shape Creation Wizard

As well as drawing shapes using the mouse, ModelMaker has a simple wizard to draw shapes using dimensions and coordinates typed on the keyboard.

Click the Shape Creation Wizard to display the wizard box. Select one of the shapes to make and type in the dimensions. The illustration shows a 2 x 2 x 2 inch cuboid drawn using the wizard.

The Shape Creation Wizard can be used to draw any of the shapes available in ModelMaker.

Each shape is defined by the user in terms of dimensions and coordinates, and some of the more complicated shapes like the irregular prism are drawn by defining the coordinates for each of the points in the shape.



Shape creation wizard

Quick Tip

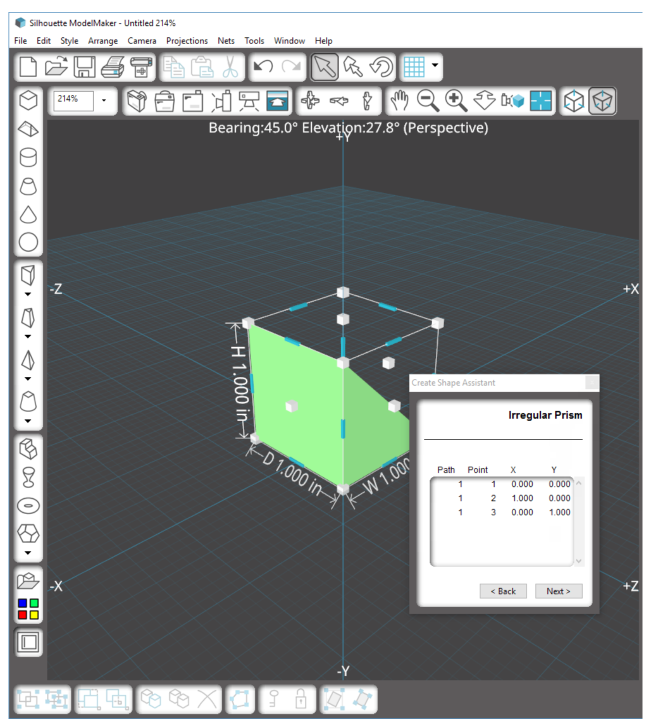
The coordinates for each shape are relative to the center of the shape.

A cuboid with dimensions 1 x 1 x 1 inch placed in the very center of the scene will have the coordinates:

X=0 Y=0 Z=0

A cuboid with dimensions 1 x 1 x 1 inch placed in the center of the scene, but sitting on top of the grid will have the coordinates:

X=0 Y=0.5 Z=0



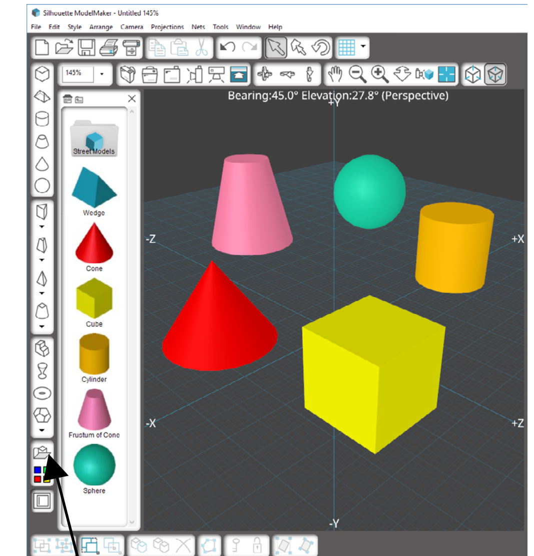
Using the shape creation wizard to plot the points of an irregular prism.

QuickShapes

In addition to drawing shapes using the mouse and by using the Shape Creation Wizard, Modelmaker has a small library of QuickShapes which can be dragged onto the screen.

Select the QuickShapes button to open a window containing the shapes.

Drag shapes onto the screen using the mouse. The library contains a small selection of simple shapes and a folder of buildings.

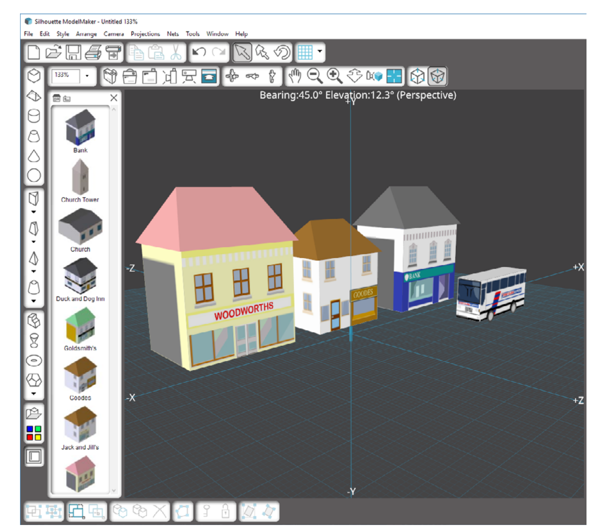


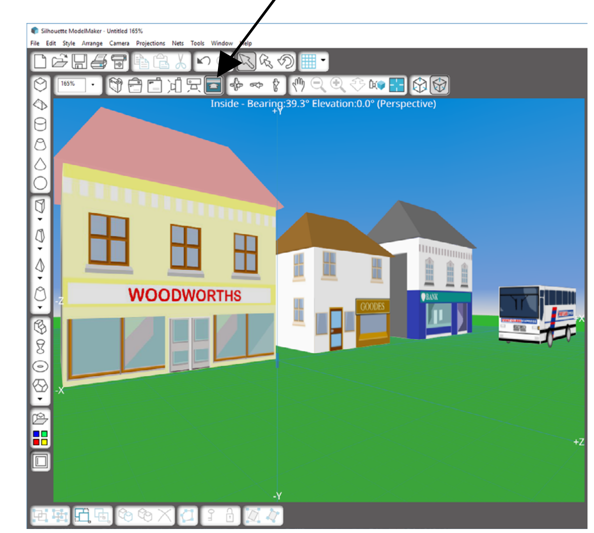
QuickShapes

Quick Tip

When drawing a model one can select all the different camera views to see the model from different angles.

By clicking the Go Inside button, one can go inside the model and walk around using the arrow keys.

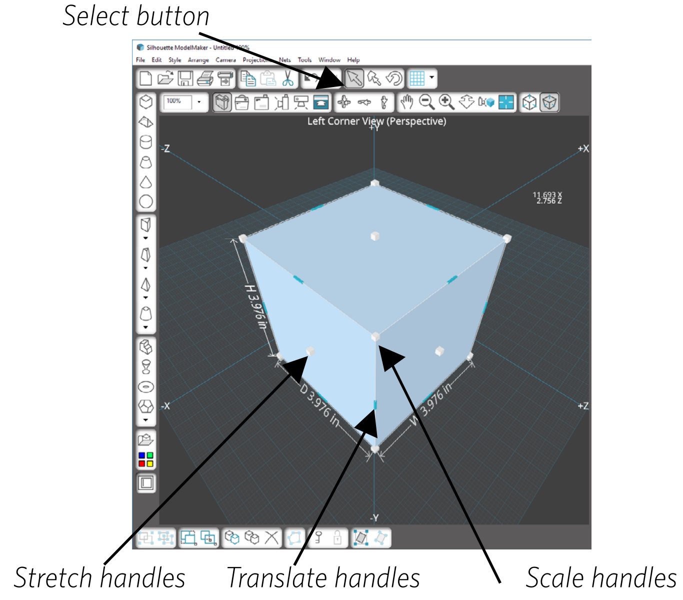




Go Inside

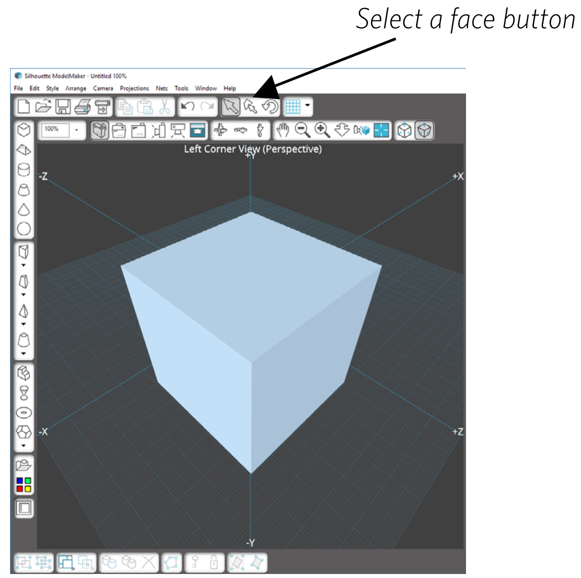
Select a Shape

To apply any actions to a shape, it must first be selected. This is done simply by clicking on the shape with the mouse. If the select button is active when a shape is clicked, it is selected and bounded by a box with handles to stretch, scale, and move it. If the rotate button is selected when the shape is clicked, it will selected and bounded by a box with handles to change the axis, rotate, and move it.



The following actions/attributes can be applied to a selected shape:

1. Stretch (in select mode)
2. Scale (in select mode)
3. Translate (in select mode)
4. Rotate (in rotate mode)
5. Color
6. Texture
7. Copy
8. Clone
9. Lock
10. Delete
11. Edit
12. Viewed up close
13. Wireframe or solid
14. Grouped with another shape
15. World or shape axes



When a single face is selected, all the other faces are made transparent to make it easier to see which face is selected. Selected faces can be colored or textured and can be used in conjunction the texture orientation controls.

Quick Tip

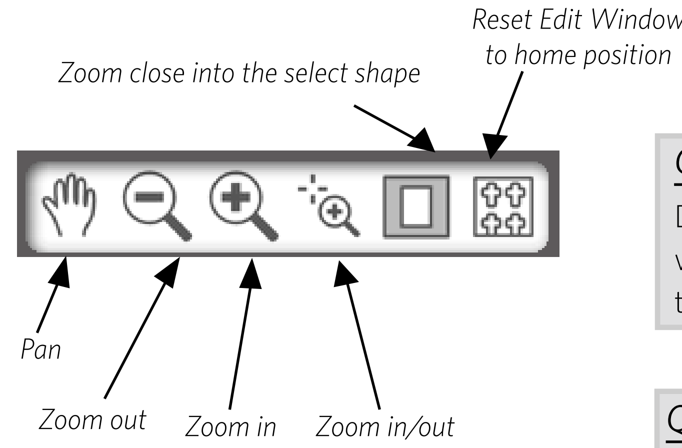
Selecting a face is useful during operations such as changing the orientation of an image on the face. But to color or texture a face, it doesn't need to be selected. Just drag the color or image file onto a face.

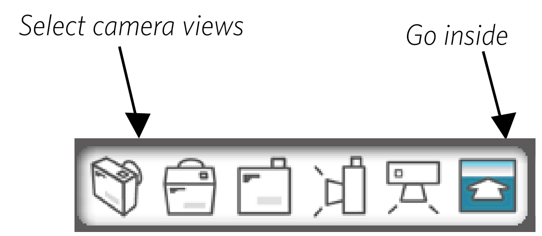
Silhouette ModelMaker™

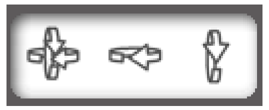
Edit Window controls

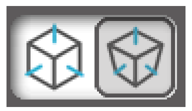
The Edit Window can be rotated, panned, zoomed, and reset to its home position. It can be viewed from a selection of different camera angles and displayed in either orthographic or perspective.

The Edit Window can also be used to zoom in on a selected shape.






Edit Window rotate controls


Perspective or Orthographic view

Quick Tip

Drawing shapes equidistant around the center of the window makes it easier to see what's going on and easier to see the model when rotating the window.

Quick Tip


Use this button to zoom in on small shapes in the drawing.

