ShapeMaker User Guide

ShapeMaker User Guide 2

ShapeMaker - A paint.net plugin by

The Dwarf Horde

Rob Tauler (TechnoRobbo) - Code Lead, Design

John Robbins (Red Ochre) - Graphics Lead, Design

Scott Stringer (Ego Eram Reputo) - Documentation Lead, Design

David Issel (BoltBait) - Beta Testing, Design

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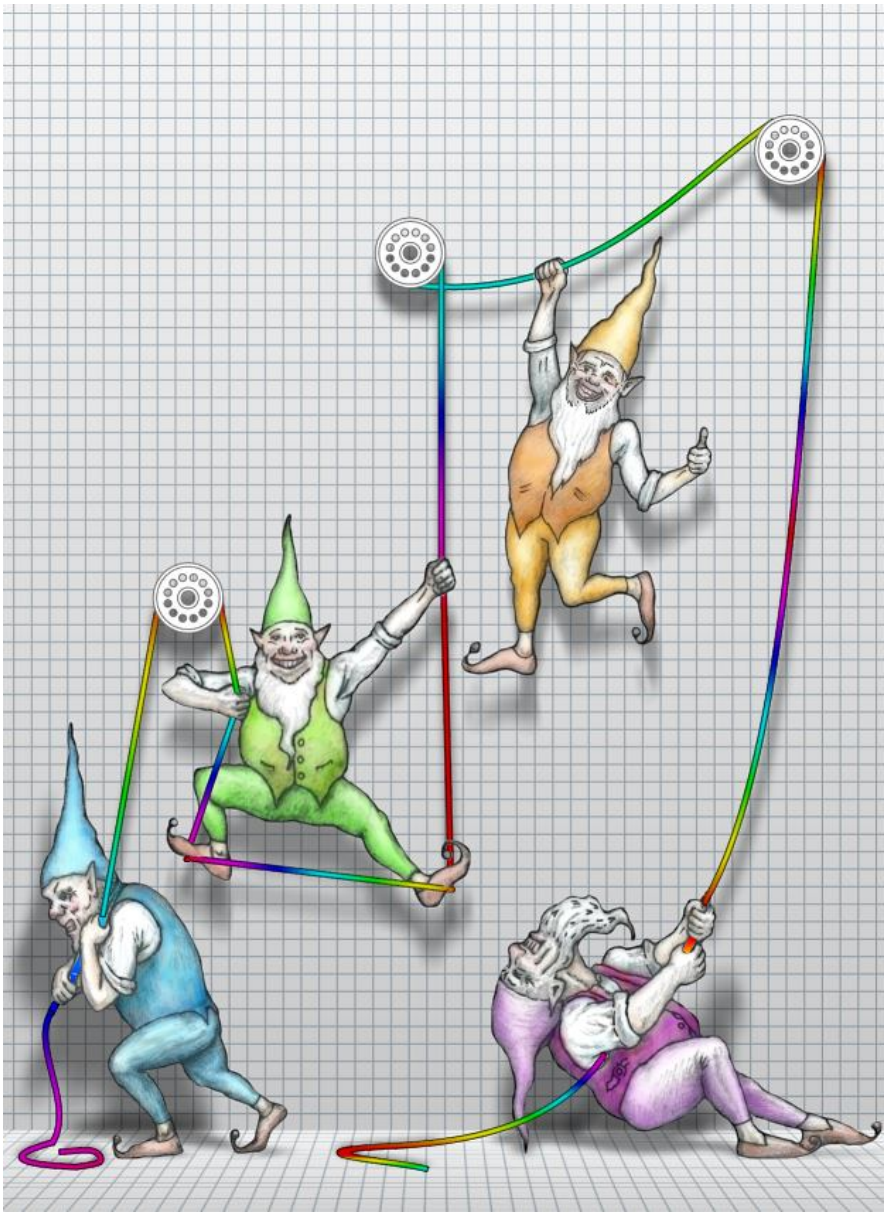

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Foreword

The ShapeMaker plugin is a tool which facilitates the creation of SVG (Scalable Vector Graphics) Shapes, Lines and Curves.

The tool itself uses a WYSIWYG interface where Lines, Curves and entire Paths can be created and manipulated using just the mouse. Knowledge of the complex SVG structure is not required. ShapeMaker will create all that complex stuff for you and generate the Shape, code, or a complete reusable file.

Why did we write this plugin?

We wanted to create an easy-to-use click-and-drag interface which could create custom Shapes that paint.net itself could reuse via the new Shapes tool. That's right. Paint.net 4.0.6+ allows the user to add their own Shapes to the Shapes tool set. Not only can ShapeMaker Shapes be reused, the valid SVG generated can be pasted into HTML documents for modern browsers to render.

We hope you like ShapeMaker!

~ TechnoRobbo

~ Ego Eram Reputo

~ Red Ochre

~ BoltBait

Definitions used in this guide

Circle - a compound type consisting of two semi-circular Ellipses.

Compound Types - One of two shapes (Rectangle and Circle) which are composed of individual elements to create the Shape. A Rectangle is composed of four Straight Lines and a Circle is two semi-circular Ellipses. These two compound types are included to ease drawing these common shapes.

Control nub - a little graphic representing a dragable control point.

Contiguous - a line or curve which starts from the same point where another ends.

Curve - any one of a number of Curve types which extend between two points (Start and End). In ShapeMaker Curves have one or more control nubs which can be used to alter them.

Drawing Grid - the square space where Lines, Curves and Paths are created and edited.

Ellipse - a special type of Curve. Ellipses create their own individual Path and cannot be joined in a series like the other types.

End point - the place where a Line or Curve terminates.

Line - a straight Line between two points: Start point and End point.

Mid point - any point occurring in a Path that is not a Start or End point.

Path - a series of continuous connected Lines or Curves of the same type. Ellipses and Circles cannot be joined in series to create a Path.

Path List - the contents of the Path pane. Paths created are listed here - just like paint.net's Layers window.

Primitive Types - one of the Line/Curve types: Straight Line, Cubic Bézier, Quadratic Bézier or Ellipse.

Rectangle - a compound type consisting of four parallel Straight Lines.

Shape - the object created from all the Paths in the Path List.

Smooth Types - a subset of Curves which interact with neighboring Curves in the same Path to make the overall Curve continuously smooth. There are two Smooth types: Smooth Cubic Bézier and Smooth Quadratic Bézier.

Start point - the place where a Line or Curve begins.

ShapeMaker User Interface (UI)

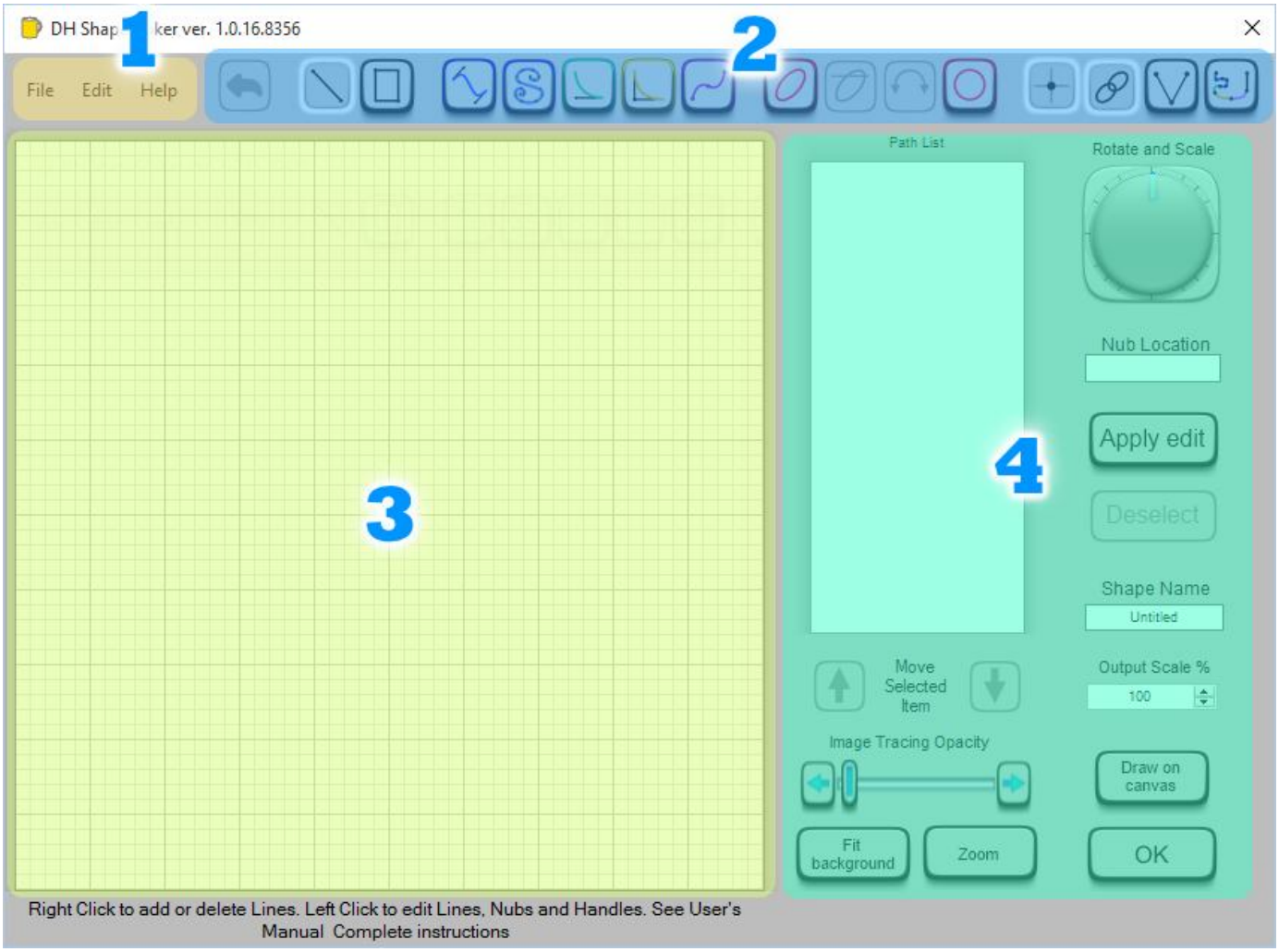
The ShapeMaker UI can be divided into four main areas;

Menus - File, Edit and Help.

Tool Bar - with icons for various Lines, Curves and options.

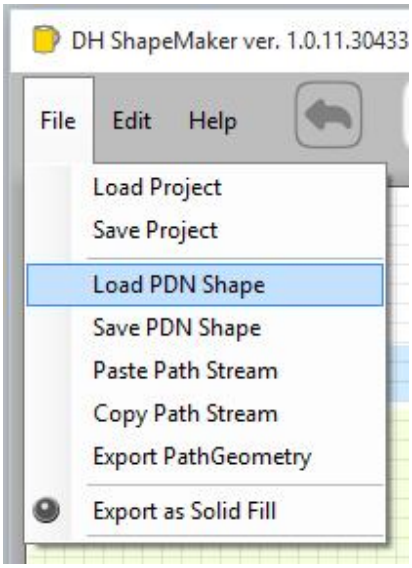
Drawing Grid - where Shapes are created.

Path List, Editing Tools & Options.



File Menu

This menu contains basic file handling options. The menu can be opened by clicking on it or using the keyboard combination Alt + F.



Load Project

Loads a previously saved ShapeMaker xml file. The Shape defined in the file is loaded into the Path List and shown on the Drawing Grid.

Save Project

Saves the current Shape as an xml file in a proprietary ShapeMaker format. This format preserves all line/curve definitions in Path List. This feature is particularly useful if you wish to continue editing the Shape at some later date.

Load/Save PDN Shape

Paint.net 4.0.6+ allows the addition of custom Shapes to the Shapes menu. These Shapes are stored in the Paint.net\Shapes\ directory. The first two entries in the File menu allow for loading one of these Shapes or saving the current Shape in a paint.net compatible (XAML) format in the correct directory.

Note: You will need to restart paint.net to use a newly saved Shape as they are only loaded on start up.

Paste Path Stream

Paste Path Stream is used to copy SVG Shapes into ShapeMaker. Simply copy the SVG code between the Path tags then hit File > Paste Path Stream to paste the Shape into the Drawing grid and Path List.

Paste Path is capable of interpreting StreamGeometry strings which are a lightweight version of PathGeometry strings. Both can appear in XAML files - but only StreamGeometry can be parsed by ShapeMaker. Users attempting to paste in PathGeometry strings will get a "Bad Format" error even though there is nothing 'wrong' with the string.

For further information can be found on the distinction between the two string formats using these links:

Geometry Overview

https://msdn.microsoft.com/en-us/library/ms751808%28v=vs.100%29.aspx

StreamGeometry Tutorial

https://msdn.microsoft.com/en-us/library/ms742199%28v=vs.100%29.aspx

PathGeometry Tutorial

https://msdn.microsoft.com/en-us/library/ms745814%28v=vs.100%29.aspx

Copy Path Stream

Copy Path Stream copies all the Paths in the Path List to the clipboard for pasting elsewhere. Use this option to export SVG graphics outside of the paint.net environment.

Export PathGeometry

Saves the Shape to an XAML file using the more complex PathGeometry format. Use this option to save Shapes for reuse outside of the paint.net environment.

Export as Solid Fill

This option is included under the File menu because it only affects saved files.

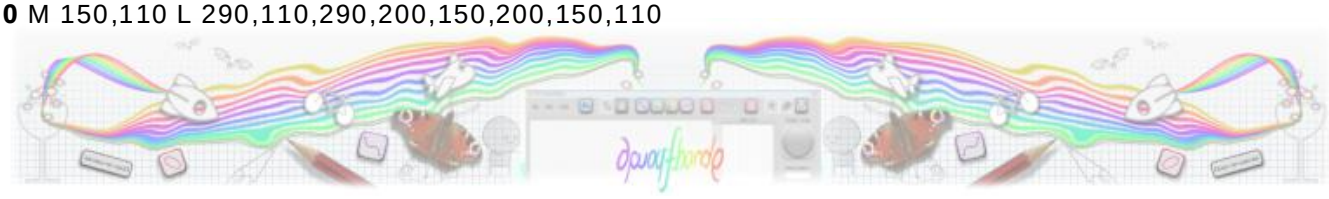
The toggle button switches between the F0 and F1 fillRules in the StreamGeometry and PathGeometry formats.

When the button is unselected (greyed out) the fillRule is set to F0 (EvenOdd). As this is the default fillRule it is left out of the actual Path e.g.

M 150,110 L 290,110,290,200,150,200,150,110

is the same as

F0 M 150,110 L 290,110,290,200,150,200,150,110



Using the F0 fillRule, a series of concentric circles is rendered this way

When the button is selected (green LED is lit) the fillRule is set to F1 (NonZero). F1 is stated at the start of the Path e.g.

F1 M 150,110 L 290,110,290,200,150,200,150,110

Using the F1 fillRule, a series of concentric circles is rendered this way

For further information on these fillRules, see:

Path Markup Syntax (Microsoft)

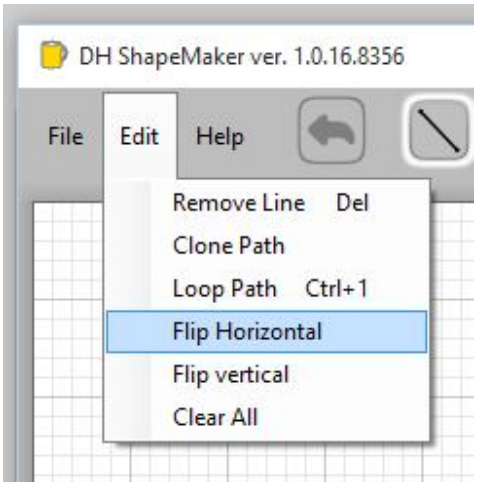
https://msdn.microsoft.com/en-us/library/ms752293%28v=vs.110%29.aspx

FillRule Enumeration (Microsoft)

https://msdn.microsoft.com/en-us/library/system.windows.media.fillrule%28v=vs.110%29.aspx

Edit Menu

The Edit menu contains editing tools to manipulate the current Line/Curve, Path or Shape. The menu can be opened by clicking on it or using the keyboard combination Alt + E.



Some of these commands have different effects depending on whether a Line/Curve is actively being edited. This table should clarify some of these differences.

	Edit Buffer Empty	Line/Curve Active	New Line/Curve
Remove Line	yes	yes	no
Clone Path	yes	yes	no
Loop Path	no	yes	yes
Flip Horz	yes	yes	yes
Flip Vert	yes	yes	yes

Remove Line (Delete key)

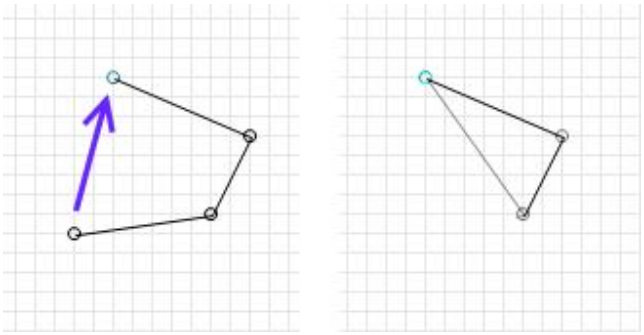
Erases the currently highlighted Path from the Path List.

Clone Path

Creates a duplicate of the currently highlighted Path. The duplicate is drawn on top of the existing Path, move the new Path (Shift + drag any nub) to relocate it.

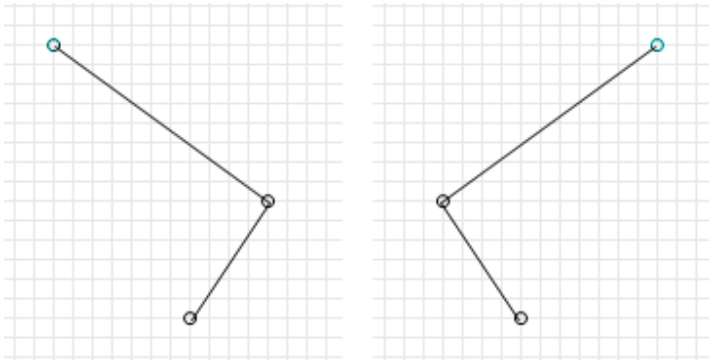
Loop Path (Ctrl + 1)

Relocates the End point of the highlighted Path to the same location as the Start point of the Path. This is a simple way to close a Shape.



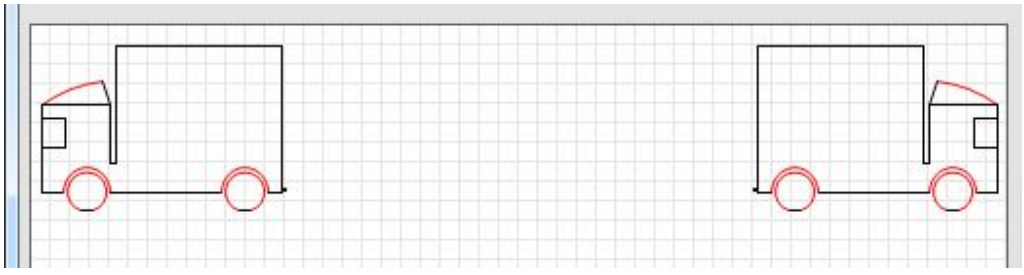
Flip Horizontal

When a Line/Curve is actively being edited, this command mirrors the entire Line/Curve horizontally.



Before Flip Horizontal After Flip Horizontal

When no Line/Curve is active, **Flip Horizontal** flips the entire Shape.

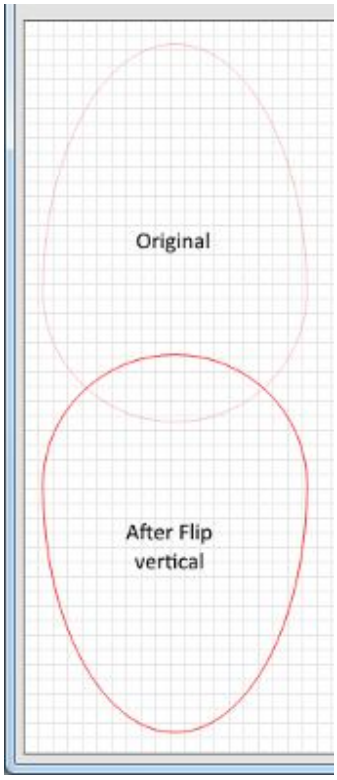


Original Shape Following Flip Horizontal

Flip Vertical

When a Line/Curve is actively being edited, this command mirrors the entire Line/Curve vertically.

When no Line/Curve is active, **Flip Horizontal** flips the entire Shape.

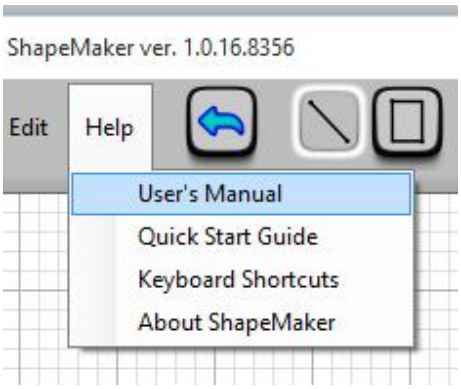


Clear All

Clear All removes all the entries from the Path List. This has the same effect as clearing the entire drawing grid.

Help Menu

The Help menu can be opened by clicking on it or using the keyboard combination Alt + H.