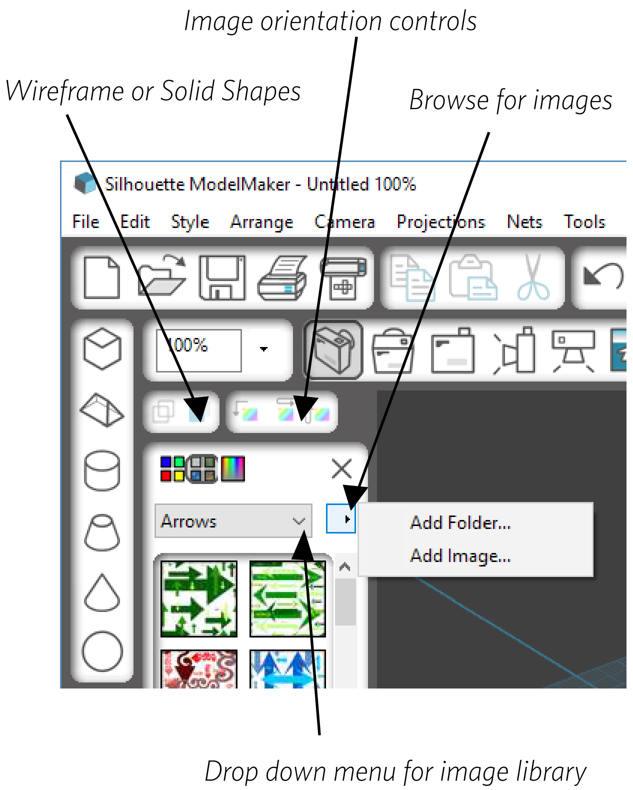
Quick Tip

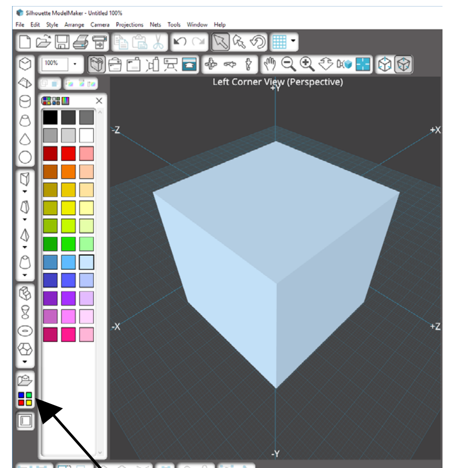

You can go inside the model and walk around using the arrow keys and look up and down using the A and Z keys. This is especially useful when making large models like a street scene.

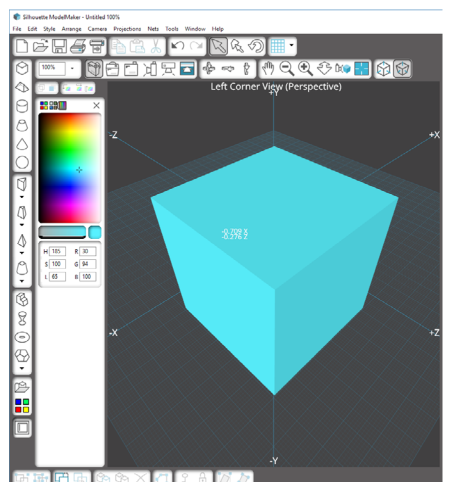
Coloring Shapes

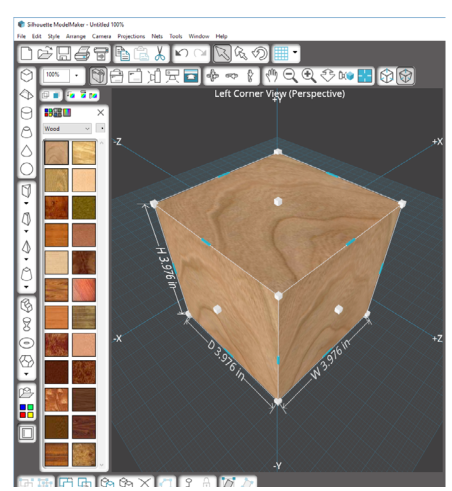
The color palette window contains:

1. Color palette.
2. RGB/HSL color picker.
3. Image library.
4. Image orientation controls
5. Wireframe button.
6. Solid button.
7. Browse for images.

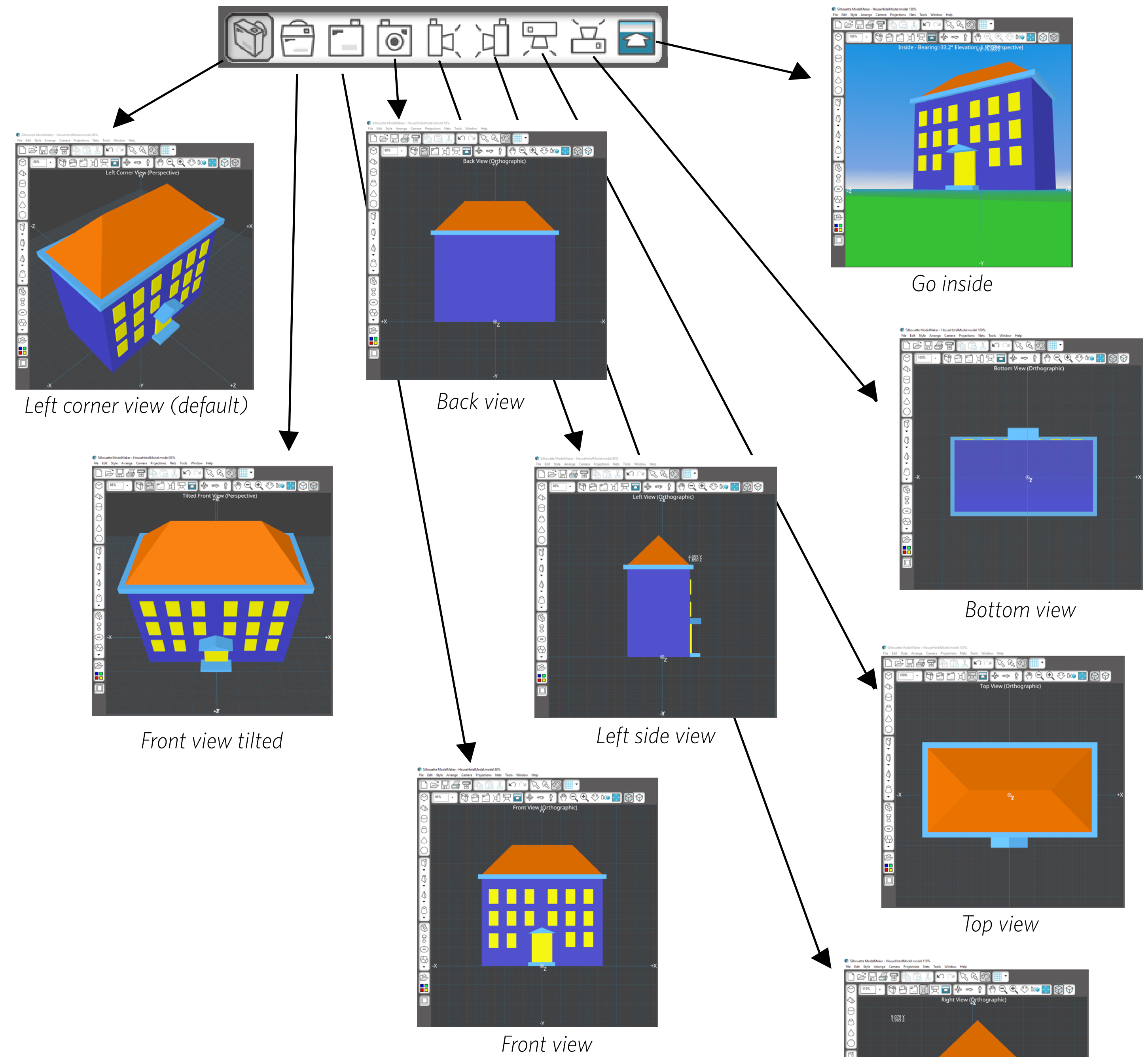


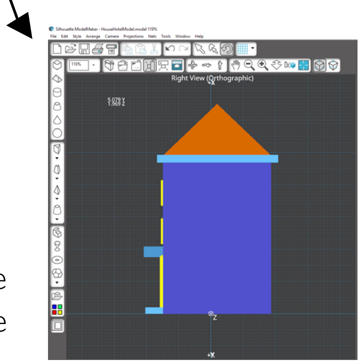

Color Palette





> **Quick Tip**
>
> Color or texture a shape:
>
> 1. Select the shape then click a color or image.
> 2. Drag a color onto a face.
> 3. Drag an image file from the hard disc onto a face.




Right side view

Camera views

There are eight camera view buttons and one to take the viewer inside the model to walk around. Other controls allow the model to be rotated to any angle using the mouse. Views be toggled between perspective and orthographic.

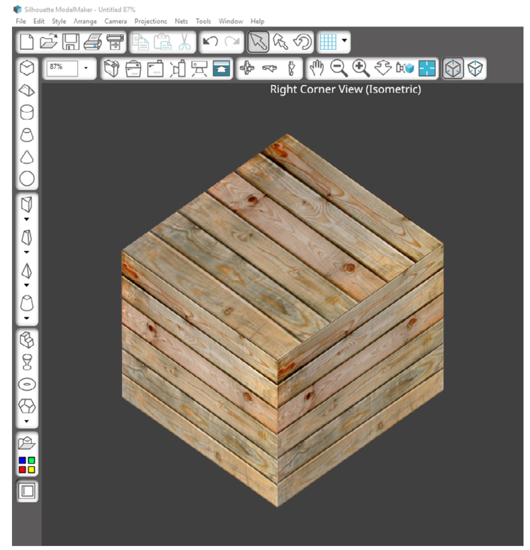
Orthographic and Perspective views

Shapes can be drawn and viewed in either an orthographic or a perspective view.

Orthographic view

The orthographic view is when the shape is displayed with its dimensions exactly as they are in the real world.

Look at the model of the wooden crate. It is a cuboid, and the dimensions of its front and back sides are exactly the same. If it were a real wooden crate, then it's obvious that the actual dimensions remain the same wherever it is, near or far from the viewer. Although the dimensions in this orthographic view are accurate, the wooden crate looks wrong. This is because when we view an object in the real world, our eyes take into account the distance we are from the object. The further away an object, the smaller it looks. If the front of an object is closer to the viewer than its back, the dimensions at the front "look" bigger than the same dimensions at the back.

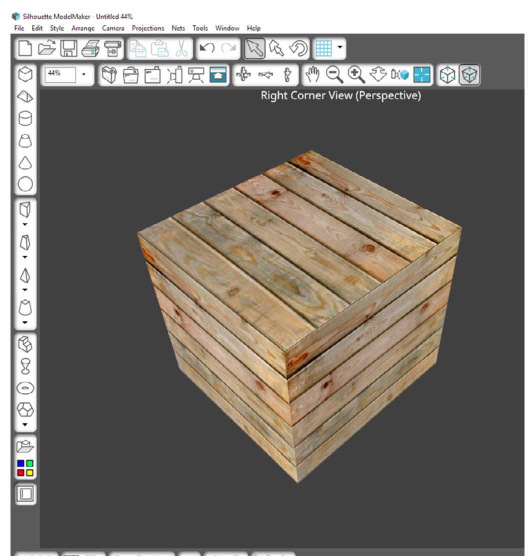


This orthographic view of a wooden crate looks wrong. The edge at the back looks wider than the edge at the front!

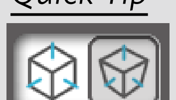
Perspective view

The perspective view is when shapes are drawn in a way to simulate how we perceive objects viewed through the lens of our own eyes, or how they appear in the real world. Shapes in ModelMaker are drawn in a way to provide the illusion of depth or distance. Imagine a railway track; a railway track comprises a pair of parallel rails and when one looks along the rails going off into the distance the they appear to converge.

The gap between the rails is identical at both ends of the track, near and far, but in reality the gap between the rails at the near end looks much wider than the gap at the far end. In the far distance they seem to converge to a point!



In this perspective view the box is drawn with the back edge narrower than the front edge, providing the illusion of depth.

> **Quick Tip**
>
> 
> Toggle the perspective and orthographic buttons. Which view is real? And which one looks real?

Shape Parameters

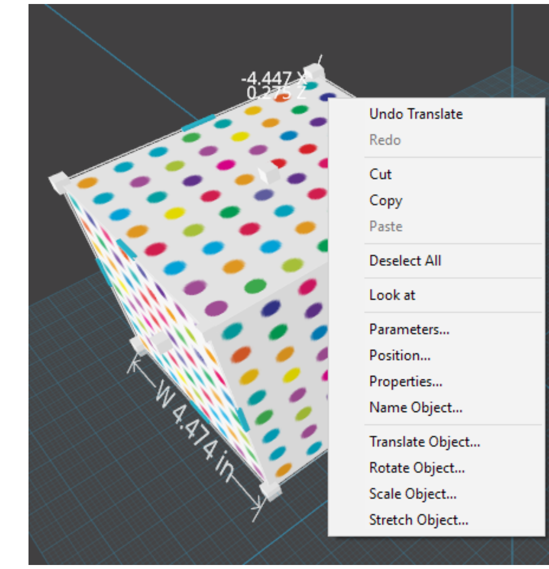
All the shapes used in ModelMaker can be modified in some way by changing its parameters. For example, one can change the shape and size of a cuboid by modifying its width, height, and depth parameters.

Cuboid Parameters = W, H, D

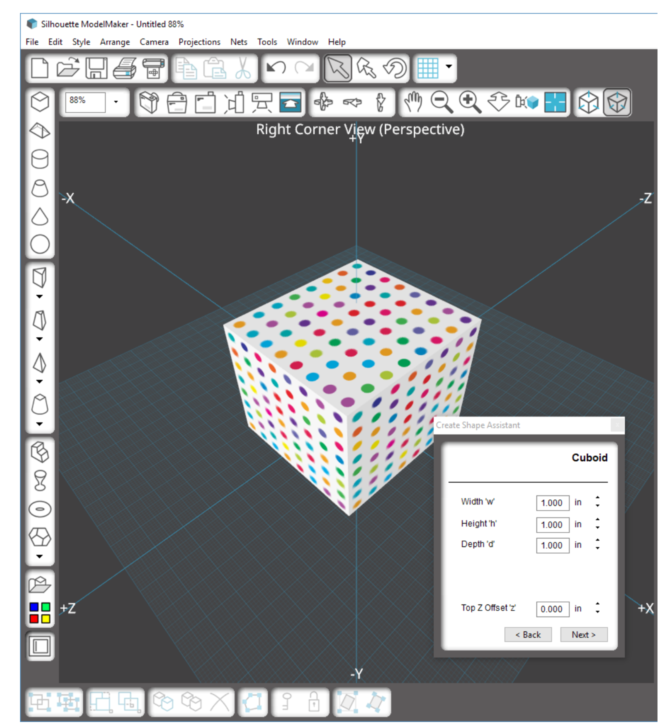
A cylinder can be modified by changing its radius and height parameters.

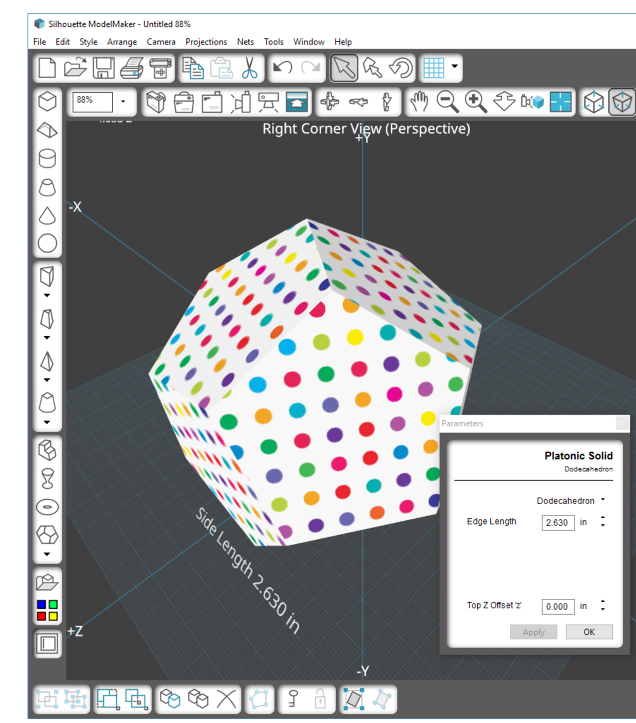
Cylinder Parameters = R, H

A platonic solid shape can be modified by changing the length of one of its sides (or a sphere by changing its radius).



Right-click on a shape to display its menu.





> **Quick Tip**
>
> You can change the size and shape of a shape by changing its parameters using the keyboard.

Shape Position

ModelMaker is used to draw 3D shapes and to position them in a 3D space. The actual position of a shape in 3D space can be defined by a set of coordinates.

Position is defined by X, Y, and Z coordinates.

X, Y, and Z refer to the axes:

X is a horizontal axis (left to right).

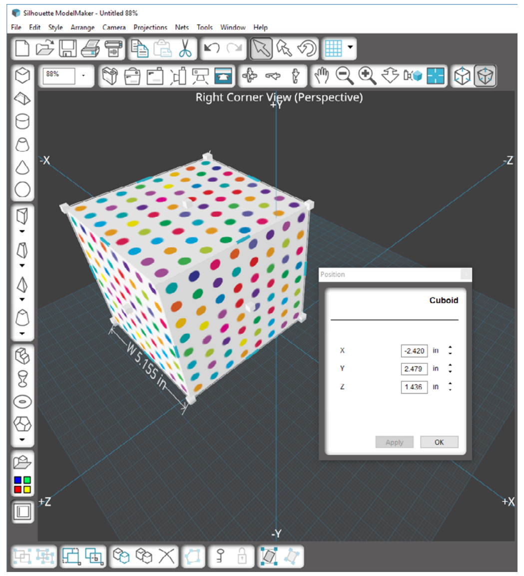
Y is a vertical axis (top to bottom).

Z is a depth axis (in and out of the screen).

The coordinate at the very center of the screen is:

X = 0, Y= 0 , Z = 0

ModelMaker references all coordinate data to the center of the shape.



Right-click on a shape to display its menu, then click "Position".

Quick Tip

You can change the size and shape of a shape by changing the values in its properties pane using the keyboard.

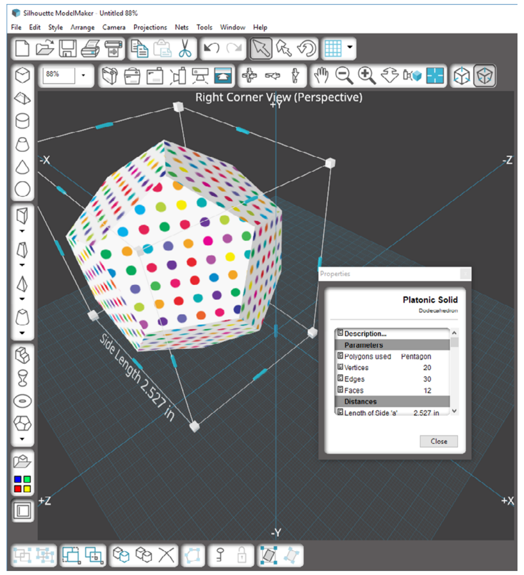
Shape Properties

The properties of each shape can be displayed by right clicking on a shape and selecting the Properties option.

The shape properties pane contains sub-headings to display properties relevant to that shape. A cuboid will display properties such as:

- Description
- Formula
- Area
- Volume

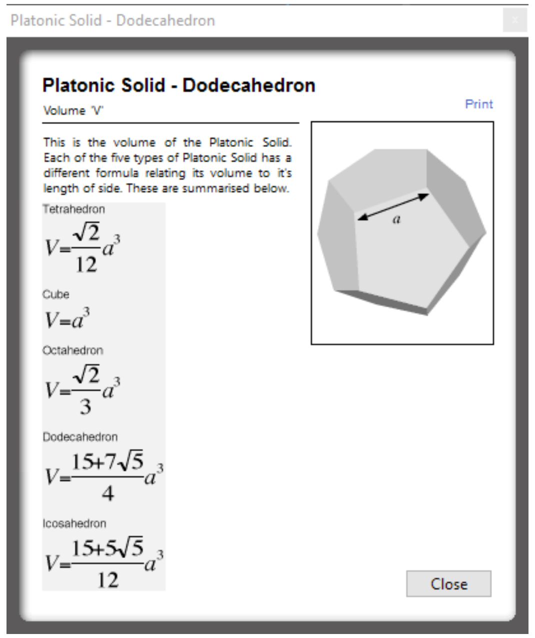
Other shapes have different properties. A platonic solid shape, for example, will show the type of face, number, and length of sides, vertices, etc.

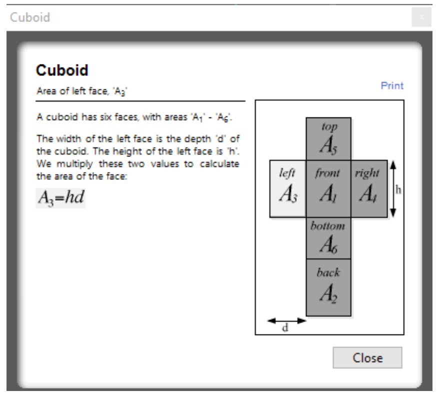


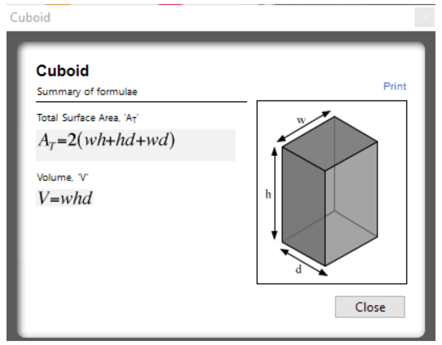
Right-click on a shape to display its menu, then click "properties".

Shape Properties (continued)

Here are a few examples of the shape properties panes found in ModelMaker.





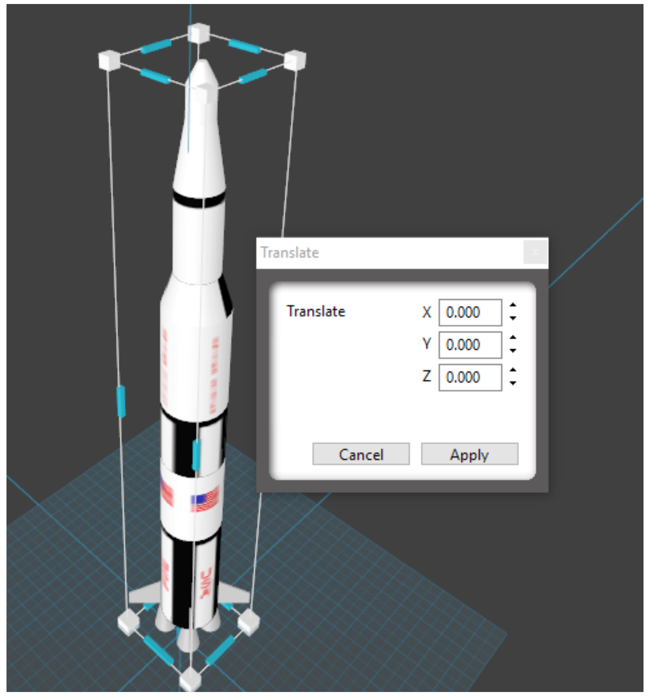


Translate a shape

Any shape can be translated, or moved with the mouse. A shape's position can also be translated accurately by using the keyboard to type values into the translate pane.