User's Manual

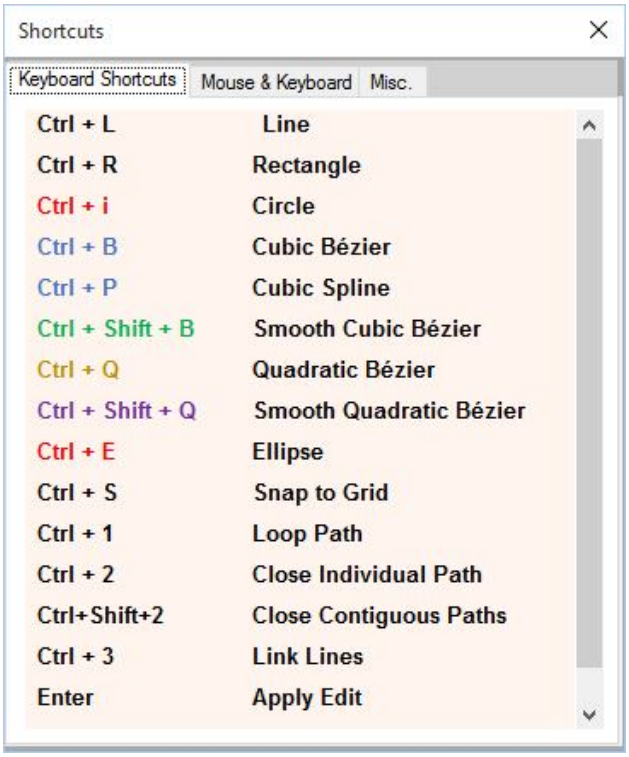
Opens this user manual using the installed PDF viewer. The PDF is bundled with ShapeMaker. The PDF file should be placed in the paint.net/Effects/ folder along with the ShapeMaker dll in order to make it available from within ShapeMaker.

Quick Start Guide

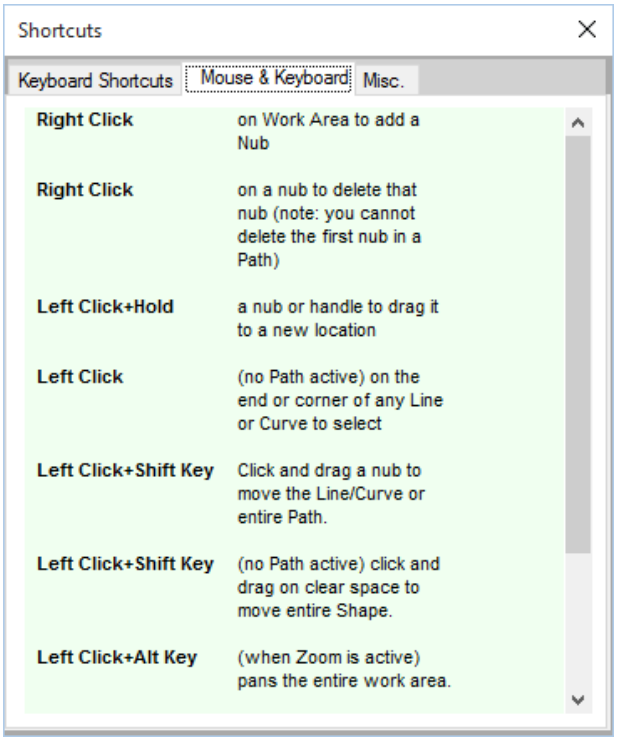
The Quick Start guide is designed to get you up and running with ShapeMaker. It takes you through the major features as you're guided through creation of a simple Shape. As with the User Guide, the Quick Start PDF should be placed in the paint.net/Effects/ folder to make it available from within ShapeMaker.

Keyboard Shortcuts

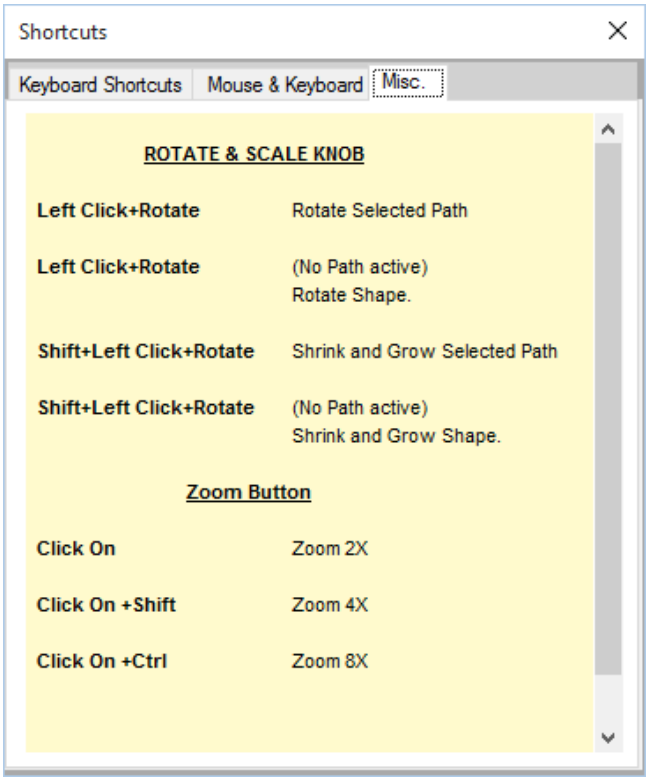
Opens a window showing Keyboard shortcuts.



The second tab shows Mouse & Keyboard combinations.

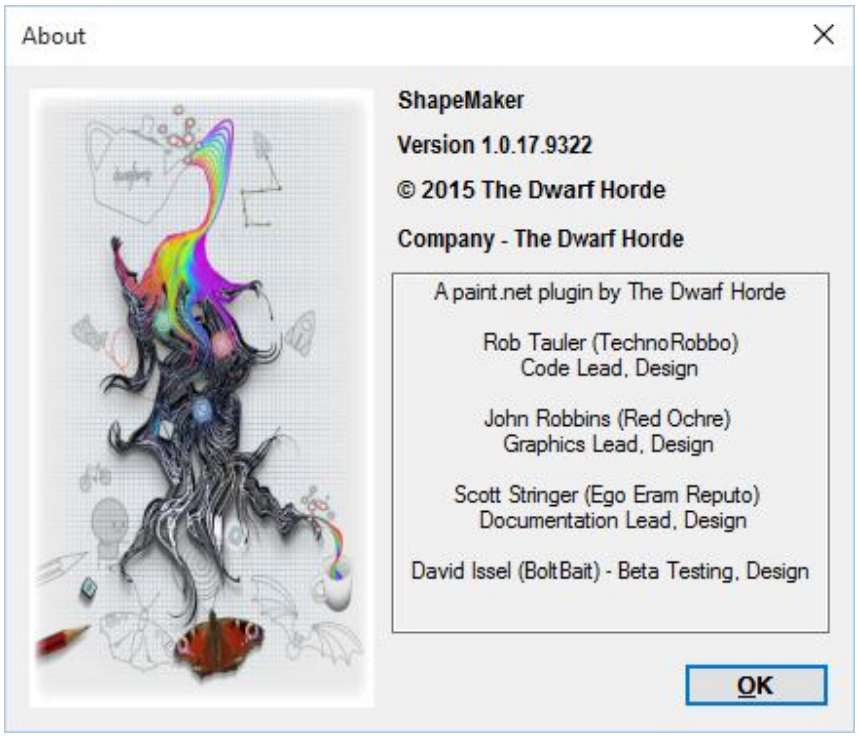


The third tab contains miscellaneous commands.



About

Shows the following dialog with version, copyright and author details.



Tool Bar

The Tool Bar contains a number of icons which are used to change drawing tool and provides some options for how the current Line, Curve or Path behaves.

From left to right the icons are

Undo - reverses the last change(s) in the editing buffer.

Straight Lines - Creates Straight Lines between Start and End points.

Auto Rectangle - Creates a Rectangle between Start and End points.

Cubic Bézier - Creates a Cubic Bézier Curve between Start and End points.

Cubic Spline - Transforms Cubic Béziers into Cubic Splines.

Smooth Cubic Bézier - Creates a Smooth Cubic Bézier Curve between Start and End points.

Quadratic Bézier - Creates a Quadratic Bézier Curve between Start and End points.

Smooth Quadratic Bézier - Creates a Smooth Quadratic Bézier Curve between Start and End points.

Elliptical Arc - Creates an elliptical arc between Start and End points.

Large Arc (over 180 degrees) - Toggles which portion of an Elliptical Arc is drawn.

Sweep Direction - Toggles between clockwise and anti-clockwise directions for the Elliptical Arc.

Auto Circle - Creates a Circle whose diameter is set by Start and End points.

Snap to Grid - Forces control nubs and points onto grid boundaries.

Linked with previous Line - Keeps the last created End point active following Apply Edit so another Line/Curve can be drawn from the same point.

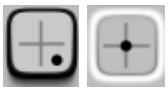
Close Individual Path - Automatically closes a Path by drawing a Straight Line from End point back to the Start point.

Close Contiguous Path - Automatically closes a series of connected Paths by drawing a Straight Line from End point back to the Start point.

Undo (Ctrl + Z) 

The Undo button rolls back the last changes made in reverse order. The last change is the first removed. The change might have been the creation of, or modification to, a point, Line, Curve or Path.

Undo has a maximum of 15 plies or levels meaning it will not reverse more than 15 changes.

Snap to Grid (Ctrl + S) 

This toggle forces new points and points being dragged onto Drawing Grid boundaries.

If Snap-To-Grid is enabled, a new point will be created on the nearest grid boundary. If Snap-To-Grid is disabled the point will be created where the mouse cursor is located. Similarly when dragging a point, grid boundaries will be forced if Snap-to-Grid is enabled.

Existing points are not relocated by this button.

Linked Lines (Ctrl + 3) 

This toggle button when enabled preserves the focus on the last created End point when the Apply Edit button is clicked. This feature allows the next Line/Curve to be drawn from the same point.

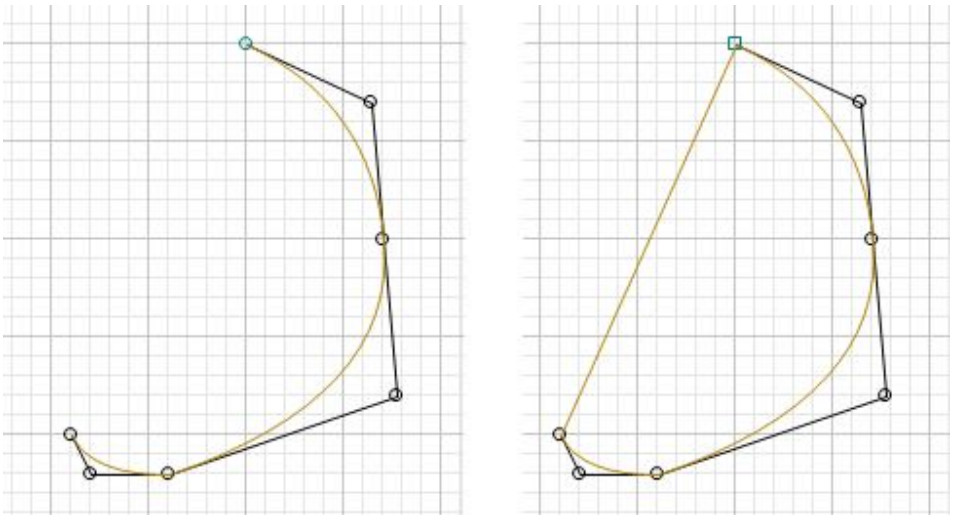
If this feature is disabled, clicking Apply Edit removes the focus from the entire previous object.

Close Individual Path (Ctrl + 2) 

When the Closed Path feature is engaged, any Shape being drawn will automatically be closed with a straight Line from the current End point back to the Start point.