Right-click a shape and select "Translate" to display the pane. Shapes can be translated in the X, Y, and Z axes by applying the values set in the translation pane. Values can be positive or negative ones. When moving a shape in the Y axis, for example, it can be translated upwards or downwards if the value used is negative.

When a translation is applied to a shape, the values set in each of the X, Y, and Z fields are applied at the same time. More ways to translate a shape are on the next pages.



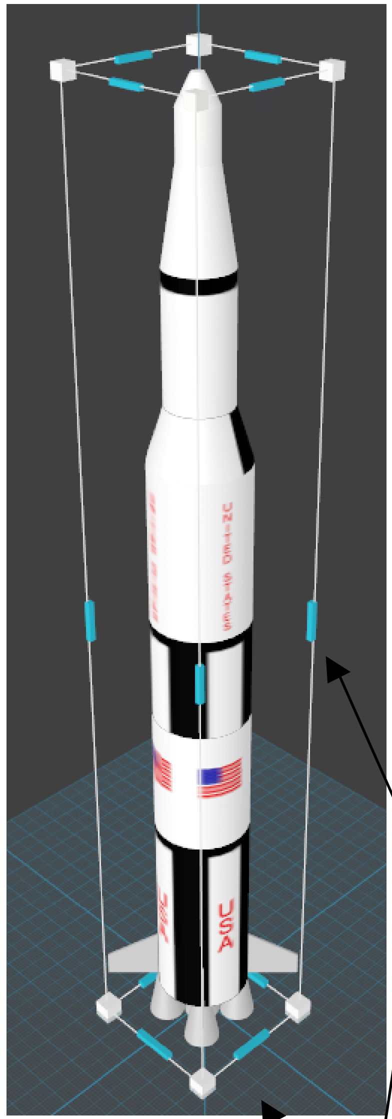
Translate a shape (continued)

Any shape can be translated (or moved using the mouse). Simply drag a shape with the mouse to a different part of the screen. However, because the screen is a flat 2D screen and the shape is inside a 3D world, it is not possible to accurately move a shape accurately without some aid.

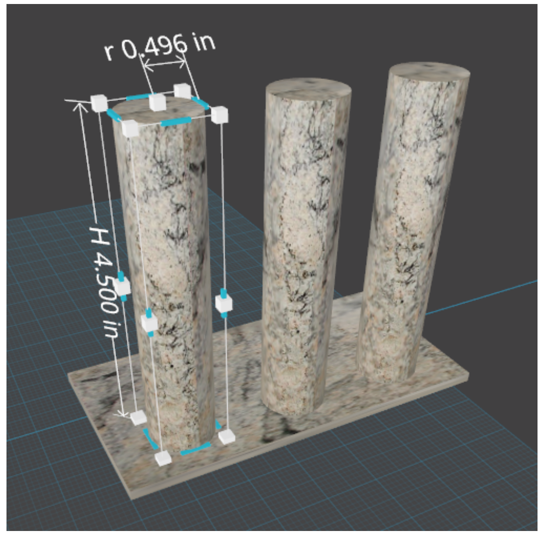
In addition to typing values into the translate pane to move the shape in the three X, Y, and Z axes, ModelMaker appends translate handles to the bounding boxes on each shape or group of shapes. These can be used to move the shape.

There is a translate handle in the middle of each edge of a bounding box. It is used to translate the shape in the direction of that edge. For example, when a shape is translated using the handle on a vertical edge of the bounding box, the shape will move exactly vertical.

If a shape has not been rotated in any way since it was made, then the translate handles can be used to move the shape in each of the X, Y, and Z planes.



Translate or move handles.

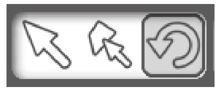


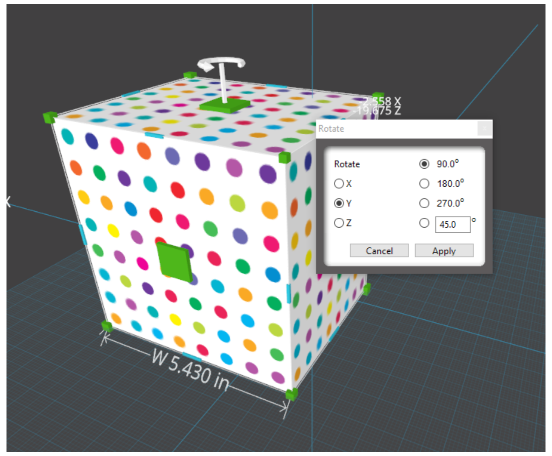
Quick Tip

To draw a tidy row of three columns, draw one column and select it. Then click the clone button twice. Use the translate handle on the X axis to drag the cloned copies off of the original column and translate them to the new position.

Clone button

Rotate a shape





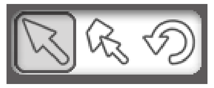
Shapes can be rotated by:

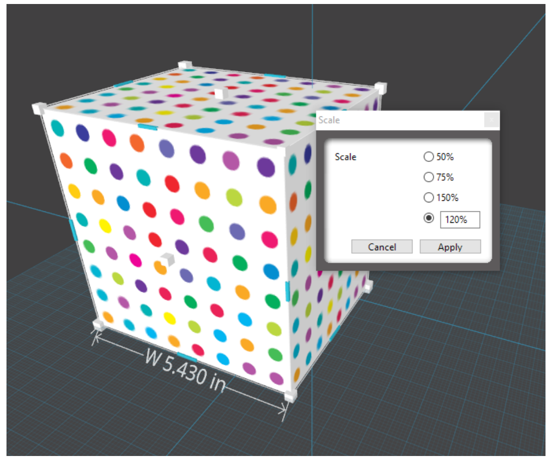
- Dragging a rotate handle with the mouse.
- Applying a value in the Rotate pane.

When the Rotate button is active, selected shapes will be bounded by a box with green handles and axes handles.

Click on an axis handle to determine which axis to rotate the shape. The rotate the shape by dragging the green handles. A more accurate way to rotate the shape is by applying a value typed into the Rotate pane. The pane can be accessed by right-clicking the shape and choosing the Rotate option or via the Arrange menu.

Scale a shape





Shapes can be scaled by:

- Dragging a scale handle with the mouse.
- Applying a value in the Scale pane.

When the Select button is active, selected shapes are bounded by a box with scale handles at each corner. The white handles in the middle of each face are for stretching the shape.

Dragging a handle on the corner will scale the shape while dragging the middle will stretch the shape in the direction of that face. A more accurate way to scale the shape is by applying a value typed into the Scale pane. The pane can be accessed by right-clicking the shape and choosing the Rotate option or via the Arrange menu.

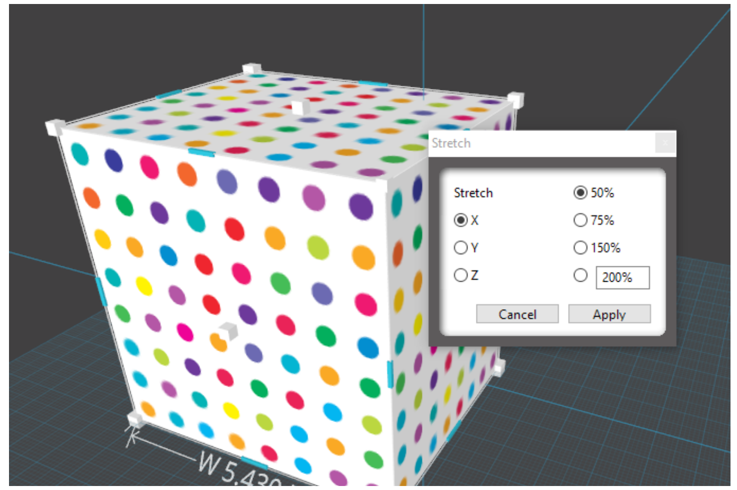
Stretch a shape

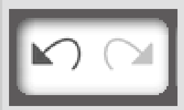
Shapes can be stretched by:

- Dragging a stretch handle with the mouse.
- Applying a value in the Stretch pane.

When the select button is active, selected shapes will be bounded by a box with white scale and stretch handles attached. Stretch the shape in the direction of the face by dragging the stretch handles.

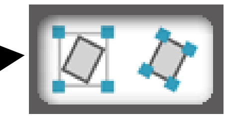
A more accurate way to stretch the shape is by applying a value typed into the Stretch pane. The pane can be accessed by right-clicking the shape and choosing the Rotate option or via the Arrange menu.



> *Quick Tip*
>
> 
>
> If you stretch or rotate a shape by hand and make a mistake, use the Undo button to go back and try again. The Undo button can undo all the actions carried out since the last undo/redo.

Silhouette ModelMaker™

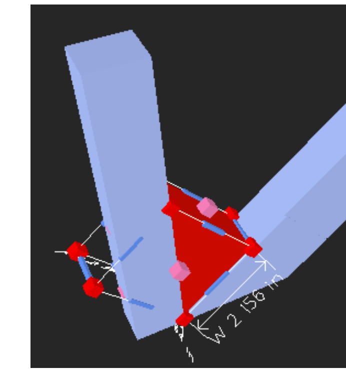
World Axis



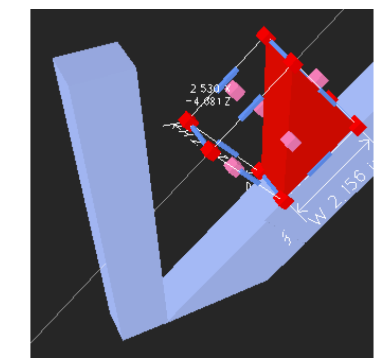
Shape Axis

Shape Axis

Shape axis means that the X, Y, and Z axis of the shape will remain relative to the shape even after it has been rotated.



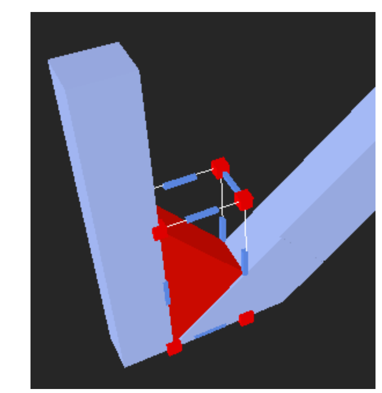
In the illustration, the red shape has been rotated to rest between the vertical and slanted purple shapes.



The axis of the red shape has been set by the Shape Axis button. Using the translate handles, the shape is moved accurately along the face of the slanted shape.

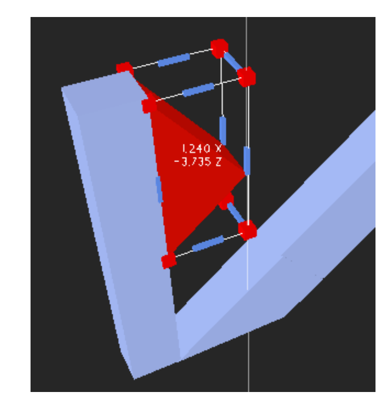
World Axis

The world axis is X, Y, and Z axis of the whole 3D scene, and it never changes.



In the illustration the red shape has been rotated to rest between the vertical and slanted purple shapes.

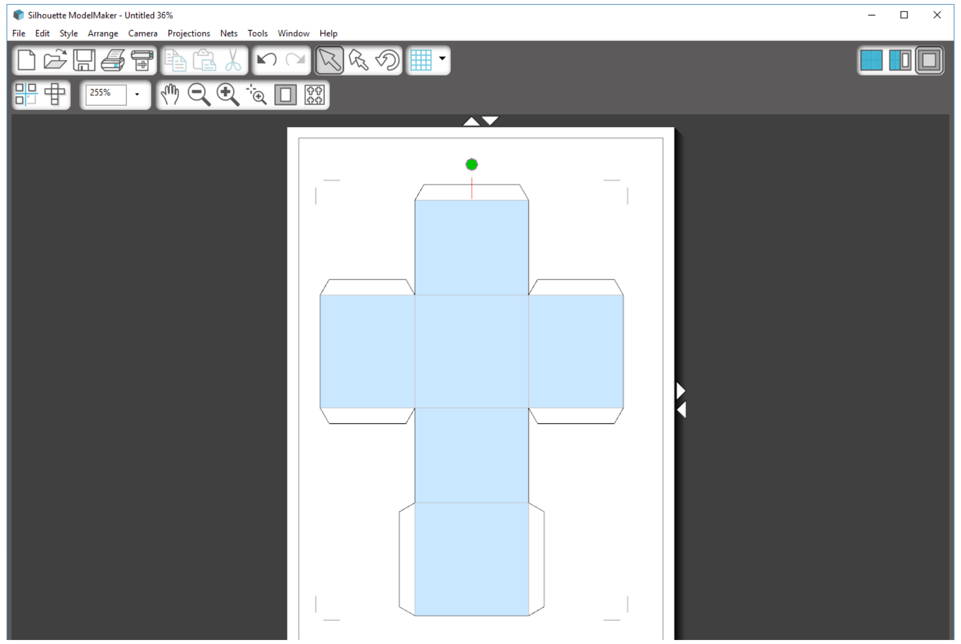
The axis of the red shape has been set by the World Axis button. Using the translate handles the shape is moved accurately up the face of the vertical shape.



> *Quick Tip*
>
> To move a rotated shape in the X, Y, and Z axes (horizontally, vertically, and in depth), select the shape and set its axis to World Axis. Use the mouse to drag the translate handles.

Section 5: Output Window

The output window is like a print preview page; whatever is displayed in the Output Window is what is sent to the printer. The Output Window displays nets and projections as they appear on the page to be printed or cut with a Silhouette.

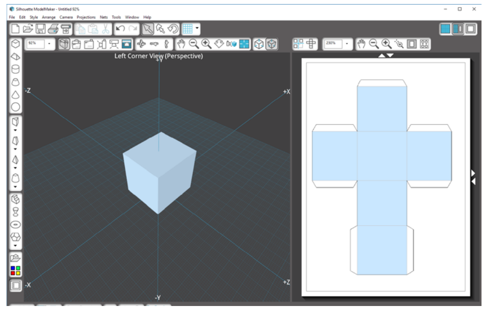


The output window can be set to display either the nets or the projections of shapes.

Shape Nets

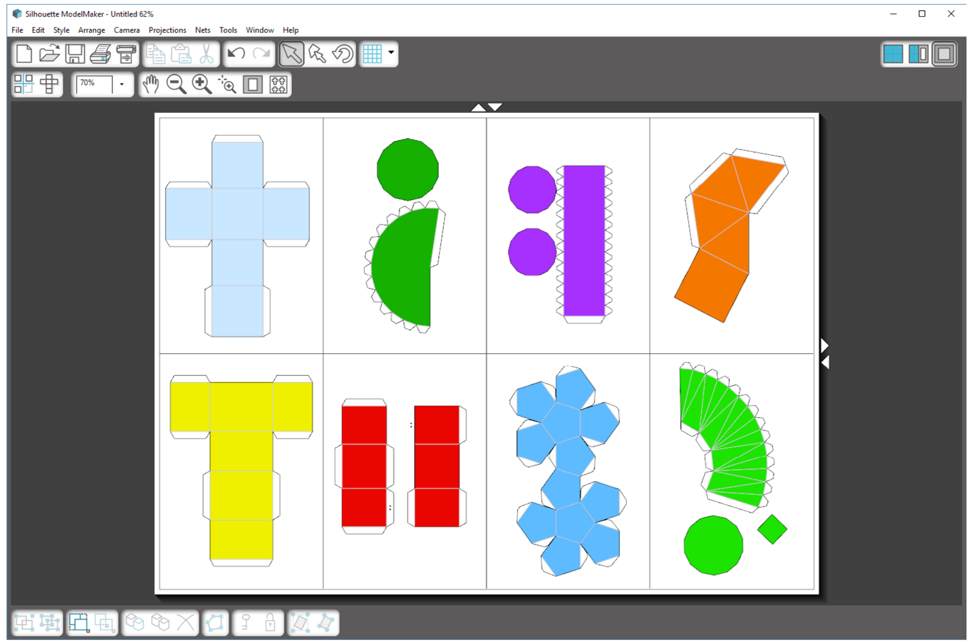
Nets of shapes displayed in the Output Window are directly related to the 3D shape drawn in the Edit Window. The figure below shows a cuboid and its associated net. Nets are the 3D shape unfolded and flattened. When the cuboid is scaled larger or smaller, the net will display larger or smaller, as well.

.The net can be printed, folded, and glued to make the original 3D shape. Nets of shapes would be almost impossible to make into a physical 3D model, so tabs are added to the faces of each net to help adhere sides together while making the physical model.

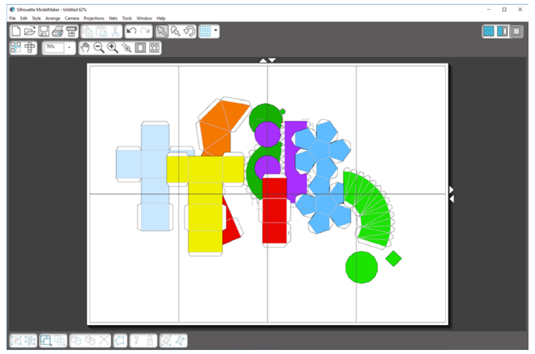


> *Quick Tip*
>
> Initially, try to limit the size of shapes so that their nets fit onto one page. A cuboid 2 x 2 x 2 inches for example will easily fit onto a page.

Whatever one designs in the software, it can be printed out, cut and scored with fold lines, and then constructed in the real world from cardstock. Here are some of the nets found in ModelMaker.



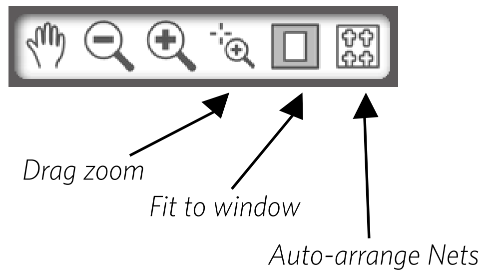
When a 3D shape is drawn in the Edit Window, its associated net is drawn automatically and placed in the Output Window. Nets are placed in an orderly layout, and can be rotated and moved to make the best use of the space on the page.

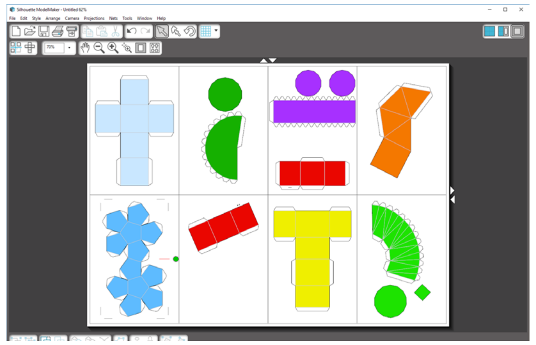


If the nets get into a mess...

Auto-arranging Nets

Sometimes there are lots of nets and the layout can become confusing. In this case, the Auto-arrange Nets button is useful for organizing the nets neatly.

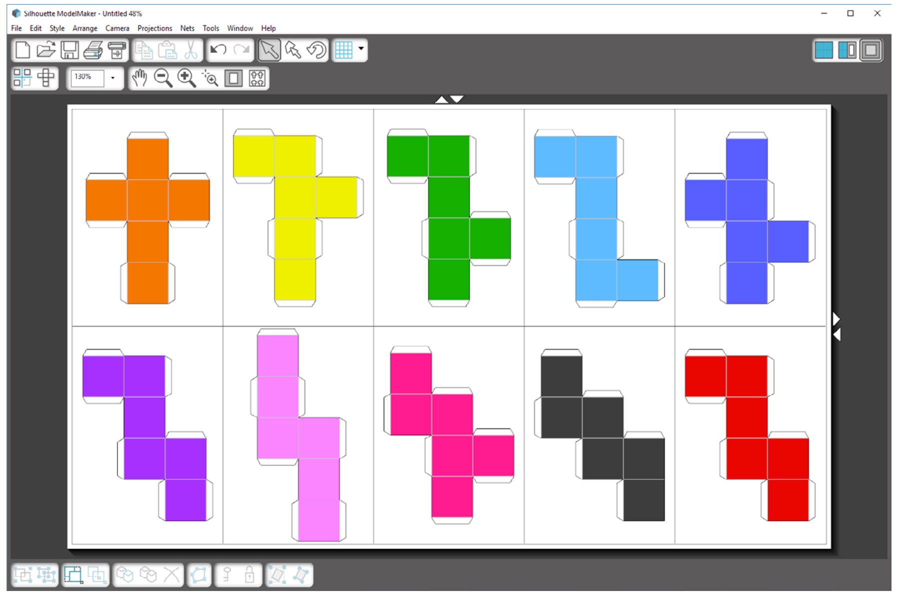




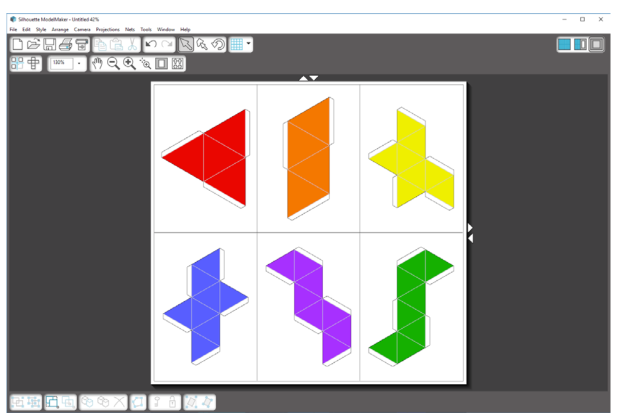
... click the Auto-arrange Nets button.

Net Permutations

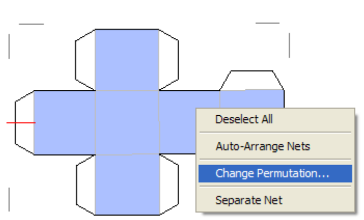
The cuboid, tetrahedron, and octahedron have a choice of net permutations. These are selected by right-clicking on the net to display a menu of options. Here are some different permutations for the cuboid net.



Cuboid nets be displayed with different permutations of the faces



The tetrahedron and octahedron have a couple of different permutations



Right-click net menu

In Silhouette ModelMaker™, all the nets of 3D Shapes are displayed in the Output Window and can be printed to make 3D paper models.

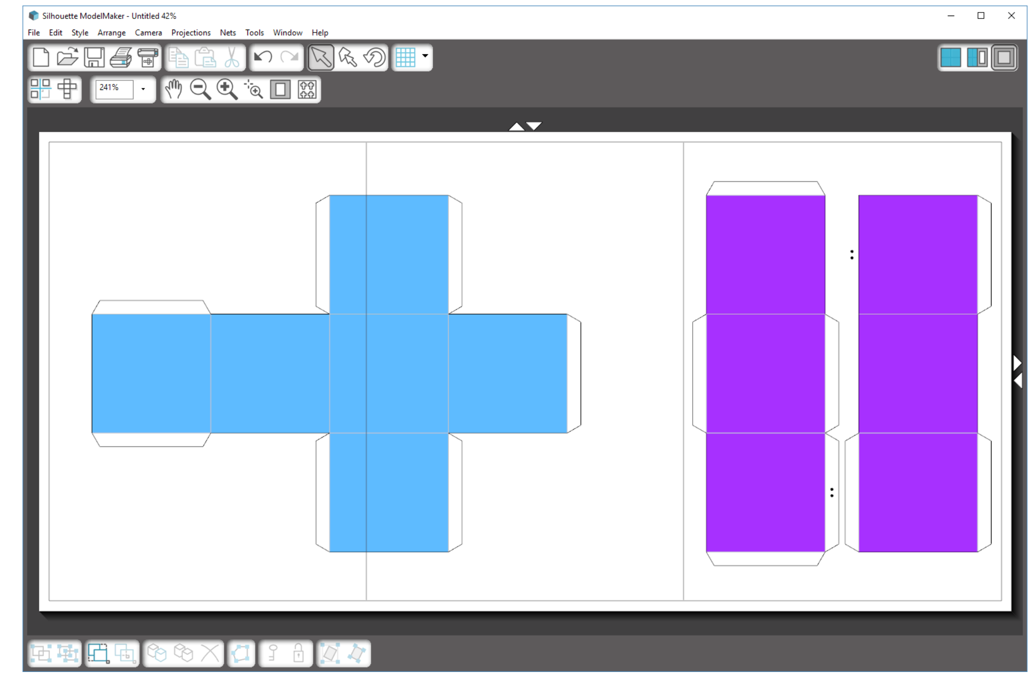
Nets can be rotated and moved to better fit the paper. Different net permutations can be displayed for shapes like the tetrahedron, hexahedron, octahedron, and cuboid shapes.