Enable Closed Path if you wish to create a closed Shape automatically. Disengage the Closed Path feature to leave a Shape open.

The nub at junction of the automatic join will be rendered as a cyan box.

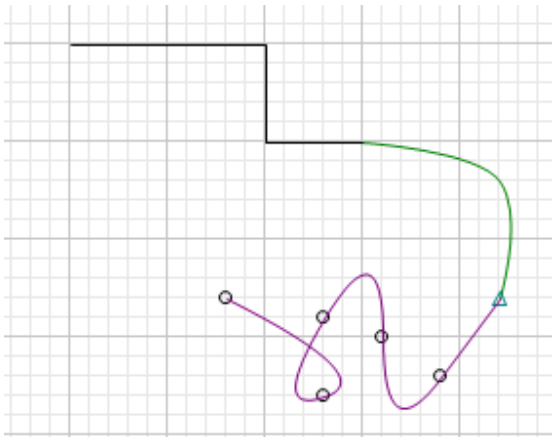


Closed Path Disabled Closed Path Enabled

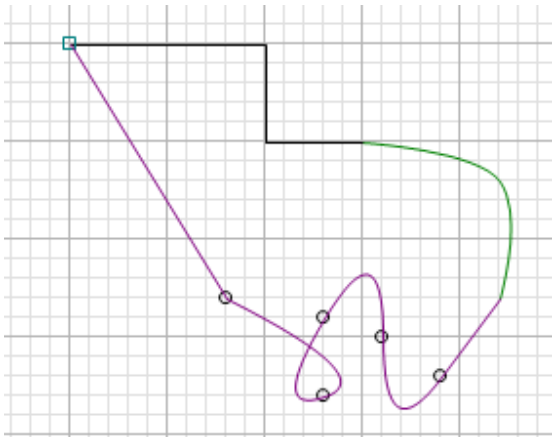
If an individual Path is closed sing this feature, a Z will appear before the Path name in the Path List. In the diagram below, the Smooth Cubic Béziers path is closed.

Close Contiguous Paths (Ctrl + Shift + 2) 

If the Closed Paths radio button is on, ShapeMaker will attempt to close the current Path with a straight line. It does this by backtracking along contiguous Paths until a start nub is found (i.e. the origin of the series of connected Paths).



Close Contiguous Paths disabled



Close Contiguous Paths enabled

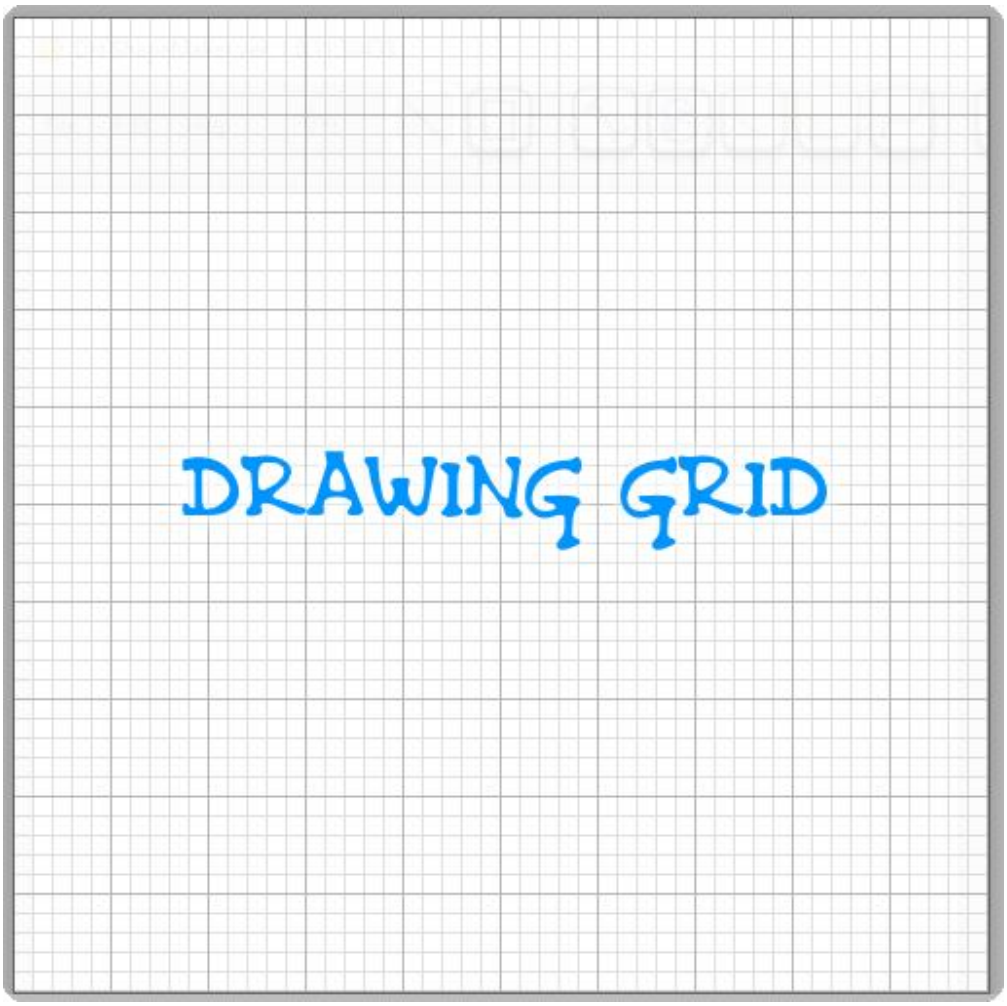
Note the square cyan colored nub in the second diagram which denotes the closure point.

If a series of contiguous Paths is closed using this feature, the characters MZ will appear before the last Path name in the Path List. In the diagram below the Cubic Beziers path is automatically closed with the preceding path(s).

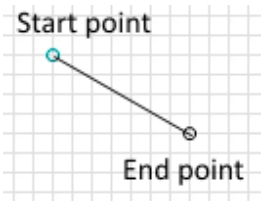
If there is only one path, Close Contiguous Paths acts in the same way as Close Individual Path.

Drawing Grid

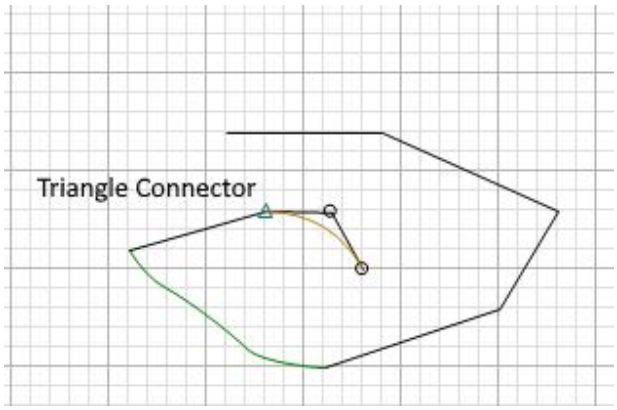
The Drawing Grid is where Lines and Curves are drawn to create Paths and Shapes.



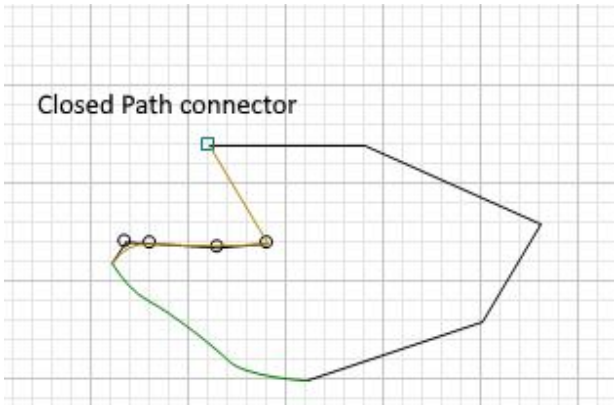
When a Line, Curve or Path is active on the Drawing Grid, the Start point is colored cyan. This is so the direction of the object can be easily discerned at a glance.



A cyan colored triangle is shown as the nub connector where contiguous elements meet.



Where Paths are closed with the Close Individual Path or Close Contiguous Paths feature, the connecting nub is shown as a cyan box.



The Drawing Grid is set a default grid size, so the grid dimensions cannot be altered. If you want to zoom in on the Grid, click the **Zoom button**. This will increase the view size. Shift and Ctrl can be used in association with clicking on the Zoom button to further increase the zoom size.

When **Zoom** is enabled, the **Alt key + left mouse button** allows the Shape and background to be panned around the drawing grid.

If **Snap-To-Grid** is enabled, new points and points being dragged around the Drawing Grid will be forced onto the Grid boundaries. This is useful for creating straight lines and aligning points.

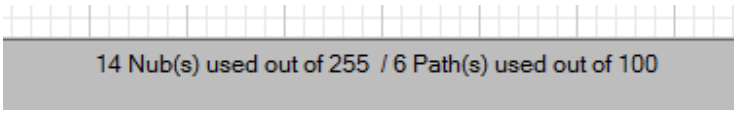
If **Snap-To-Grid** is disabled new points will be created where the mouse cursor is located. When dragging a point the Grid is ignored.

The currently active paint.net layer is shown behind the Drawing Grid. Alter the opacity of the layer by changing the **Image Tracing Opacity** slider. This feature allows the layer to be used as a base for tracing.

If the **Fit Background checkbox** is checked, the background layer is scaled to fit within the Drawing Grid. The height and width ratio is maintained when scaling.

If **Fit Background** is unchecked, the unscaled layer is either centered in the drawing grid space (if less than 500px square) or aligned to the top left corner (if greater than 500px square).

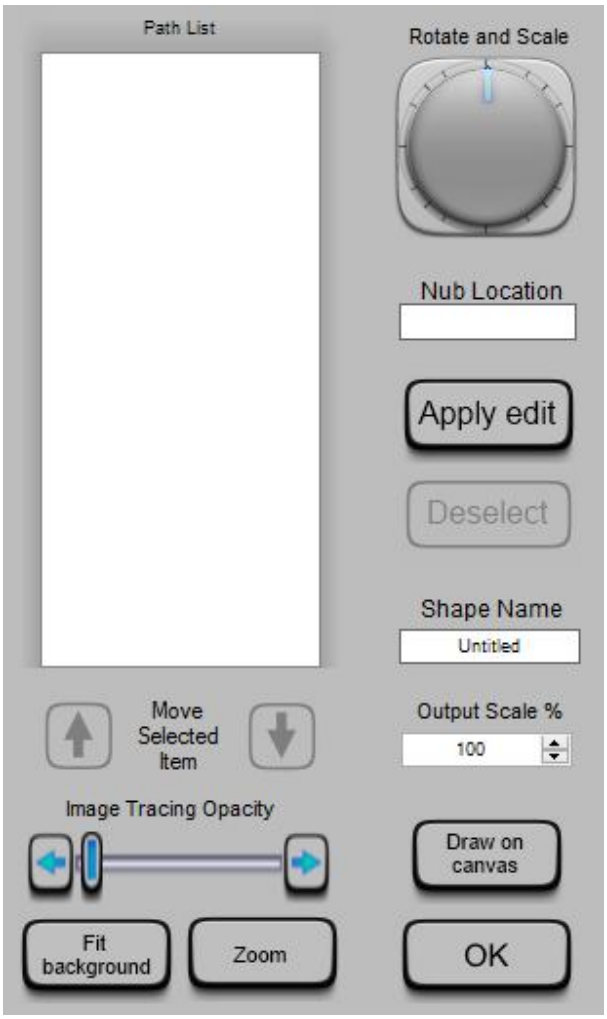
Underneath the Drawing Grid is a simple status bar. When drawing is begun, the number of nodes and Paths is shown along with the maximum number available.