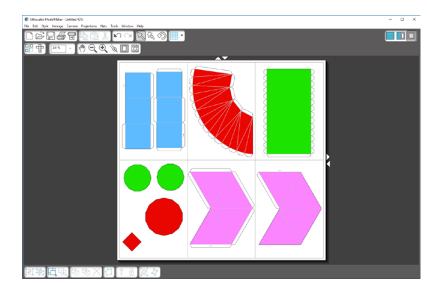
All the shape nets can be printed onto paper or cardstock, scored and trimmed using a Silhouette machine, and folded and glued to make 3D paper models. A Saturn V rocket can be made from cylinder shapes, or a new package for after-dinner mints could be made from cuboid shapes.

Silhouette ModelMaker™

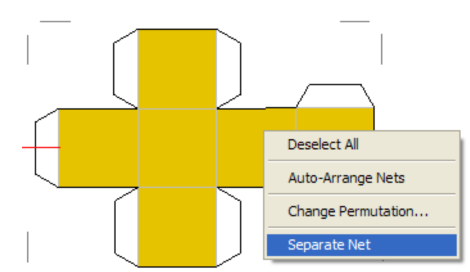
Separating Nets

In addition to being able to move and rotate nets to achieve a better fit on the page, nets can also be broken into two parts. Separating a net into two parts provides more flexibility and can save a lot of space.





All these nets have been separated allowing better use of the available space



Right-click net menu

To place nets more efficiently on the page, it is useful to select the Separate Nets function. This splits the net into parts. Right-click on the net and choose "Separate Nets".

In a real-life situation where many thousands of copies of a product are made, saving material in this way is environmentally friendly and makes economic sense.

Quick Tip

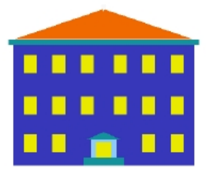
If a net is too big for the page, separate it into parts and move them around to fit.

Orthographic Projection

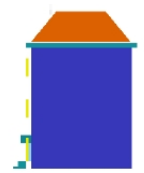
An orthographic projection comprises six views of an object: front, back, right side, left side, top, and bottom.

However, it is common to only use three of these views when drawing 1st or 3rd angle projection. Here are all six views of the model of a mansion building drawn from simple 3D shapes in Silhouette ModelMaker™.

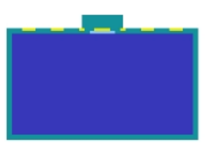
Top view



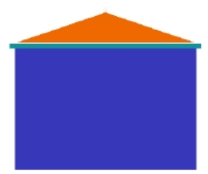
Front view



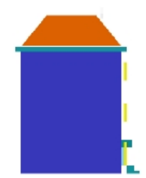
Right side view



Bottom view



Back view

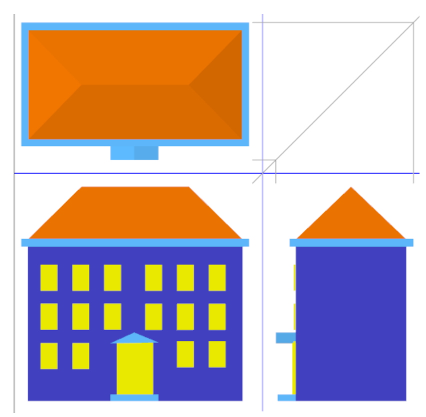


Left side view

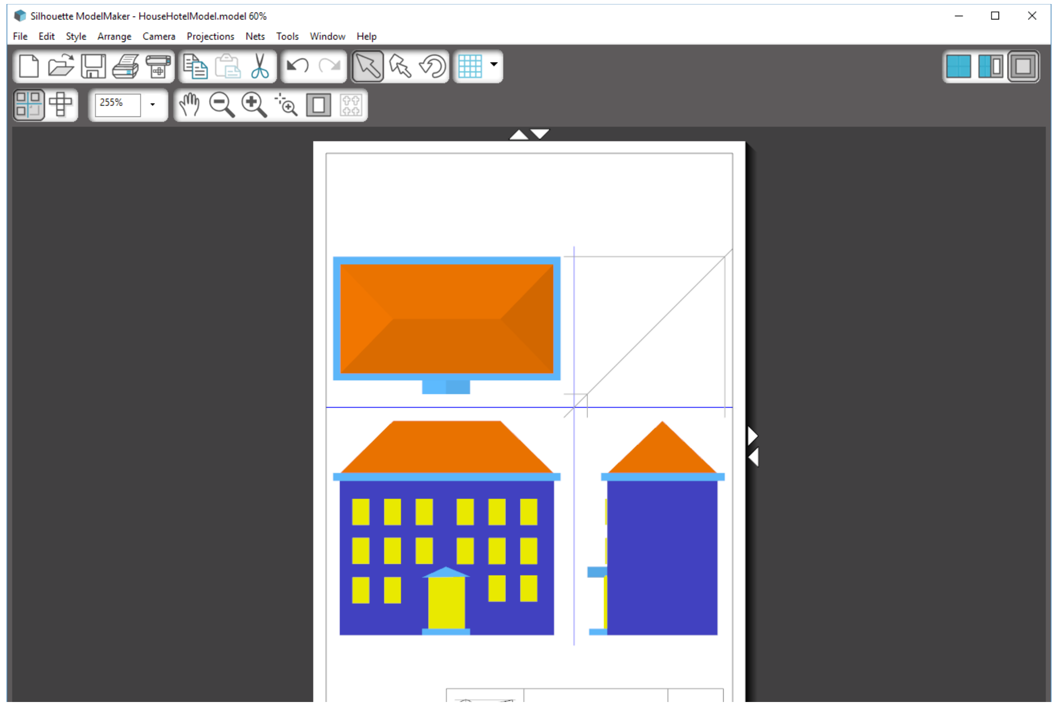
An orthographic projection includes the front and plan views of an object and will include either or both the left and right hand sides as well. A projection would be complete when it includes the rear and bottom views too, making a total of six 2D views to illustrate the 3D object.

However, a standard drawing of an orthographic projection comprises just three views: front, side, and plan.

There are two ways to draw an orthographic projection: the 3rd angle projection and the 1st angle projection. Both these projections are used to represent the model being drawn and differ from each other only in how the front and side views are positioned in the drawing.



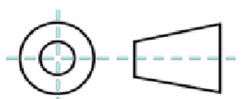
A standard orthographic drawing normally comprises three views: front, top, and side.



3rd angle projection

3rd Angle Projection

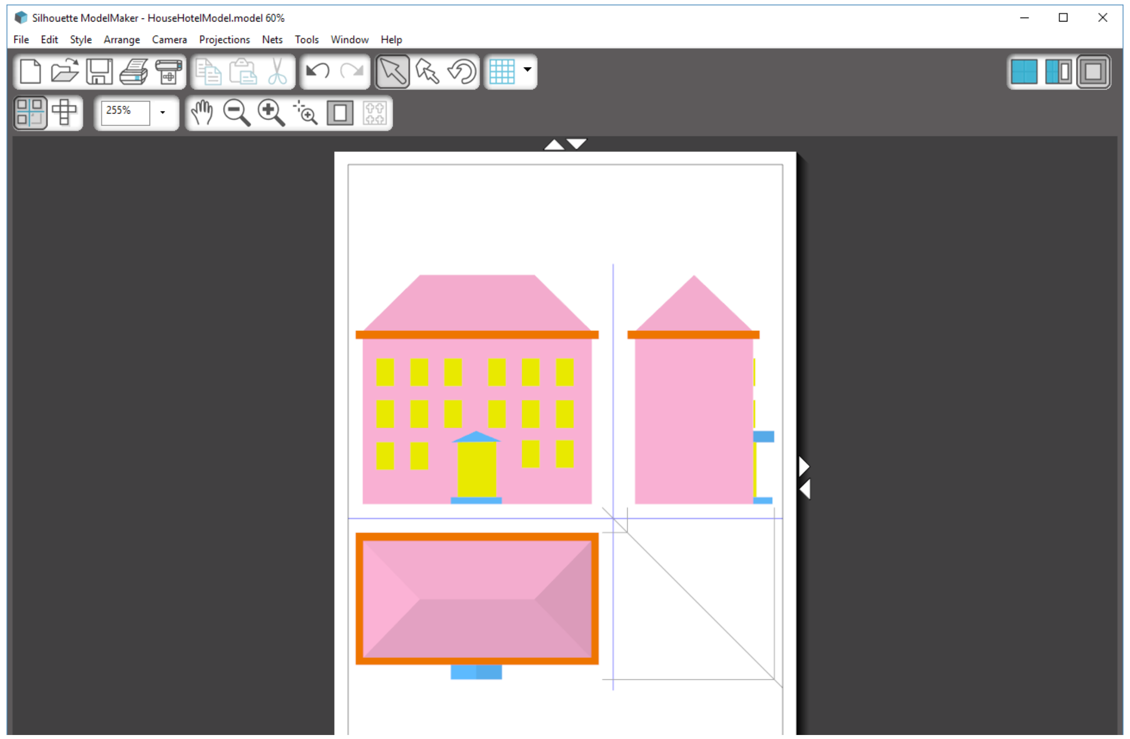
The 3rd angle projection is the most favored of the two projections and is commonly seen on technical and architectural drawings in the USA and in the UK. ModelMaker can display the 3rd angle projection with either the left or right views, or with both. Students display the projections rendered in color, with white and black lines, or as line drawings with the hidden lines included.



An orthographic projection will always be accompanied by a symbol to clearly show which projection has been drawn. This is normally placed at the bottom of the drawing. A 3rd angle projection will be indicated by the symbol shown here.

> ***Quick Tip***
>
> Whether your 3D model is big or small, its 1st or 3rd angle projection can be scaled to neatly fit the page.

There has been endless controversy about which projection is the best one to use. The 3rd angle projection is considered more logical in its layout and has always been the standard in USA. With the exception of the UK, the 1st angle projection is still the standard in Europe.



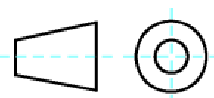
First angle projection (showing the left view on the right)

1st Angle Projection

The 1st angle projection displays the same drawings as the 3rd angle projection. The difference is found in the way the views are arranged.

It is easy to see why the 1st angle projection is seen by some as illogical. When the projection is displayed showing the right view, the view is actually placed on the left. Also, the top view is placed at the bottom.