There can be a maximum of 255 nubs in any single Path. ShapeMaker has a limit of 100 Paths for any single shape.

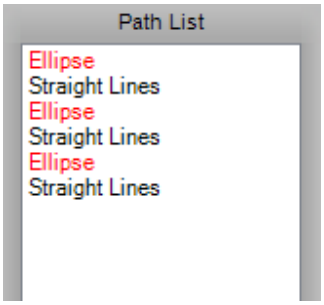
Note that the Drawing Grid is not rendered to the paint.net layer or output with any file saved by ShapeMaker. Its purpose is simply to aid the actual creation of Shapes.

Path List, Editing Tools & Options



Path List

The Path List contains a list of all the Paths that have been committed to the Shape.



The Path List operates much like paint.net's Layers Window. Paths can be reordered, cloned, flipped, removed looped and re-edited.

To focus the editing operations on a specific Path - click on the Path in the Path List. The selected Path will become editable on the Drawing Grid with all associated Control Nubs activated (the Path will be placed in the editing buffer).

If you do make changes to an existing Path remember to commit the changes by clicking the **Apply Edit** button (or use the Enter Key).

The Path Names contained in the Path List are automatically generated. These can be changed by double-clicking on the Path in the Path List. A dialog opens allowing a new text string to be entered.

Custom Path Names are saved along with the Shape only when saved as a ShapeMaker Project (File > Save Project).

If an individual Path is closed using the Close Individual Path feature, a Z is added to the path name in the Path List. Similarly, closing a series of contiguous Paths with the Close Contiguous Paths feature will result in MZ being appended to the Path name in the Path List.

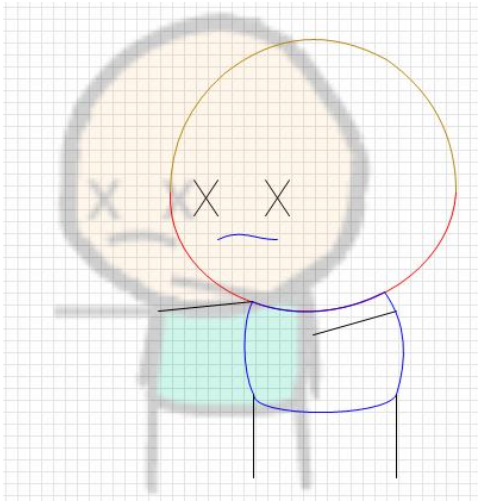
Up/Down Arrows

ShapeMaker supports reordering of the entries in the Path List. The correct order of Paths is necessary to close a Shape when using an automated SVG fill to color the Shape.

Highlight a Path in the Path List and click the arrows to shift the Path higher or lower in the list. The arrows are enabled only when a Path is highlighted in the Path List.

Image Tracing Opacity

This slider determines the opacity of the active paint.net layer which is shown behind the drawing grid. This feature allows the layer to be used as a base for tracing.



Fit Background

If the Fit Background feature is enabled (button is highlighted with a white border), the background layer is scaled to fit within the grid space. The height and width ratio is maintained.

If the feature is disabled (button not highlighted), the unscaled layer is either centered in the drawing grid space (if less than 500px square) or aligned to the top left corner (if greater than 500px square).

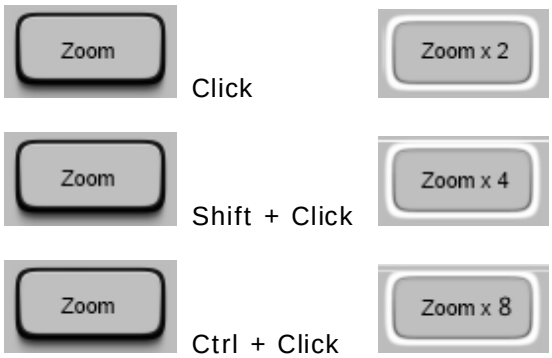
Zoom

This button magnifies the size of the Drawing Grid. 1x, 2x, 4x and 8x magnification are available to assist when fine tuning Shapes and nub positions.

Clicking the button toggles the zoom amount between 1x and 2x view.

If the Shift key is held down while clicking the zoom button, a 4x zoom will be used.

If the Ctrl key is held down while clicking the zoom is increased to 8x.



When Zoom is enabled, the Alt key + left mouse button allows the Shape and background to be panned around the drawing grid. To move just the Shape, use Shift + left mouse.

Rotate and Scale Knob

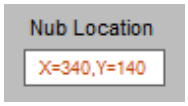
While an object is being actively edited, the Rotate and Scale knob will rotate the object on the drawing grid.

Using the Rotate knob with no Path in the Edit buffer (no Control Nubs showing on the Drawing Grid) will rotate the entire image.

To use the Scale feature, hold down the **Shift** key. This toggles the knob from its primary Rotation function to Scaling the Path or image. Clockwise movement of the knob in association with the Shift key enlarges the Path/image. Anti-clockwise movements with Shift decrease the size of the Path/image.

Nub Location

The location of the last created or moved nub or point is shown in the Nub Location box.



The X coordinate is the horizontal dimension from the left hand side of the drawing grid. The Y coordinate is the distance from the top of the drawing grid.

Apply Edit (Enter Key) 

This button commits changes made to the currently active object.

If a new object is being created a Path will automatically be created in the Path List for the object.

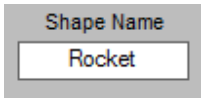
If an existing Path is being edited (i.e. one that already exists in the Path List) the Path will be updated by clicking the Apply Edit button.

Deselect (Esc Key) 

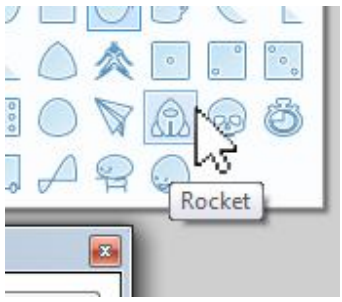
This button removes the editing focus from the last object's End point. In other words it deselects the currently active Path or object.

Shape Name

This text box is used to name your Shape.



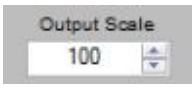
In paint.net this name will be used as a tool tip when the Shape is hovered over in the Custom Shapes menu.



If a Name has been specified in the Name box it will be used to prepopulate the File Save dialog when saving the Shape to file.

Output Scale

This control determines the size of the Shape in relation to what is visible on the drawing grid.



100% represents a 1:1 ratio in pixel terms. Lower values will reduce the output size while larger values will increase the output size.

Draw on Canvas

The Draw on Canvas button renders the current Shape to the currently active paint.net layer.

This feature is intended as a quick way to get a Shape onto the active paint.net layer.

The Lines and Curves in the Shape will be rendered in the Primary color. Line with will be dictated by the current Brush Width setting. Any closed areas in the Shape will be filled with the Secondary color.

Note that the currently specified paint.net Shape Fill Mode (Outline, Filled or Filled + Outline) is not used by ShapeMaker.

Remember that only Paths that appear in the Path List form the Shape. If you have made changes you need to click Apply Edit to commit the changes to the Path List.

Note: Draw on Canvas uses the Scale Ratio value to scale the output size.

Ok

The Ok button is used to terminate the current ShapeMaker session.

If Draw on Canvas is enabled, the current Shape will be rendered to the current paint.net layer.

If Draw on Canvas is disabled clicking OK will simply close the plugin. Remember to save your work! As a fail-safe, the current Shape will be reloaded into the Drawing Grid and Path List if the plugin is reopened within the same paint.net session.

Drawing Types

There are four Primitive types, two Smooth types and two Compound types.

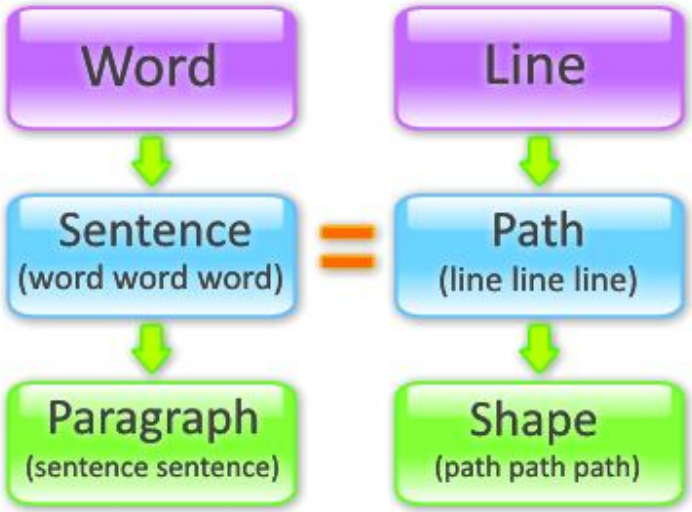
Primitive Types - Straight Line, Cubic Bézier, Quadratic Bézier and Ellipse.

Smooth Types - Cubic Spline, Smooth Cubic Bézier and Smooth Quadratic Bézier.

Compound Types - Rectangle and Circle.

These are the basic building blocks from which Shapes are formed. If the same type is linked in a series the resultant "string" is called a Path.

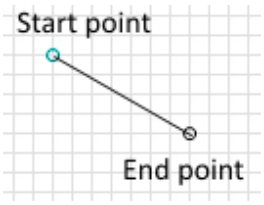
Think of the relationship Line/Curves > Paths > Shapes like the relationship words > sentences > paragraphs. In ShapeMaker, the contents of a Path (sentence) must contain Lines or Curves (words) of the same type. You can add as many Paths (sentences) as you need to create a Shape (paragraph).



The Primitive Types

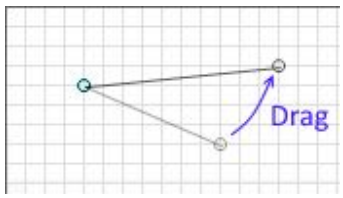
Straight Line (Ctrl + L) 

The Straight Line draws a continuous Line between the Start point and End point (the black Line shown in the following diagram).

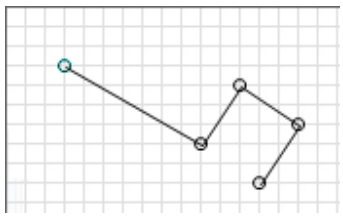


To draw a Straight Line, select the Straight Line type. Right click anywhere there is a clear space on the drawing grid. This will place the Line Start point. Right click in another clear space to set the Line End point. The Line will be drawn between the two points.

Drag either of the points with the left mouse button to adjust the length and angle of the Line.



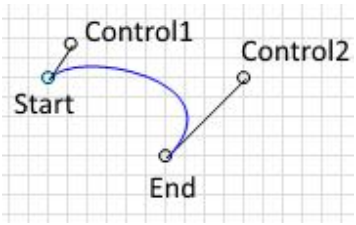
To draw a connected series or *Path* of Straight Lines, add more points by right clicking. The new Lines will be added in a continuous sequence or series. Each new Line will be connected to the previous Line's End point.



Cubic Bézier (Ctrl + B) 

The Cubic Bézier draws a continuous smooth Curve between the Start point and End point (the blue colored curve shown in the following diagram).

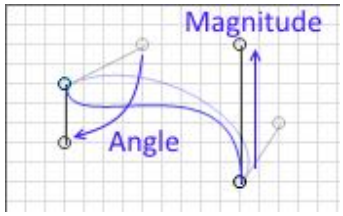
Two Control points are used to independently adjust the amount of curvature and the magnitude at opposite ends of the Curve.



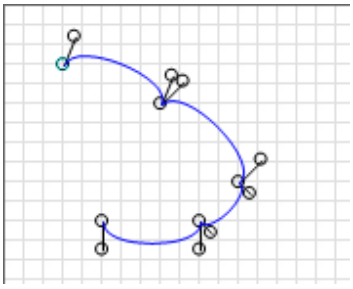
The Start and End points can be moved as described above (i.e. drag with left mouse button - see Straight Line). Similarly, either Control point can be dragged with the left mouse to relocate it.

The Control Points are connected to their parent point via a line segment. The rotation or angle that the line segment makes adjusts the curvature.

Drag the Control point further away from the parent point to increase the magnitude of the curvature. Dragging the Control point closer decreases the magnitude of the curvature.



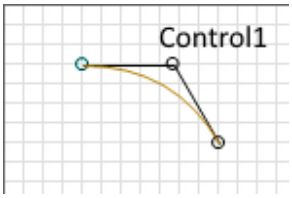
To draw a connected series or *Path* of Cubic Béziers, add more points by right clicking. The new Curves will be added in a continuous sequence or series. Each new Curve will be connected to the previous Curve's End point.



Manipulating a control nub in a series of Cubic Béziers changes only the curves adjacent to the altered control nub.

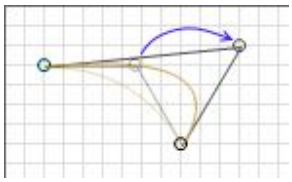
Quadratic Bézier (Ctrl + Q)

The Quadratic Bézier draws a continuous smooth curve between the Start point and End point (the tan colored curve shown in the following diagram).

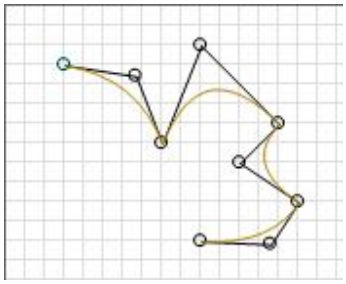


The Curve is governed by a single Control point. The Control point is used to simultaneously adjust both the amount of curvature and the magnitude. Two line segments give visual cues to the angle and magnitude of the Curve.

The Start and End points can be moved (drag with left mouse button - see Straight Line). Drag the Control point with the left mouse to similarly relocate it.

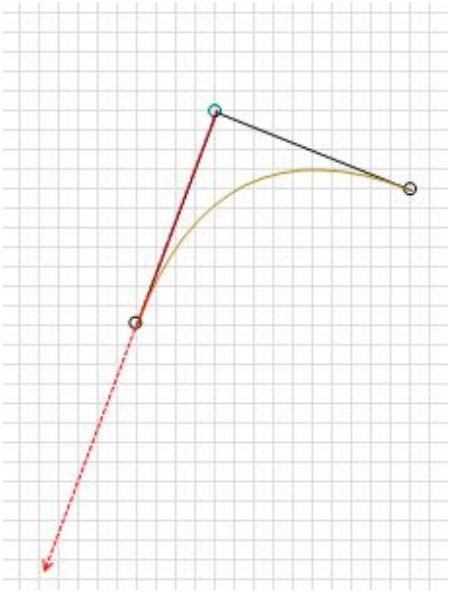


To draw a connected series or Path of Quadratic Béziers, add more points by right clicking. The new Curves will be added in a continuous sequence or series. Each new Curve will be connected to the previous Curve's End point.



The Quadratic Bézier has a special modifier: the **Alt** key. When the curve is being manipulated, the Alt key restricts the location of a Start/Mid/End point to the line segment on which it lies.

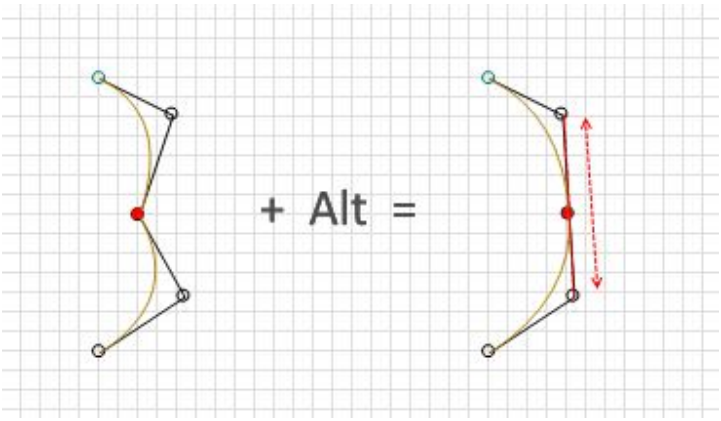
In the following diagram, imagine that the Alt key is being held down while the lower left point is being dragged. The placement of that point will be restricted to anywhere along the red line as long as the Alt key remains held down.



Releasing the Alt key returns the placement of the point to the normal range.

When a series or Path of Quadratic Béziers has been created, the **Alt** key modifier used on a mid-point transforms the two adjacent control lines to become a single line between the two control points. The point being dragged is restricted to this line.

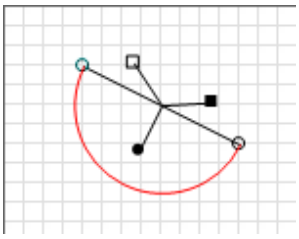
In the diagram below the red point is being dragged. With the addition of the Alt key, the point is restricted to a straight line between the two adjacent control points.



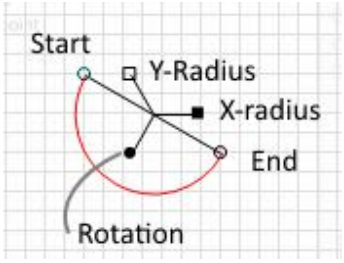
Ellipse (Ctrl + E) 

(Dwarf Horde would like to acknowledge and give credit to svg.codeplex.com for the Elliptical Arc Algorithm)

The Ellipse type draws an elliptical curve from the Start point to the End point (the red curve shown in the following diagram).

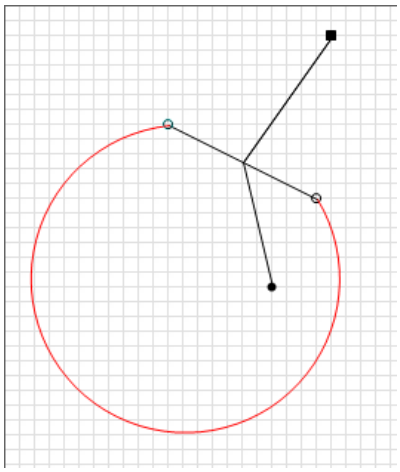


The Elliptical Curve is governed by three Control points; one each for Rotation, Y-radius and X-radius.

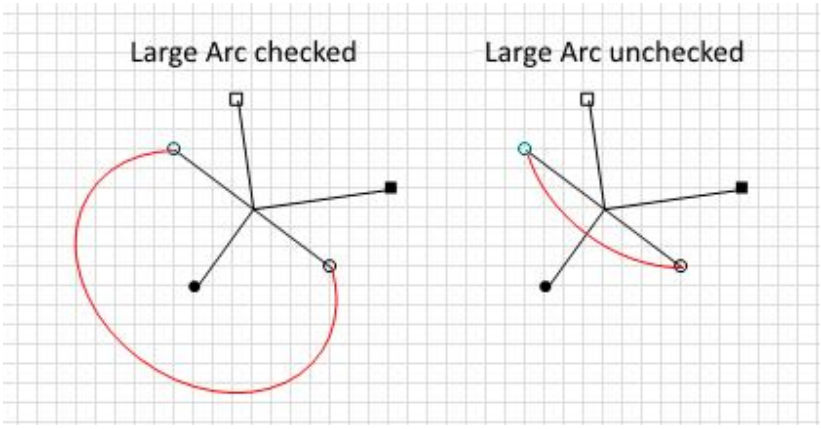


As with all other Control points, Left -click and hold to drag the point to a new location. The length of the line segment gives a visual clue to the magnitude while the angle of the rotation line segment determines the angle.

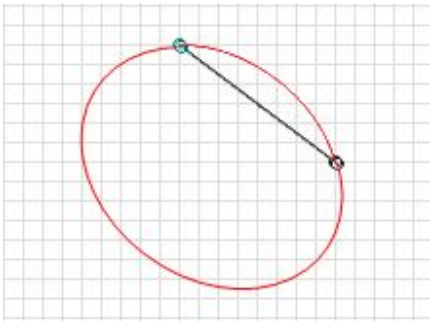
Note: If the X-Radius and Y-Radius Control points are of the same magnitude (i.e. superimposed on each other) the Curve will be circular.



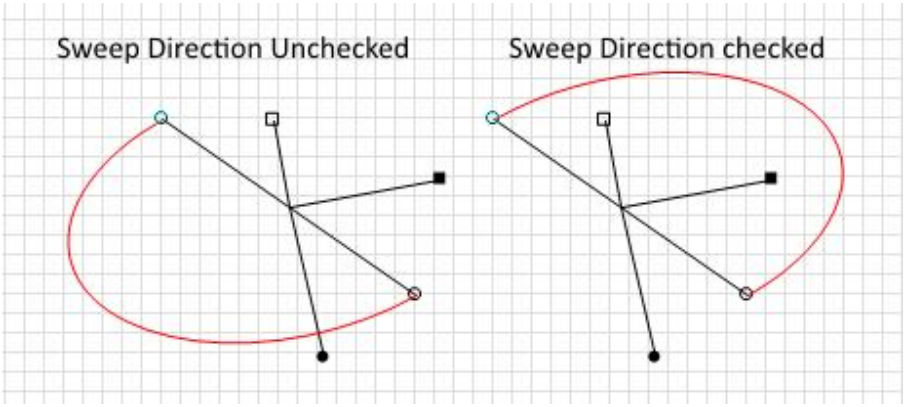
The **Large Arc button**  is used to 'flip' the region of a Curve that is drawn. In the following diagram, two ellipses have been drawn with the same parameters. The only difference is the state of the **Large** Arc button.



We can see that the two curves would form a whole ellipse if one were rotated by 180 degrees and superimposed.



The **Sweep Direction button**  determines which direction the Ellipse is drawn in; clockwise or anticlockwise. Toggling this checkbox inverts the Ellipse across the line between the Start point and the End point.