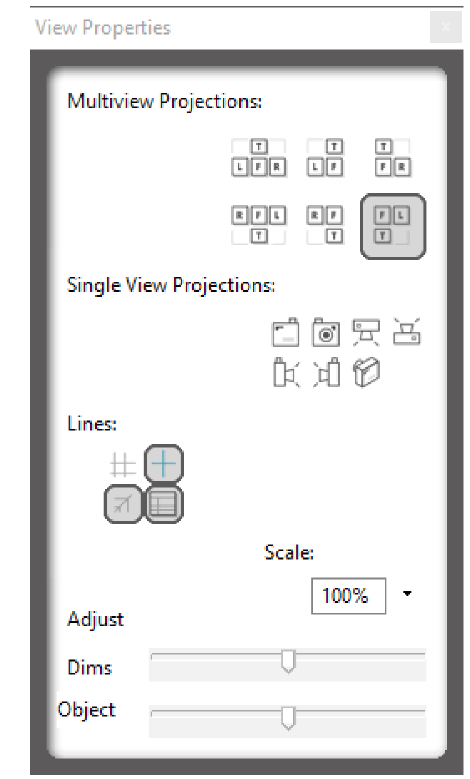
However, the 1st angle projection is still the standard projection for technical and architectural drawings in Europe.

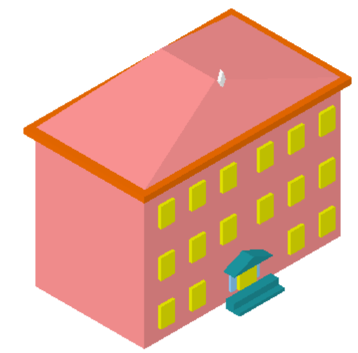


An orthographic projection will always be accompanied by a symbol to clearly show which projection has been drawn, and this is normally placed at the bottom of the drawing. The symbol shown here is used to denote that an orthographic projection has been drawn in the 1st angle.

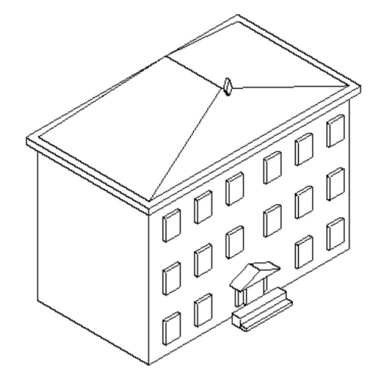
> *Quick Tip*
>
> 3rd angle projections are used in the USA, UK, and Canada, whereas in Europe projections are usually 1st angle.

Right-click on a projection to display different options for drawing it on the screen. All models can be drawn in 1st and 3rd angle projections, a choice of seven single-view projections, in color, a black line drawing, or a line drawing with hidden lines included.

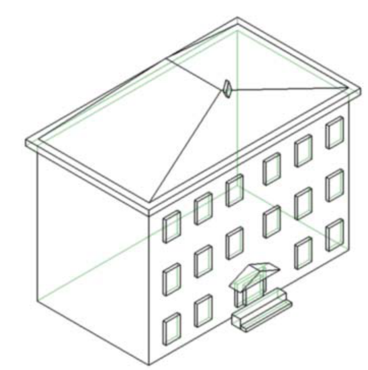




Solid color or texture



Black outline



Hidden lines

All the different projections can be toggled between the different styles of drawing shown on the left:

1. Solid color or texture.
2. Black outline.
3. Black outline with all the hidden lines showing.

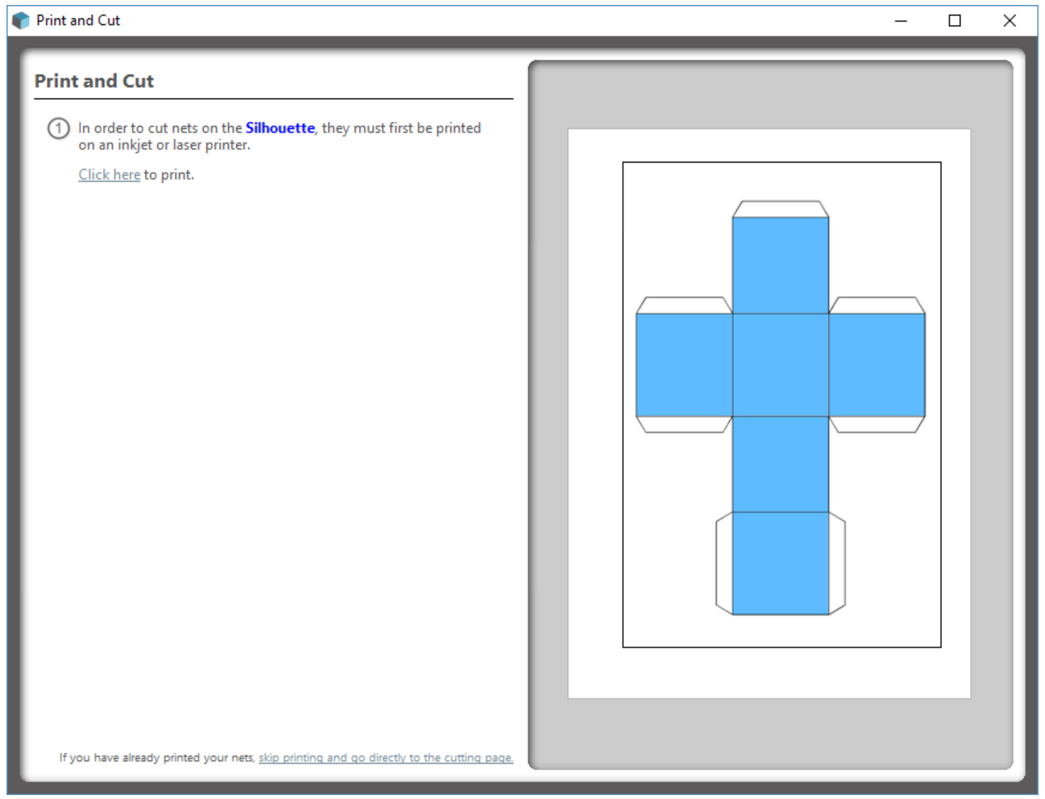
> *Quick Tip*
>
> Right-click on a projection in ModelMaker and choose how to display it.

Silhouette ModelMaker™

Section 6: Printing and Cutting

Print & Cut

Modelmaker prepares pages for a Print & Cut with a Silhouette machine. The Print & Cut function adds a set of Registration Marks for the Silhouette to read.



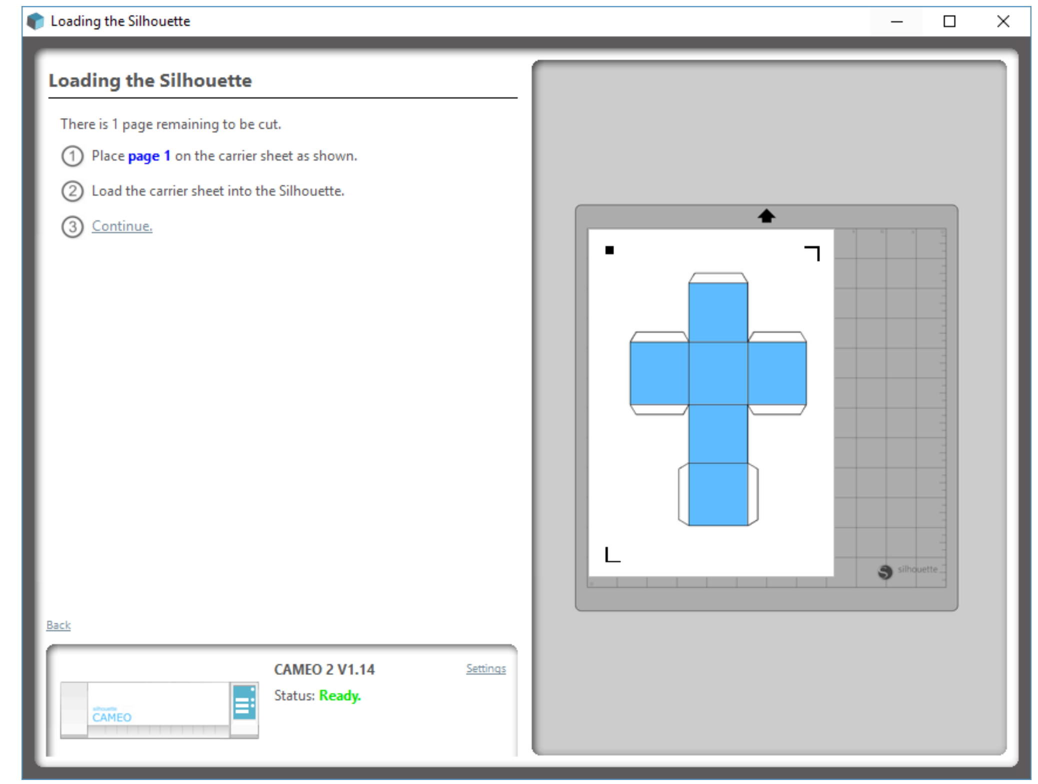
Print & Cut window

The Print & Cut window is like the Print window, but when the printing is complete it will offer options and instructions to cut the page just printed. Print & Cut is accessed via the fabrication option in the File menu or by clicking the Print & Cut button.

The page printed will have registration marks that the Silhouette machine will use to align the page prior to cutting the shape nets.

Loading the Silhouette

After the page has been printed, or if the print has been optionally skipped, the next page gives instructions for loading the Silhouette. Place the page onto a cutting mat and load it into the machine.



Print & Cut window—Loading the Silhouette

The loading page contains instructions for loading the page into the Silhouette together with a diagram showing what the page looks like on the mat. To summarize these instructions:

There is one page remaining to be cut.

1. Place Page 1 onto the mat as shown.
2. Load the mat into the Silhouette.
3. Continue.

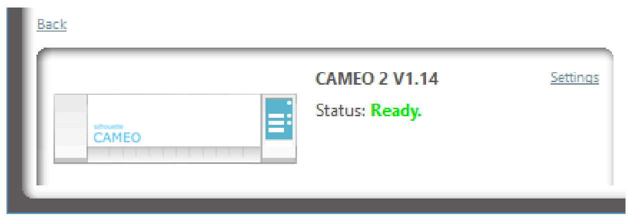
A window at the bottom shows an image of the cutting machine with its identification and status. When the machine is switched on, the status will change to "ready".

Pressing the "Continue" button displays the registration page. Registration is needed in order to align the printed page properly on the Silhouette machine.

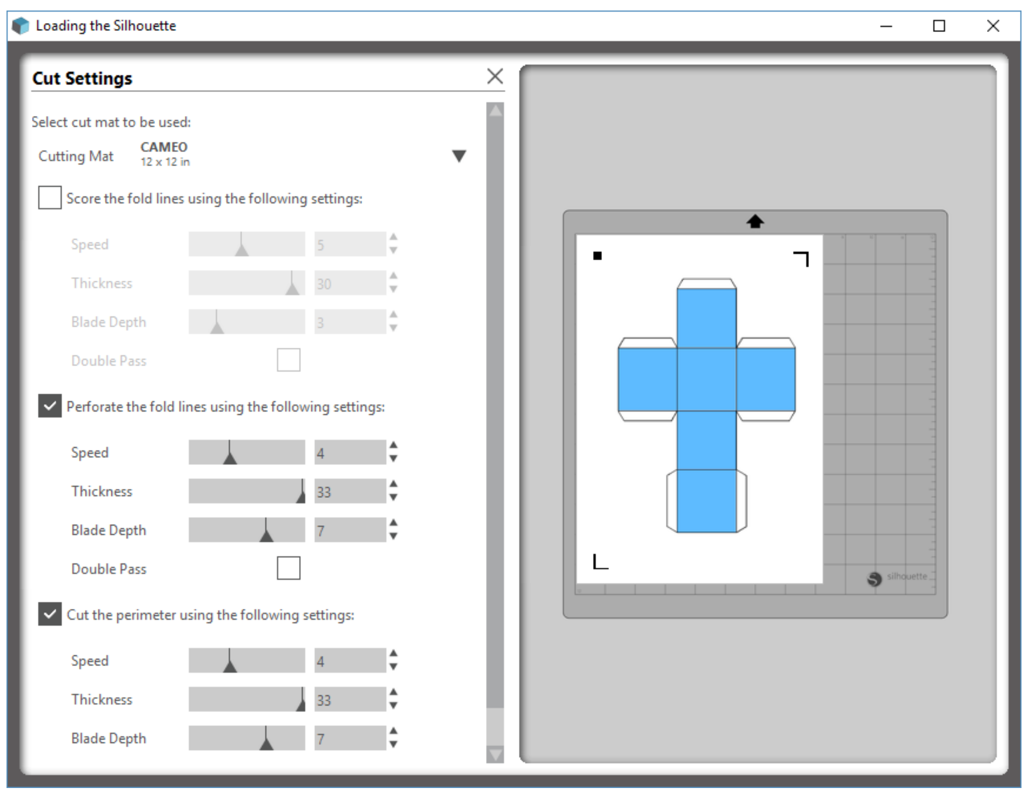
Silhouette ModelMaker™

Cut Settings

At the bottom of the "Loading the Silhouette" menu, there is an option to click the Settings link.