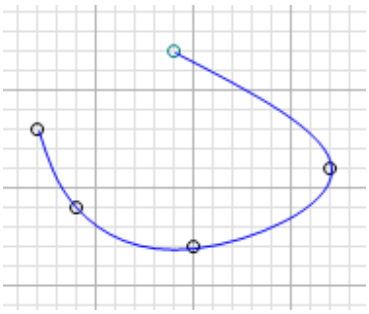


The Smooth Types

Cubic Spline (Ctrl + P)  + 

The Cubic Spline is a modifier for the Cubic Bézier curve.

Visually, the Cubic Spine button turns a Cubic Bézier curve into a Cubic Spline by removing the extra control nubs, leaving only the nubs which actually lie on the curve. The behavior of these nubs differs from the Cubic Bézier in that the curve is adjusted beyond adjacent control nubs when relocating a nub.



If you want manipulate a small section of a curve use a Cubic Bézier. If you want to change the entire curve use a Cubic Spline.

Note that once a Cubic Spline is committed to the Path List it loses it's modified state and is returned as a series of Cubic Béziers.

The Dwarf Horde would like to thank Rick Brewster for generously donating the code backing Cubic Spline. Thanks Rick!

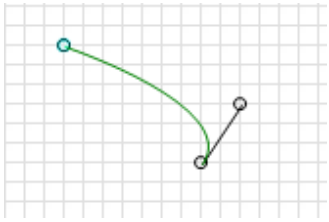
Smooth Cubic Bézier (Ctrl + Shift + B) 

Naturally this is a similar curve to the Cubic Bézier. The difference is how joined Curves are linked by common Control devices which ensure that the Curve is...

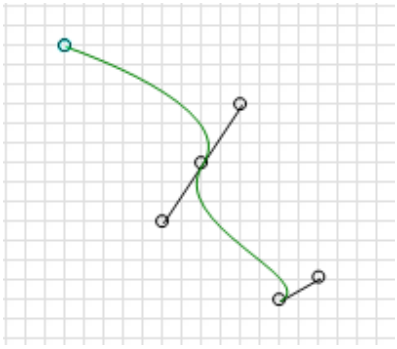
A. Is continuously smooth from one end to the other, and

B. Extends through the center of all Start, Mid and End points.

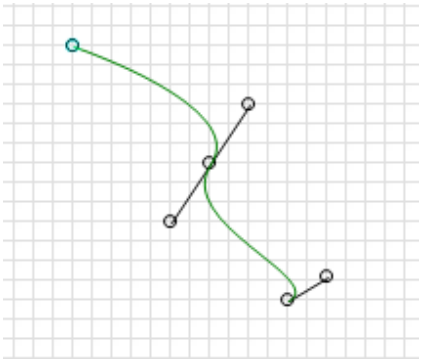
A single instance of a Smooth Cubic Bézier looks like the following diagram. Note the single Control point.

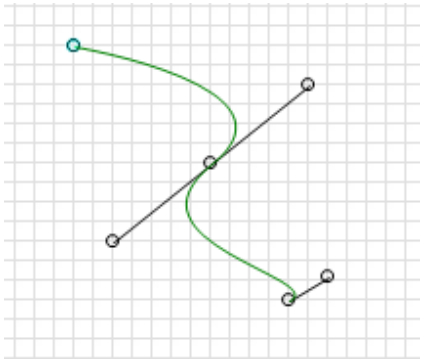


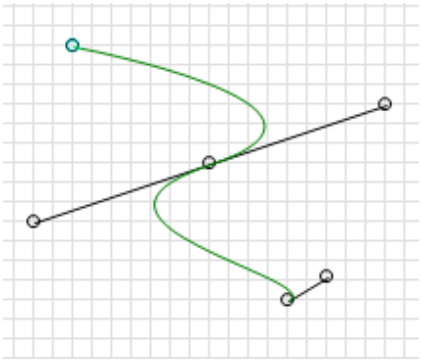
When a second Smooth Cubic Bézier is chained to the first to create a Path, the common point shares a pair of Control points which are linked. The two Control points pivot about the common point much like a binary star or a seesaw.



These twin Control points affect the Curve either side of the common point. Length of the line segments determines magnitude of the Curve while the rotation affects the curvature.







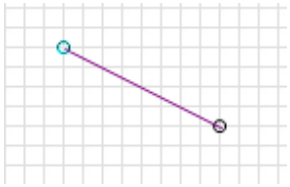
Smooth Quadratic Bézier (Ctrl + Shift + Q) 

Naturally this is a mathematically similar curve to the Quadratic Bézier. However it appears quite different. The difference is how joined Curves are linked. Gone are the Control points. Instead, the Curve is changed by dragging the Curve's common points. Like the Smooth Cubic Bézier, this Curve is...

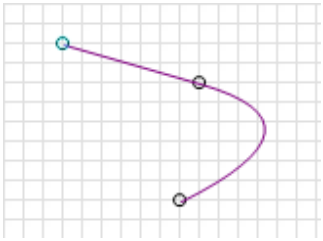
A. Is continuously smooth from one end to the other, and

B. Extends through the center of all Start, Mid and End points.

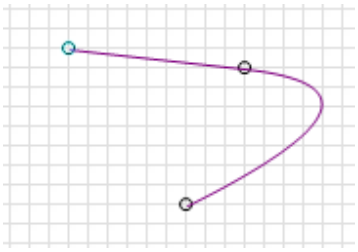
A single instance of a Smooth Quadratic Bézier looks like a Line. See the following diagram. Note the complete lack of Control points.

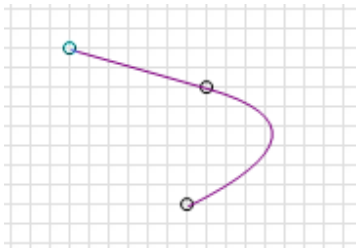


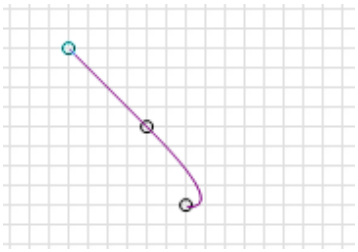
When a second Smooth Quadratic Bézier is chained to the first to make a Path, the common point becomes a Control point.

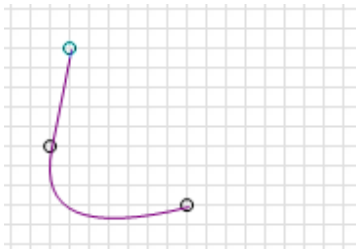


The Common points affect the curvature either side of the point. In the next four diagrams, only the central Control point has been moved. The Start and End points remain the same throughout.





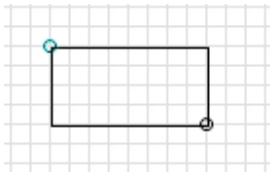




The Compound Types

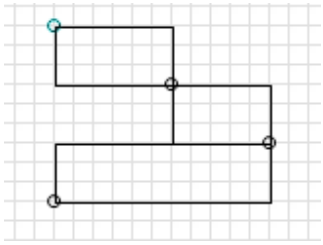
Rectangle (Ctrl + R) 

This is a macro type tool which simplifies the creation of rectangles. This combination type draws a Rectangle between Start and End points.



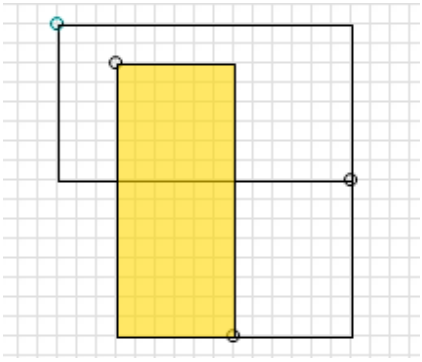
Internally the Rectangle is converted to four ordinary Straight Lines. It's much easier to draw this way!

If multiple Rectangles are chained together (a Path), each new Rectangle will use the previous one's End point as its Start point.



If a common point is relocated by dragging, both Rectangles will have their size affected.

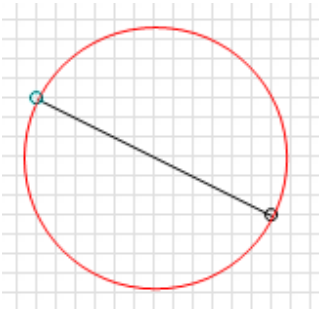
Rectangles in a Path may be overlapped. In the following diagram, the third Rectangle (colored yellow for clarity) overlaps the first Rectangle in this Path consisting of three Rectangles.



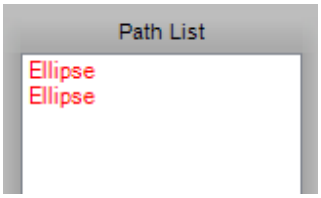
Circle (Ctrl + I) 

This is a macro type tool which simplifies the creation of circles.

The tool draws two semi circles from Start point to End point - but in opposite directions. The result is a full Circle with the diameter equal to the distance between Start and End points.

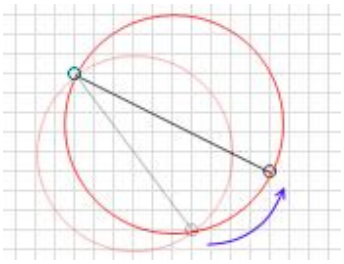


Internally the Circle is converted to two semi-circular elliptic arcs with an opposite Sweep Direction. Once a Circle is committed to the Path List it is shown as two Ellipse entries. The Circle ceases to be a single unit when it comes to re-editing.



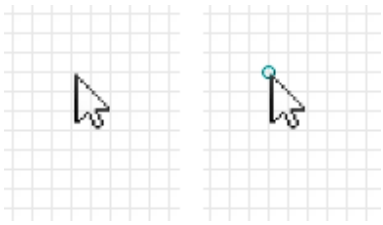
Multiple Circles cannot be chained together to form a Path. Each Circle forms a pair of Elliptical Paths.

If the Start or End point is moved, the size of the Circle is changed. Drag the points further apart to make the Circle larger. Drag the points closer together to make the Circle smaller. Dragging one point clockwise or anti-clockwise about the other rotates the Circle about the stationary point.



Creating Points

Right click any clear space in the drawing grid to create a new Start or End point.

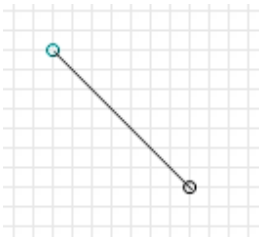


A Start point for a new Line, Curve or Path is colored cyan so the direction of the object can be easily discerned at a glance.

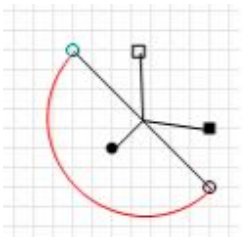
If Snap-To-Grid is enabled, the point will be created on the nearest grid boundary. If Snap-To-Grid is disabled the point will be created where the mouse cursor is located.

Creating Primitives, Smooth Types or Compound Types

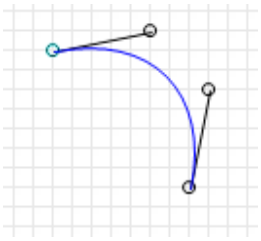
Right click any clear space in the drawing grid to create a new Start point. Right click on another location to place the End point. The currently selected Primitive/Smooth/Compound type will be drawn between the two.