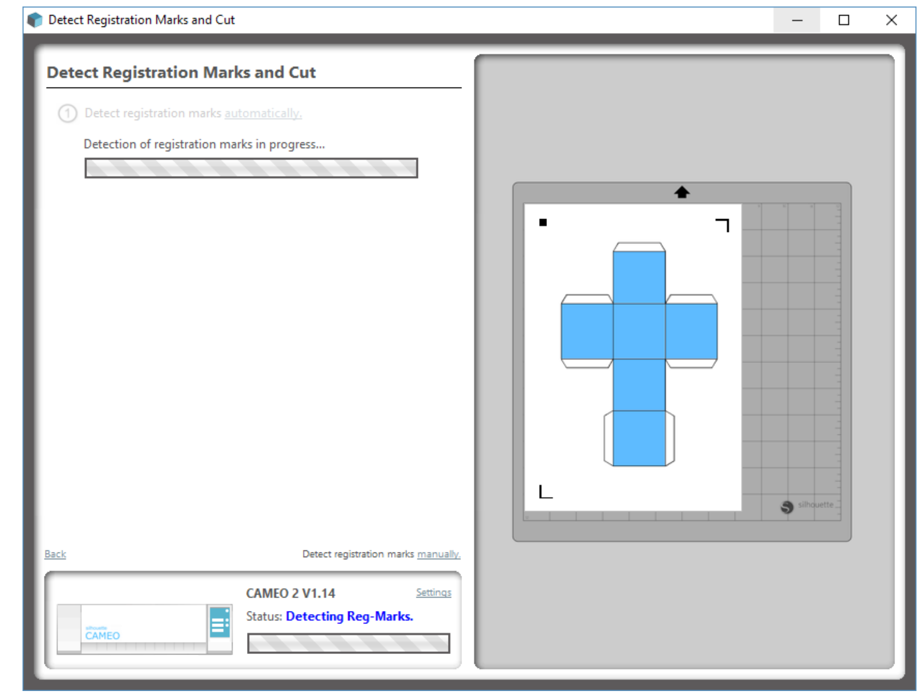
The Cut Settings default to Plain Cardstock. If you are using a different material, you can adjust the Speed, Thickness, and Blade Depth to work for your material.



Cut Settings Window

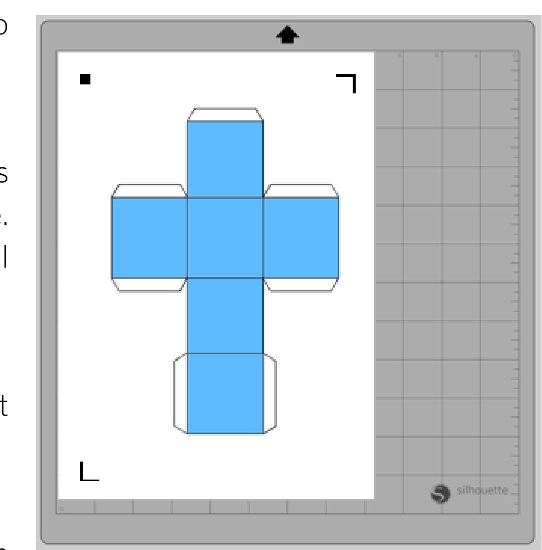
Automatic Registration

To cut the nets accurately, the page must be properly aligned in the Silhouette. This happens when the Silhouette automatically detects the registration marks and uses them to align the page.



Automatic registration in process

The Silhouette machine will detect the registration marks automatically. However, if there is a problem with auto-detection, there is also an option to detect them manually.



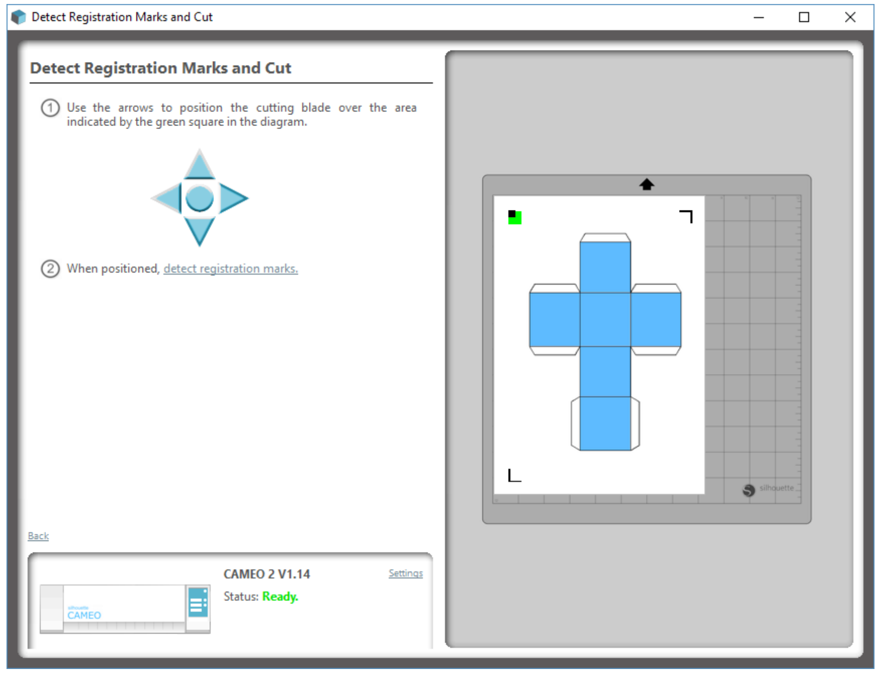
When it is starts detecting registration marks, the machine searches for the first mark, detecting it with a small light detector on its carriage. It will then move to find the other two registration marks and will display a success or failure message.

If the message says the registration was successful, then you select the prompt to cut Page 1.

Continue the process until all the pages in the model have been printed and cut.

Manual Registration

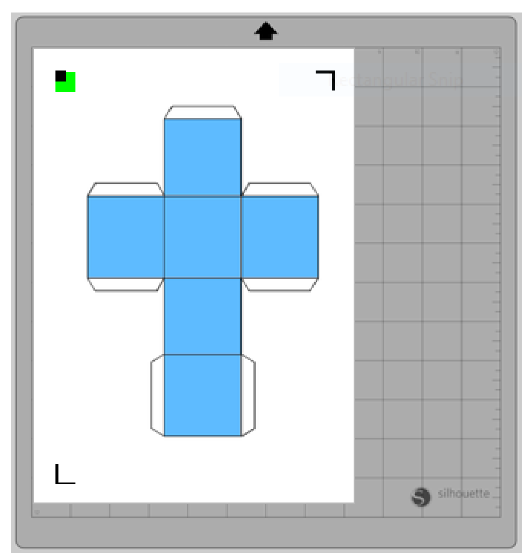
To cut the nets accurately, the page must be properly aligned in the Silhouette machine. This happens when the Silhouette automatically detects the registration marks and uses them to align the page.



Detecting the registration marks manually

As a rule the Silhouette will detect the registration marks automatically, but if it fails there is an option to detect them manually.

To detect the registration marks manually, click on the arrows to move the carriage over the first registration mark indicated by the green square on the diagram. Once it is positioned, click "Detect Registration Marks".

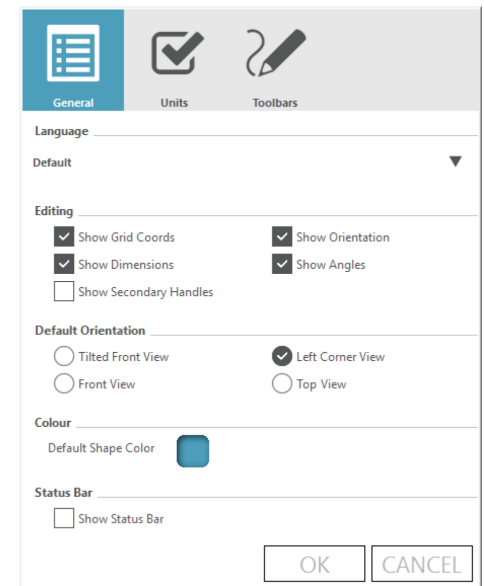


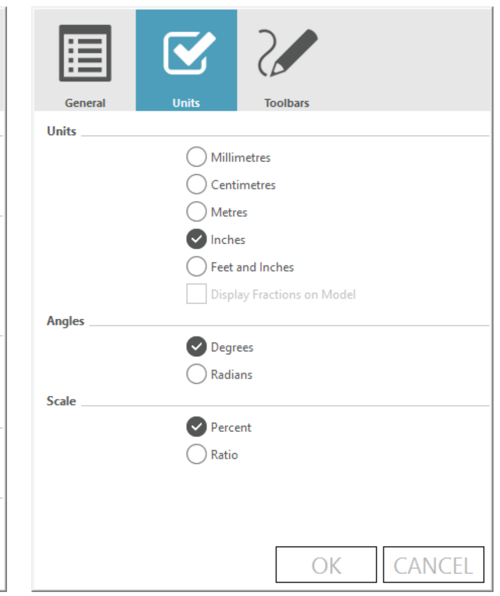
> ***Quick Tip***
>
> To help ensure reliable detection of the registration marks, always load the printed page onto the mat so that the corner of the page fits squarely at the top left-hand corner of the mat's grid.

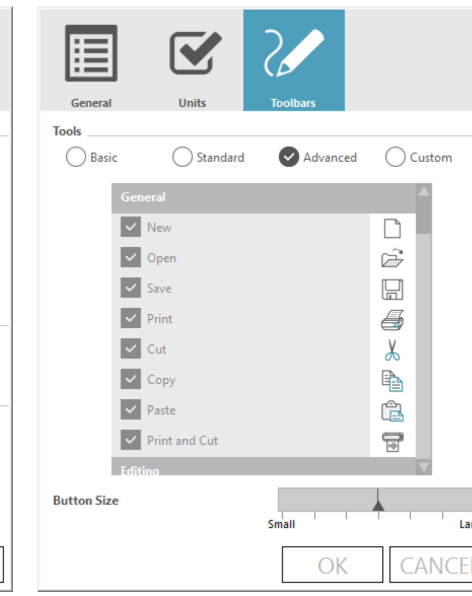
Section 7: Preferences

Preferences

Preferences may be updated by clicking on File > Preferences. Change your language or measurement units, choose your default orientation, customize the tool bars and more to make Modelmaker work for you.







Finding More Information

Website

Visit the tutorials section of www.silhouetteamerica.com for help.

Blog

Visit the official Silhouette blog at blog.silhouetteamerica.com for ideas of new projects you can create. Many blog posts contain step-by-step instructions for advanced uses of Silhouette products and software.

Newsletter

Sign up for the Silhouette newsletter at www.silhouetteamerica.com to receive product updates and special offers via email.

Customer Service

If you have any further questions, feel free to contact customer service:

Silhouette America, Inc.
support@silhouetteamerica.com
(800) 859-8243 (US only)
(801) 983-8937