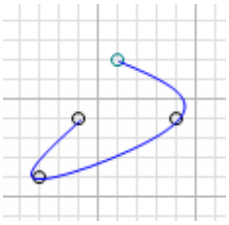
Straight Line



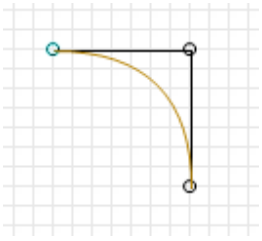
Ellipse



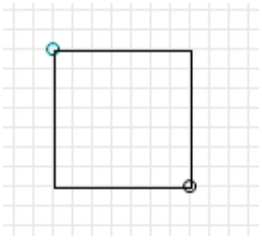
Cubic Bézier



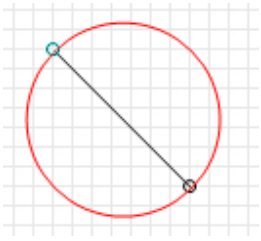
Cubic Spline



Quadratic Bézier



Rectangle

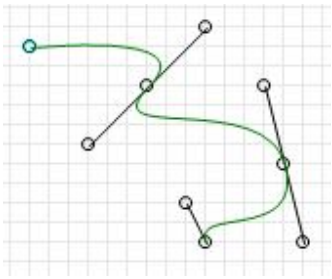


Circle

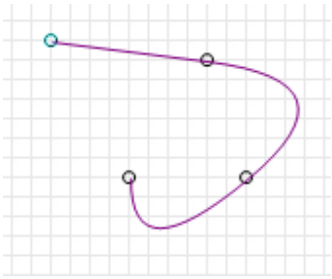
If the Type has associated Control points these can be moved just as any other point while the current object remains active (the Control nubs are visible).

Tip! Hold the **Ctrl** key down while dragging a point or nub to hide the control nubs, control lines and points. This makes viewing the Curve easier. Release the Ctrl key to show these guides again.

Smooth types can be drawn as individual elements, however they are intended to be used in series.



Three Smooth Cubic Béziers



Three Smooth Quadratic Béziers

Moving Points and Objects

When a Line/Curve is active:

Drag any visible point with the **left mouse button** to adjust its position.

If **Snap-To-Grid** is enabled  (Ctrl + S), the point will be relocated only to grid boundaries. If **Snap-To-Grid** is disabled  the point can be located anywhere in the drawing area.

Hold Shift while dragging any nub in the currently active object to move the entire object.

Hold the **Ctrl** key down while dragging a point or nub to hide the control nubs, control lines and points. This makes viewing the Curve easier. Release the **Ctrl** key to show these guides again.

While an object is being actively edited, the **Rotate and Scale Knob** will rotate the object. If **Shift** is held down, the knob scales the object instead of rotating.

To commit an edited object to the Path List, press **Apply Edit** (Enter key).

By default the last point in the previous object is used as the start point for any subsequent objects. This links them together via a common point. If this behavior is not desired, deselect the Linked Lines option  (Ctrl + 3). When **Apply Edit** (Enter) is clicked the last point will not retain the editing focus.

If a separate object is desired, click **Deselect** (Esc key). This allows the next created point to be located anywhere.

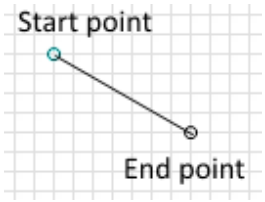
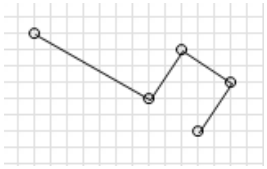
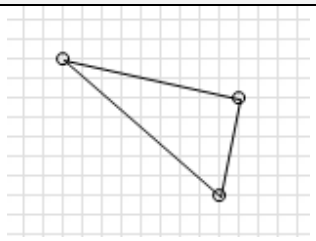
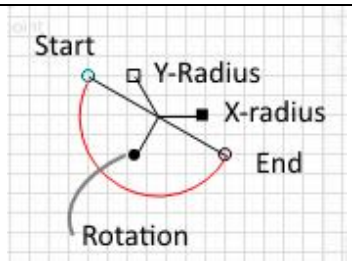
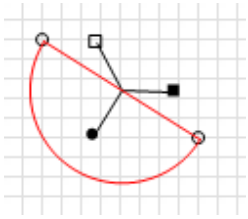
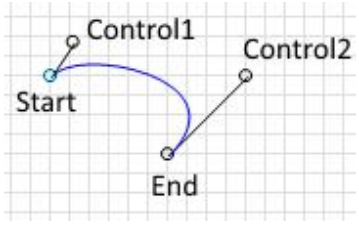
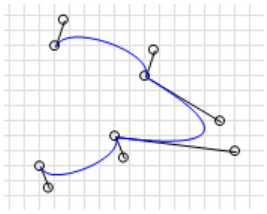
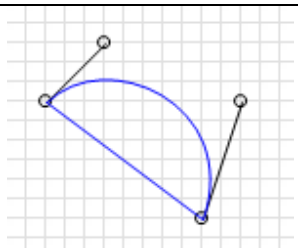
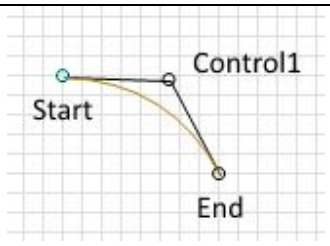
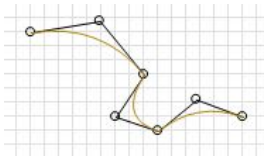
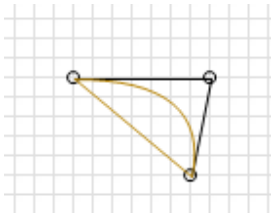
When no Line/Curve is active:

Holding **Shift** while dragging moves the entire image.

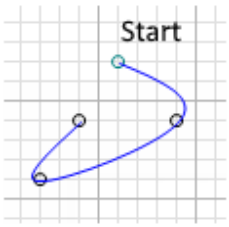
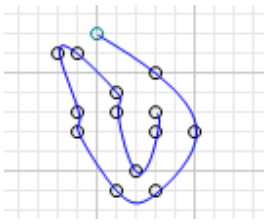
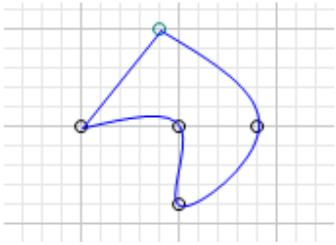
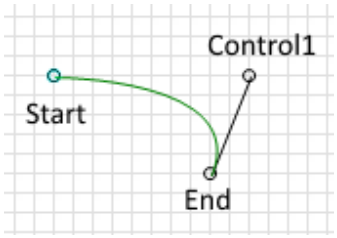
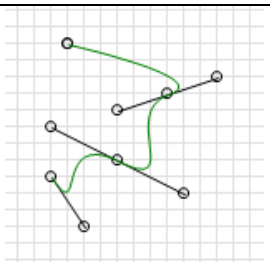
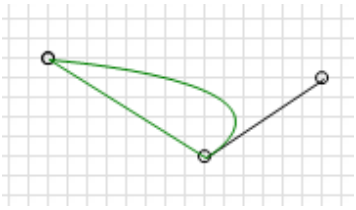
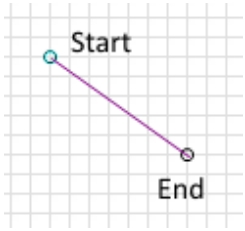
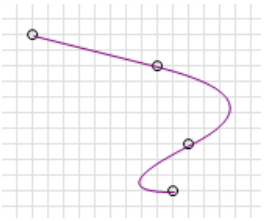
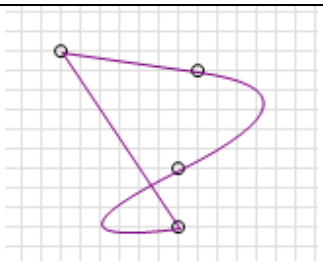
Using the **Rotate and Scale Knob** will rotate the entire image. If **Shift** is held down, the knob scales the image instead of rotating.

Clicking near an End point or crease on a Line/Curve on the Drawing Grid will select the associated Path. The Path will be selected (i.e. made active with the Controls showing).

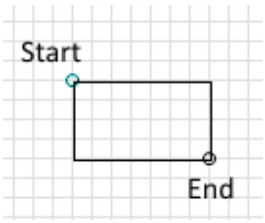
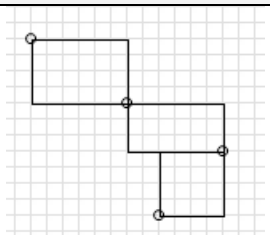
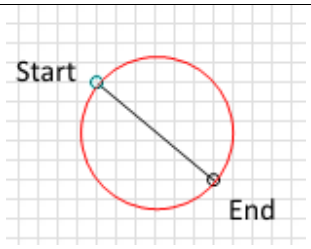
Quick Reference - Primitive Types

	Primitive	Path (Series)	Closed Form
Straight Line			
Ellipse		No Series. Individual Ellipses form their own complete Path.	
Cubic Bézier			
Quadratic Bézier			

Quick Reference - Smooth Types

	Smooth Type	Path (Series)	Closed Form
Cubic Spline			
Smooth Cubic Bézier			
Smooth Quadratic Bézier			

Quick Reference - Compound Types

	Compound Type	Path (Series)	Closed Form
Straight Line + Rectangle			No closed form
Ellipse + Circle		No Series. Circles are formed from two Ellipse Paths.	No closed form

Quick Reference - Mouse & Keyboard Shortcuts

Mouse

Right Click on Work Area to add a nub.

Right Click on a nub to delete that nub (note: you cannot delete the first nub in a Path).

Left Click + Hold a nub or handle to drag it to a new location.

Left Click (no Path active) on the end or corner of any Line or Curve to select it.

Left Click + Shift Key click and drag a nub to move the Line/Curve or entire Path.

Left Click + Shift Key (no Path active) click and drag on clear space to move entire Shape.

Left Click + Alt Key (when Zoom is active) pans the entire work area.

Left Click + Alt Key (on a Quadratic Bézier nub) restricts the nub location to the control lines.

Left Click + Ctrl hides the control nubs and points to better view a Line or Curve.

Keyboard

Ctrl + L Line

Ctrl + R Rectangle

Ctrl + I Circle

Ctrl + B Cubic Bézier

Ctrl + P Cubic Spline

Ctrl + Shift + B Smooth Cubic Bézier

Ctrl + Q Quadratic Bézier

Ctrl + Shift + Q Smooth Quadratic Bézier

Ctrl + E Ellipse

Ctrl + S Snap to Grid

Ctrl + 1 Loop Path

Ctrl + 2 Close Individual Path

Ctrl + Shift + 2 Close Contiguous Paths

Ctrl + 3 Link Lines

Enter Apply Edit

Esc Deselect

Shift + Knob Toggle knob function from rotation to scaling

Shift + Zoom Toggles zoom amount from 2x (default) to 4x.

Ctrl + Zoom Toggles zoom amount from 2x (default) to 8x.